A General Disequilibrium Model of Income and Employment

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As is now well understood, the key to the Keynesian theory of income determination is the assumption that the vector of prices, wages, and interest rates does not move instantaneously from one full employment equilibrium position to another. By implication, Keynesian economics rejects the market equilibrium framework for analyzing the determination of quantities bought, sold, and produced. This framework is associated with Walras and Marshall, both of whom proceeded as if all markets were continuously cleared. Walras rationalized this procedure by incorporating recontracting arrangements, while Marshall did so by regarding price adjustments to be an instantaneous response to momentary discrepancies between quantities supplied and demanded.

By rejecting these rationalizations, Keynesian theory proposes as a general case a system of markets which are not always cleared. Keynes was, tacitly at least, concerned with the general theoretical problem of the intermarket relationships in such a system. The failure of a market to clear implies that, for at least some individuals, actual quantities transacted diverge from the quantities which they supply or demand. Thus, the natural focus of Keynesian analysis is on the implications for behavior in one market of the existence of such a divergence in another market. Indeed, some recent writers, such as Robert Clower and Axel Leijonhufvud, have argued very convincingly that this

focus is the crucial distinguishing feature of Keynesian economics.

Unfortunately, the evolution of conventional post-Keynesian macroeconomics failed to interpret the Keynesian system in this light.[1] Instead, conventional analysis has chronically attempted to coax Keynesian results out of a framework of general market equilibrium. The result has been to leave conventional macroeconomics with an embarrassingly weak choice-theoretic basis, and to associate with it important implications which are difficult to reconcile with observed phenomena.

A classic example of such a difficulty concerns the relationship between the level of employment and the real wage rate. In the conventional analysis, the demand for labor is inversely and uniquely related to the level of real wages. This assumption accords with Keynes; who, in this respect, had adhered to received pre-Keynesian doctrine.[2] Given this assumption, cyclical variations in the quantity of labor demanded and the amount of employment must imply countercyclical variation in real wage rates. As is well known, however, such a pattern of real wages has not been observed.[3]

[1] See Leijonhufvud.

[2] Keynes wrote:
... with a given organization, equipment and technique, real wages and the volume of output (and hence of employment) are uniquely correlated, so that, in general, an increase in employment can only occur to the accompaniment of a decline in the rate of real wages. Thus, I am not disputing this vital fact which the classical economists have (rightly) asserted. ... The real wage earned by a unit of labor has a unique inverse correlation with the volume of employment. [1936, p. 17]

[3] The evidence has been recently reviewed by Edwin

A few authors have pointed out the inappropriateness of attempts to force Keynesian analysis into a market equilibrium framework. Contributions by Don Patinkin (1956) and Clower, in particular, represent important attempts to reconstruct macroeconomic theory within an explicitly disequilibrium context.

In the unfortunately neglected chapter 13 of *Money, Interest, and Prices*, Patinkin analyzed involuntary unemployment in a context of explicit market disequilibrium; and he showed that the misleading implications of the conventional analysis regarding the real wage are a direct consequence of its general equilibrium character.[4] Patinkin presented a theory in which involuntary unemployment of labor can arise as a consequence of disequilibrium, in particular, excess supply in the market for current output. In this theory, the inability of firms to sell the quantity of output given by their supply schedule causes them to demand a smaller quantity of labor than that given by their conventional (or notional) demand schedule. The immediate significance of this theory is that it is able to generate unemployment without placing any restrictions on the level or movement of the real wage.[5] Unemploy-

ment of labor requires only that the vector of prices and wages implies a deficiency of demand for current output. As Patinkin suggests, this interpretation of the proximate cause of unemployment is more Keynesian than Keynes' own discussion.

The essence of Patinkin's theory is causality running from the level of excess supply in the market for current output to the state of excess supply in the market for labor. Patinkin thereby explains the proximate cause of cyclical unemployment, but his analysis involves only partial, rather than general, disequilibrium. At the least, a general disequilibrium model would, in addition, incorporate the possibility of a reverse influence of the level of excess supply in the labor market upon the state of excess supply in the market for current output.

Clower's important paper develops a theory emphasizing this causal relationship. He presents a derivation of the Keynesian consumption function in which he interprets the relationship between consumption and income as a manifestation of disequilibrium in the labor market. This approach to explaining household behavior is obviously similar to Patinkin's analysis of the firm. The only significant difference is that Clower's households have a choice between consuming and saving, so that his problem is explicitly choice theoretic. However, if Patinkin's approach were generalized to a multi-input production function, the resulting analysis would be formally analogous to Clower's.

The analysis in this paper builds on the foundations laid down by the Patinkin and Clower analyses of a depressed economy. Our purpose is to develop a generalized analysis of both booms and depressions as disequilibrium phenomena.[6] Section I

Kuh, esp. pp. 246–48; and Ronald Bodkin. Keynes (1939) recognized this discrepancy, and offered a rather contrived explanation for it in terms of monopoly and procyclical variation in demand elasticities. More recently, Kuh attempted to explain this discrepancy in terms of a fixed proportions production function in the short run.

[4] Chapter 13 also appears, apparently unchanged, in the second edition of *Money, Interest, and Prices* (1965). Patinkin had first presented some of the essentials of this analysis in an earlier article (1949). A similar formulation appears in Edgar Edwards.

[5] Patinkin's theory does not involve any restrictions either upon the substitutability among factors of production or upon demand elasticities. (See fn. 3.) Of course, this theory does not deny that an excessive level of real wages can be an independent cause of unemployment. But, a clear analytical distinction is made between unemployment due to this cause, and unemployment which occurs even when the level of real wages is not excessive.

[6] The analysis by Robert Solow and Joseph Stiglitz, although they emphasize different questions, is somewhat similar to the present approach. However, their analytical format does differ from ours in at least three

sketches the analytical framework employed. Section II reviews and generalizes Patinkin's analysis of the labor market and involuntary unemployment. Section III develops a distinction, implied by Patinkin's analysis, between two concepts of unemployment; one associated with excess supply in the labor market and the other associated with equilibrium in the labor market but with disequilibrium elsewhere in the system. Section IV reviews Clower's analysis and shows how it is formally analogous to Patinkin's. Section V joins the Patinkin and Clower analyses into a model of an economy experiencing deficient aggregate demand. Section VI formulates an analogous model of an economy experiencing excessive aggregate demand. Finally, Section VII summarizes the main results.

I. Analytical Framework

The following discussion utilizes a simple aggregative framework which involves three economic goods—labor services, consumable commodities, and fiat money—and two forms of economic decision making unit—firms and households. Labor services are the only variable input into the production process. Other inputs have a fixed quantity, no alternative use, and zero user cost. Consumable commodities are the only form of current output; there is no investment.[7] Money is the only store of value, and it also serves as a medium of exchange and unit of account. The nominal quantity of money is exogenous and constant.

Firms demand labor and supply commodities. They attempt to maximize

profits. Households supply labor and demand commodities and money balances. They also receive the profits of the firms according to a predetermined distribution pattern. Households attempt to maximize utility. Each firm and household is an atomistic competitor in the markets for both commodities and labor.

Following Patinkin (1956, 1965), each of the flow variables in the model—commodities, labor services, and the increment to money balances—is for simplicity expressed as the quantity which accrues over a finite unit of time, say a week, so that each assumes the dimensions of a stock. The model thus includes the following variables:

$y =$ quantity of commodities
$x =$ quantity of labor services
$m =$ increment to real money balances (in commodity units)
$\pi =$ quantity of real profits (in commodity units)
$M =$ initial stock of nominal money balances
$P =$ money price of commodities
$w =$ real wage rate (in commodity units)

Throughout the following discussion, the method of analysis is to take a particular vector of the price level and real wage rate as given, and to work out the levels of income and employment implied by that vector. This procedure represents a non-Marshallian, or Keynesian, extreme, and following John Hicks may be denoted as the "fix-price method." The analysis does, of course, have implications for the appropriate specification of the forces making for changes in prices and wages. This paper does not explicitly investigate these implications, although we do consider a parenthetical example concerning the model's implications for the cyclical behavior of real wages.[8]

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substantial respects: First, they do not discuss the choice-theoretic basis for the theory. Second, the equilibrium price level is indeterminate in their model. Third, by introducing restrictions on the rate of change of employment, they complicate matters and obscure what would seem to be essential in the intermarket effects of disequilibrium.

[7] It should be clear that the incorporation of investment and a market for securities would alter none of the conclusions advanced in this paper.

[8] Grossman develops a more general model of multimarket disequilibrium based on Clower's choice-theoretic paradigm, and focuses in detail on the implications

II. Patinkin's Analysis of the Labor Market

Consider the behavior of the representative firm under the provisional assumption that it regards profit maximization as being constrained only by the production function. In particular, the firm perceives that it can purchase all the labor which it demands and sell all the output which it supplies at the existing levels of w and P. Thus, profits are given by

$$\pi = y^S - wx^D,$$

where the superscripts indicate supply and demand quantities. Assuming the production function to be

$$y = F(x),$$

with positive and diminishing marginal product, profit maximization implies

$$x^D = x^D(w),$$

such that $\partial F/\partial x = w$, and

$$y^S = F(x^D)$$

Patinkin (1956, 1965) contrasts the above to a situation in which commodities are in excess supply. Voluntary exchange implies that actual total sales will equal the total quantity demanded. The representative firm will not be able to sell its notional supply y^S.[9] Let y represent its actual demand-determined sales, where $y < y^S$.[10] Then, the profit maximization

problem becomes simply to select the minimum quantity of labor necessary to produce output quantity y.[11] In other words, the firm maximizes

$$\pi = y - wx^{D'},$$

subject to $y = F(x)$. The variable $x^{D'}$ may be denoted as the effective demand for labor. Profit maximization now implies

(1) $x^{D'} = F^{-1}(y)$ for $\dfrac{dF}{dx} \geq w$

The constraint of $y < y^S$ implies $x^{D'} < x^D$, with $x^{D'}$ approaching x^D as y approaches y^S.[12]

of this model for the disequilibrium behavior of prices and interest.

[9] We assume here that the firm would actually like to sell y^S. Such behavior may not always be optimal. For example, Section VI discusses a situation of excess demand for labor in which the firm's effective supply $y^{S'}$ is less than y^S. However, we assume for simplicity that excess demand for labor never coexists with excess supply of commodities and vice versa. Grossman presents a more general treatment of multi-market disequilibria which allows for the coexistence of excess supply in one market and excess demand in another, as well as excess supply or demand in both.

[10] In principle, y need not be less than y^S for every firm. The apportionment of the actual sales among the firms depends upon established queuing or rationing procedures. Grossman presents an explicit analysis of this apportionment within a framework of voluntary exchange.

The inability of a firm to sell its desired output at the going price violates an assumption of the perfectly competitive model. Kenneth Arrow has stressed this inconsistency of perfect competition with disequilibrium. Essentially, he argues that economic units which act as perfect competitors in equilibrium must (at least in certain respects) perform as monopolists in disequilibrium. In this paper we focus on the reaction of economic units to given (equilibrium or disequilibrium) price levels. If, in addition, one wished to analyze explicitly the dynamics of price adjustment, it would be necessary to discard the perfectly competitive paradigm of the producer as a price taker. (In this regard, see Barro 1970, 1971.)

[11] This analysis abstracts from inventory accumulation or decumulation. For simplicity, we assume throughout that output always adjusts instantaneously to equal the smaller of supply and demand. Permitting inventory accumulation would not affect the essentials of the analysis, although it would introduce a complication analogous to the inclusion of an additional input. In general, we might obtain $dy/dt = k[\min (y^D, y^S) - y]$, where $k = k(w, y) > 0$. A similar gradual adjustment process for employment might also be possible, as in Solow and Stiglitz.

[12] The choice-theoretic nature of the problem becomes much more interesting when there is more than one form of input. Assume profits to be given by $\pi = y - w_1 x_1^{D'} - w_2 x_2^{D'}$, where the production function is $y = F(x_1, x_2)$, which has the usual convexity properties. Profit maximization now implies

(1.1) $x_1^{D'} = x_1^{D'}\left(\dfrac{w_1}{w_2}, y\right)$

(1.2) $x_2^{D'} = x_2^{D'}\left(\dfrac{w_1}{w_2}, y\right)$

such that at output y, $(\partial F/\partial X_1)/(\partial F/\partial X_2) = (w_1/w_2)$. In reducing output y^S to y, the firm must now make a decision regarding optimal input combinations. However, as y approaches y^S, $x_1^{D'}$ and $x_2^{D'}$ approach x_1^D and x_2^D.
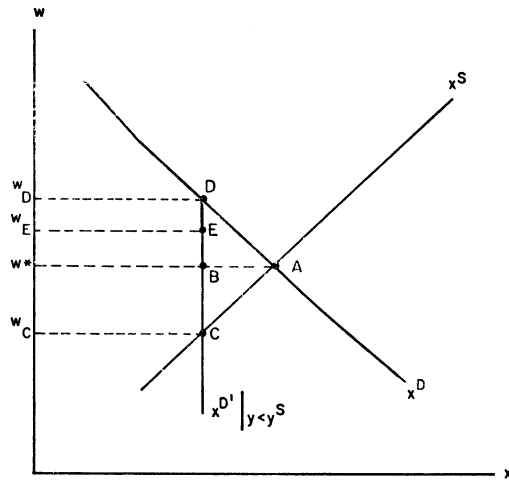
FIGURE 1. THE LABOR MARKET WITH EXCESS SUPPLY
OF COMMODITIES

The essential implication of equation (1) is that the effective demand for labor can vary even with the real wage fixed. Given voluntary exchange, employment cannot exceed the effective demand for labor. The quantity of employment thus is not uniquely associated with the real wage.

III. The Concept of Unemployment

Figure 1 depicts the preceding analysis of the labor market. The notional demand schedule for labor x^D is downward sloping. If $y=y^S$, the effective demand for labor $x^{D'}$ coincides with the notional demand. If $y<y^S$, the effective demand is independent of the real wage and less than the notional demand. The (notional) supply schedule for labor x^S, which will be derived below, is shown as upward sloping.

Figure 1 suggests a distinction between two concepts of unemployment—involuntary unemployment associated with excess (effective) labor supply, and voluntary unemployment associated with equilibrium in the labor market, but with disequilibrium elsewhere in the system. Suppose that initially the commodity market is in equilibrium, so that $y=y^S$ and $x^{D'}=x^D$, and that initially the real wage is w^*. Thus, the labor market is in equilib-

rium at point A, which may be denoted as full employment general equilibrium. Now suppose, say because the price level P is too high, that commodity demand is lower so that $y<y^S$ and $x^{D'}<x^D$. At the real wage w^*, excess supply of labor will amount to quantity AB. Failure of the price level to adjust to clear the commodity market leads to excess supply in the labor market. This excess supply represents what we usually refer to as involuntary unemployment. It is also what the Bureau of Labor Statistics ideally intends to represent by its statistical measure of unemployment—those seeking but not obtaining work at the going real wage. Involuntary unemployment clearly does not require a rise in the real wage above the level consistent with full employment equilibrium.

Now suppose that the real wage were to decline to w_C, so that the supply and effective demand for labor are equilibrated at point C. At point C, involuntary unemployment has vanished, but clearly this situation is not optimal. The reduced real wage has induced AB man-hours of labor to leave the labor force. Employment remains AB man-hours below the level associated with general equilibrium. Involuntary, i.e., excess supply, unemployment has been replaced by voluntary unemployment.[13]

The conclusion is that too high a real wage was not the cause of the lower employment, and a reduction in the real wage

[13] In terms of the *BLS* unemployment statistic, it is not clear that "zero" unemployment would be measured at w_C. If the higher wage, w^*, were (at least for a time) viewed as "normal," a considerable proportion of job seekers at wage w_C would be those willing to work at w^*, but not at w_C. These people are in the labor market seeking information on possible employment opportunities at (or above) w^*, and would not actually be willing to work at the going wage (see Armen Alchian). To the extent that the *BLS* measure includes this type of frustrated job seeker, the index will be a better measure of the gap between actual and general equilibrium employment BA, while simultaneously being a poorer index of those seeking but not obtaining employment at the going wage w_C.

is only a superficial cure. The real cause of the problem was the fall in commodity demand, and only a reflation of commodity demand can restore employment to the proper level.

The above analysis suggests the following cyclical patterns of real wages and employment: A decline in commodity demand and output produces a decline in employment with a corresponding excess supply of labor (point B). To the extent that real wages decline in response to this excess supply, a fall in real wages toward w_C will accompany (follow upon) the decline in employment. If, at point C or at some intermediate point between B and C, some action is taken to restore effective commodity demand, excess demand for labor (or, at least reduced excess supply) will result. In that case, a rising real wage may accompany the recovery of output and employment. Thus, disequilibrium analysis of the labor market suggests that real wages may move procyclically. This result differs from the conventional view that employment and real wages must be inversely related.

The present model can also be used to analyze involuntary unemployment which results from an excessive real wage. Clearly, if the real wage were above w^*, no stimulation of commodity demand could bring about full employment equilibrium, unless the real wage were reduced. This classical type of involuntary unemployment should be clearly distinguished from the type of unemployment discussed above, which arises, with the real wage at or below w^*, from a deficiency of demand for commodities.

IV. Clower's Analysis of the Consumption Function

In order to close the model, we must also analyze household behavior. Consider the behavior of the representative household under the provisional assumption that it regards utility maximization as being sub-ject only to the budget constraint. In particular, the household perceives that it can sell all the labor which it supplies and purchase all the commodities which it demands at the existing levels of w and P. Assume the utility function to be

$$ U = U\left(x^S, y^D, \frac{M}{P} + m^D \right), $$

with the partial derivatives $U_1 < 0$, $U_2 > 0$, and $U_3 > 0$. The budget constraint is

$$ \pi + wx^S = y^D + m^D $$

x^S, y^D, and m^D may be denoted as the notional supply of labor, the notional demand for commodities, and the notional demand for additional money balances. Utility maximization in general will imply that x^S, y^D, and m^D are each functions of w, M/P, and π. For simplicity, we shall assume that x^S depends only on the real wage. The important point is that the notional demand functions for commodities and additional money balances do not have the forms of the usual consumption and saving functions with income as an argument, because the household simultaneously chooses the quantity of labor to sell.

Clower contrasts the above notional process to a situation in which labor services are in excess supply. Given voluntary exchange, actual total employment in this situation equals the total quantity demanded. Thus, the representative household is unable to sell its notional labor supply x^S and obtain its implied notional labor income wx^S.[14] Labor income is no longer a choice variable which is maximized out, but is instead exogenously given. We may assume that the representative household is able to obtain the quantity of employment x, where $x < x^S$,

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[14] We assume that the household would actually like to sell x^S. As indicated in fn. 9, we assume for simplicity that excess demand for commodities never coexists with excess supply of labor.

so that its total income is $wx+\pi$. In this case, the utility maximization problem amounts to the optimal disposition of this income.

In other words, the household maximizes

$$U\left(x, y^{D'}, \frac{M}{P} + m^{D'}\right)$$

subject to $\pi+wx=y^{D'}+m^{D'}$. The variables $y^{D'}$ and $m^{D'}$ may be denoted as the effective demands for commodities and additional money balances. Utility maximization now implies

$$(2) \qquad y^{D'} = y^{D'}\left(\pi + wx, \frac{M}{P}\right),$$

and

$$(3) \qquad m^{D'} = m^{D'}\left(\pi + wx, \frac{M}{P}\right)$$

Note that, in aggregate, $\pi+wx=y=F(x)$. Thus, since all income accrues to the households, consumption and saving demand depend ultimately only on the level of employment and real money balances and not on the real wage rate. The constraint $x<x^S$ would generally imply $y^{D'}$ $<y^D$ and $m^{D'}<m^D$, but as x approaches x^S, $y^{D'}$ and $m^{D'}$ approach y^D and m^D.[15]

The important property of equations (2) and (3) is that they do have the form of the usual Keynesian consumption and saving functions. Labor income enters the consumption and saving functions as it represents the constraint upon the demand for current output imposed by the excess supply of labor.

[15] To the extent that long-run employment (income) exceeds current employment (income), a household may be more willing to maintain a higher demand for commodities at the expense of money balances. In this case effective commodity demand would remain closer to notional demand, and the "income multiplier" (as depicted later in Figure 4) would be smaller. In general, the size of the effect of quantity constraints on effective demands will depend on whether the constraint is viewed as "permanent" or "transitory."

The formal analogy between the Clower and Patinkin models should be apparent from the derivations of equations (2), (3) and equation (1), or more particularly equations (1.1) and (1.2) in footnote 12. Patinkin's model involves profit maximization subject to an output constraint, whereas Clower's model involves utility maximization subject to an employment constraint.

V. General Disequilibrium Involving Excess Supply

In Patinkin's analysis, the effective demand for labor was derived for a given level of demand for current output. To close this model, the demand for current output must be explained. In Clower's analysis, the effective demand for current output was derived for a given level of demand for labor. To close this model, the demand for labor must be explained. Thus, the Patinkin and Clower analyses are essential complements. When appropriately joined, they form a complete picture of the determination of output and employment in a depressed economy.

Figure 2 depicts Clower's analysis of the commodity market. The notional supply schedule for commodities is a downward sloping function of the real wage. The two notional demand schedules are upward sloping functions, reflecting the effect of substitutability between consumption and leisure as well as a positive income effect. As the real wage rate rises, leisure becomes relatively more expensive, and households tend to work and consume more. The schedule corresponding to the general equilibrium price level P^* passes through the point A. At point A, which corresponds to point A in Figure 1, P^* and w^* are consistent with simultaneous notional equilibrium in both the labor and commodity markets. The other notional commodity demand schedule in Figure 2 corresponds to the higher price level P_1. Because of the real balance effect, this
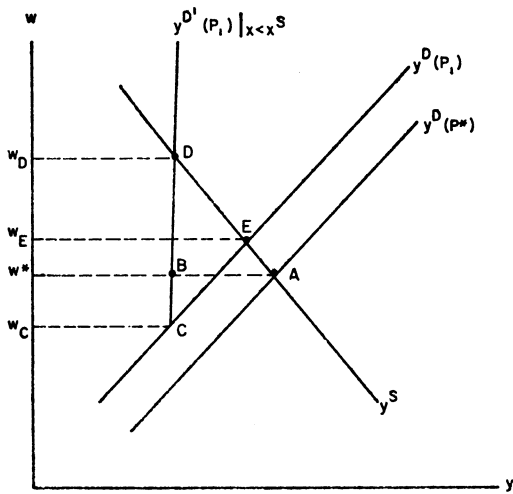
FIGURE 2. THE COMMODITY MARKET WITH
EXCESS SUPPLY OF LABOR

FIGURE 3. INTERACTION OF EXCESS
SUPPLY IN BOTH MARKETS

curve lies to the left of the curve associated with P^*.[16] If $x=x^S$, the effective demand for commodities coincides with the notional demand. If $x <x^S$, the effective demand is independent of the real wage, as noted above, and is less than the notional demand. The effective demand schedule shown in Figure 2 corresponds to the higher price level P_1. Points B, C, D, and E also correspond to the same points in Figure 1. This correspondence can be seen most clearly by explicitly depicting the interaction between the two markets, as is done in Figures 3 and 4.

Figure 3 illustrates the relationship between the existence of excess supply in one market and the other. In Figure 3, the points A, B, C, D, and E coincide with the same points in Figures 1 and 2. The four loci separate the regions of inequality between the indicated supply and demand

[16] As the model is constructed, only y^D and m^D of the five notional schedules; x^D, x^S, y^D, y^S, and m^D depend on the price level independently of the real wage. In a more general model, real balances would affect x^D, x^S, and y^S, and the price level would affect these schedules also. By ignoring this possibility, the exposition is simplified without losing any of the essence of the analysis. Of course, if none of the five schedules were influenced by the price level, prices would not be determined within the model.
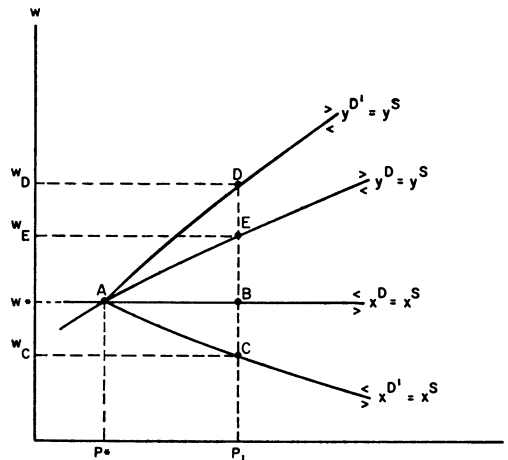
concepts. The locus $x^D=x^S$ is horizontal because, by assumption, both x^D and x^S depend only on the real wage. The locus $y^D=y^S$ is upward sloping because as shown in Figure 2, y^S is a decreasing function of the real wage, whereas y^D is an increasing function of the real wage (substitution and income effect) and a decreasing function of the price level (real balance effect). These loci intersect at point A, which depicts full employment general equilibrium. Points B, C, D, and E are all associated with a price level P_1, which is higher than the equilibrium price level P^*.[17] Point B, for example, would be consistent with notional equilibrium in the labor market, but implies excess supply in the commodity market. The essential point of Patinkin's analysis is that the effective demand for labor is smaller than the notional demand when commodities are in excess supply. Thus, the locus $x^{D'}=x^S$ exists to the right of point A and lies everywhere below the locus $x^D=x^S$. The existence of excess supply in the commodity market enlarges the region of excess supply in the labor market. Similarly, according to Clower's

[17] We could, of course, just as well think of these points as being associated with a nominal money supply which is too small.
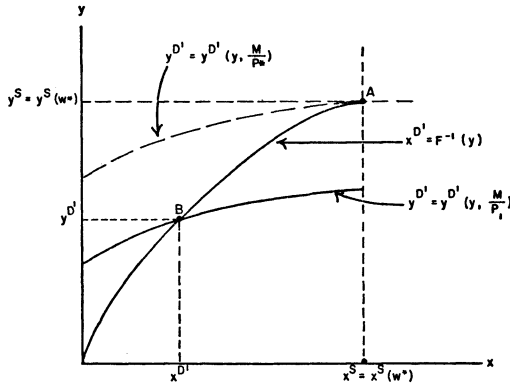
FIGURE 4. OUTPUT AND EMPLOYMENT WITH EXCESS
SUPPLY IN BOTH MARKETS

analysis, the effective demand for commodities is less than the notional demand when labor is in excess supply. Thus, the locus $y^{D'} = y^S$ exists to the right of point A and lies everywhere above the locus $y^D = y^S$. The existence of excess supply in the labor market also enlarges the region of excess supply in the commodity market.

Figure 4 illustrates the determination of the actual quantities of current output and employment when there is excess supply in both markets. In particular, Figure 4 has been drawn under the assumption that the existing wage-price vector is (w^*, P_1), that is that the economy is at point B of Figures 1, 2, and 3. Given voluntary exchange, x and y are determined by $x = \min[x^{D'}, x^S]$ and $y = \min[y^{D'}, y^S]$. The solid locus $x^{D'} = F^{-1}(y)$ describes firm behavior for values of y less than y^S. The solid locus $y^{D'} = y^{D'}(y, M/P_1)$ describes household behavior for values of x less than x^S. The intersection of these two loci determines the values of x and y corresponding to point B. Point A, full employment equilibrium, is at the intersection of y^S and x^S. Since at point B the real wage is consistent with full employment equilibrium, a movement from B to A involves on net only a fall in the price level from P_1 to P^*. In Figure 4, this fall in P is represented by an upward shift in $y^{D'}$ to the dashed locus $y^{D'}(y, M/P^*)$, which intersects $x^{D'}$ at

point A. The income multiplier in this case is given by the ratio of the difference between y^S and $y^{D'}(B)$ to the vertical distance between the two curves $y^{D'}(P^*)$ and $y^{D'}(P_1)$. Figure 4 is simply the Keynesian cross diagram with employment replacing income on the horizontal axis.

VI. General Disequilibrium Involving Excess Demand

The preceding discussion has concentrated on the case of excess supply in the markets for both commodities and labor. However, analogous considerations clearly apply to the boom situation of excess demand for both commodities and labor.

First, consider the behavior of the representative firm when there is excess demand for labor. The representative firm will be be able to obtain the quantity of labor x, where $x < x^D$. The firm then must maximize

$$\pi = y^{S'} - wx$$

subject to $y = F(x)$. The variable $y^{S'}$ may be denoted as the effective supply of commodities. The problem is simply to produce as much output as possible with the available labor. The solution is

$$(4) \qquad y^{S'} = F(x) \quad \text{for} \quad \frac{dF}{dx} \geq w$$

Figure 5 depicts the commodity market in this situation, and is analogous to Figure 2. The price level P_2 is assumed to be below P^*.

Next, consider the behavior of the representative household when there is excess demand for commodities. The representative household will be able to obtain the quantity of commodities y, where $y < y^D$. The household then has to choose between either saving, i.e., accumulating as money balances the income which it cannot spend on consumption, or substituting leisure for the unobtainable commodities by supplying less labor, or some combination of the
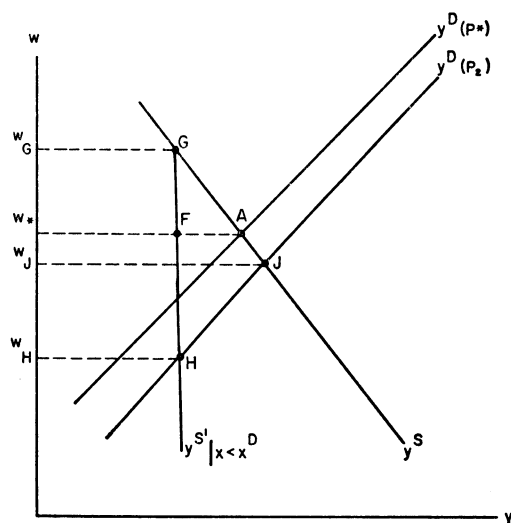
FIGURE 5. THE COMMODITY MARKET WITH
EXCESS DEMAND FOR LABOR

two. Formally, the household's problem is to maximize

$$U\left(x^{S'}, y, \frac{M}{P} + m^{D'}\right)$$

subject to $\quad \pi + wx^{S'} = y + m^{D'}$

The variable $x^{S'}$ may be denoted as the effective supply of labor. Utility maximization now implies

$$(5) \qquad x^{S'} = x^{S'}\left(w, \frac{M}{P}, \pi, y\right),$$

and

$$(6) \qquad m^{D'} = m^{D'}\left(w, \frac{M}{P}, \pi, y\right)$$

This theory stresses the fact that a household may react to frustrated commodity demand in two ways. First, the household may save the income which cannot be spent on consumption (in this model, solely by augmenting money balances). This option corresponds to the classical concept of forced saving, or, more precisely, what D. H. Robertson defined as "automatic lacking." Second, the household may increase leisure by reducing its supply of labor. The second option prob-

ably becomes more important when excess commodity demand is chronic, as in wartime or during other periods of rationing and price controls.[18] However, given that consumption, saving, and leisure in aggregate are substitutes, in general some combination of the two options will always be optimal. Excess demand will generally result in some fall in output.

Classical analysis, in which labor supply is solely a function of the real wage, assumes that households channel all frustrated commodity demand into forced saving. The possibility of reduced labor supply is ignored. However, the inclusion of this option is especially interesting, since it has the apparently paradoxical implication that excess commodity demand can result in decreased employment and output.

Figure 6, which is analogous to Figure 1, depicts the labor market in this situation. Two important observations should be stressed. First, too low a real wage, that is a real wage below the level consistent with general equilibrium, is not a necessary condition for excess demand for labor, even though the notional demand and supply for labor are both assumed to depend only upon the real wage. This observation is obviously the converse of the earlier observation that the effective demand for labor is not uniquely associated with the real wage. If commodities are in excess demand so that, given voluntary exchange, $y < y^D$, which in turn implies $x^{S'} < x^S$, at real wage w^* excess demand for labor will amount to quantity AF.

Second, with commodities in excess demand, the quantity of employment will generally be below the full employment level. The explanation of this apparent

[18] For example, R. Vicker, a recent visitor to the Soviet Union, reports the effects of suppressed inflation upon output: "Goods produced for sale in state retail outlets are snapped up more and more quickly, and the remaining excess of income over things to spend it on dilutes the incentive of Soviet workers."
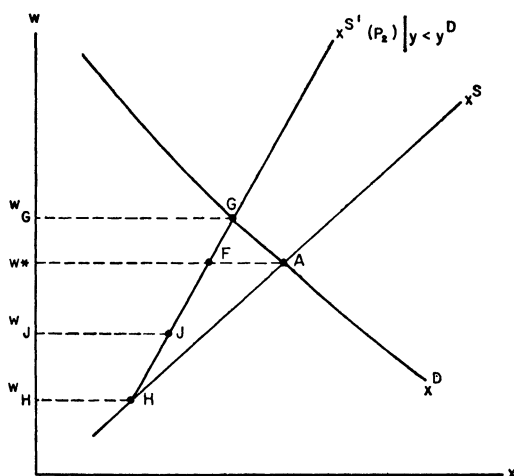
FIGURE 6. THE LABOR MARKET WITH EXCESS
DEMAND FOR COMMODITIES

Finally, Figures 7 and 8, which are analogous to Figures 3 and 4, depict the interaction between the two markets with excess demand in both. Points A, F, G, H, and J in Figure 7 coincide with the same points in Figures 5 and 6. Figure 8 is drawn under the assumption that the existing wage-price vector is (w^*, P_2), that is, that the economy is at point F. The details of the construction of these diagrams are left as an exercise for the reader.

VII. Summary

This paper describes the application of a general disequilibrium approach to familiar problems of macro-analysis. Some familiar results, such as the notion that insufficient commodity demand produces unemployment, are arrived at in a much more satisfactory manner than is possible under more conventional analysis. In addition, the specific inclusion of disequilibrium elements leads to some non-familiar results.

The impact of excess supply of commodities on labor demand removes the one-to-one classical relationship between real wage and employment. In a general disequilibrium situation, unemployment can coexist with "non-excessive" real wages, and a procyclical pattern of real wages is consistent with the theoretical model.

paradox, as indicated above, is twofold: 1) the quantity of employment can be no greater than the quantity supplied; and 2) when their consumption plans are frustrated households will generally substitute leisure and thus supply less labor at any given real wage. Notice that even if the real wage should rise sufficiently, i.e., to w_G, to eliminate the excess demand for labor, the level of employment would still be below that obtaining at general equilibrium.
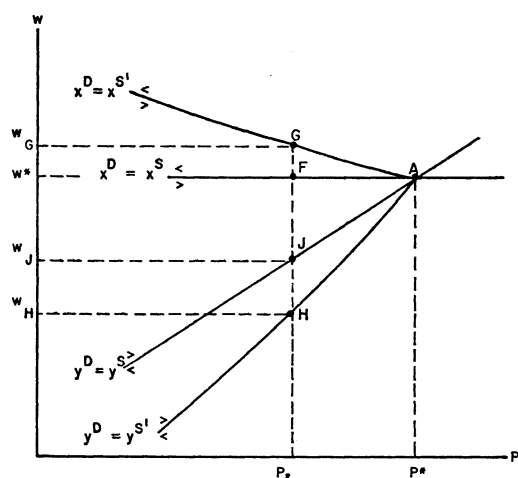

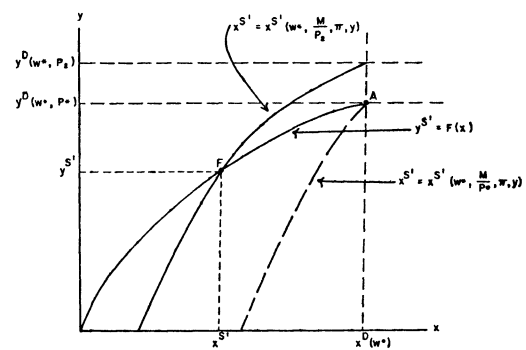FIGURE 7. INTERACTION OF EXCESS DE-
MAND IN BOTH MARKETS

FIGURE 8. OUTPUT AND EMPLOYMENT WITH EXCESS
DEMAND IN BOTH MARKETS

The disequilibrium analysis of the commodity market is formally parallel to the analysis of the labor market. The Keynesian consumption function emerges as a manifestation of the impact of excess labor supply on commodity demand. In this respect conventional macro-analysis is seen to be asymmetric. On the one hand, the disequilibrium impact of excess labor supply is implicitly recognized by entering income as a separate argument in the consumption function. However, on the other hand, the impact of excess commodity supply is neglected by adhering to the classical labor demand function which involves only the real wage. Because of this peculiar asymmetry, previous analyses of unemployment have had to rely on such contrived devices as a countercyclical pattern of real wages or fixed proportion production functions.

The framework for analyzing the excess supply, depression case is directly applicable to an analysis of sustained excess demand. The classical concept of forced saving is one aspect of the impact of excess commodity demand on household decision making. The forced saving solution is, however, incomplete, since labor supply would also react inversely to a prolonged frustration of commodity demand. To the extent that labor supply declines in response to excess commodity demand, increases in commodity demand lead to reduced employment, rather than to increased (forced) saving.

REFERENCES

A. A. Alchian, "Information Costs, Pricing, and Resource Unemployment," *Western Econ. J.*, June 1969, *7*, 109–28.

K. J. Arrow, "Toward a Theory of Price Adjustment," in M. Abramowitz, ed., *The Al-location of Economic Resources*, Stanford 1959.

R. J. Barro, "A Theory of Monopolistic Price Adjustment," read at Econometric Society Meetings, Detroit, Dec. 1970.

———, "A Theory of Optimal Adjustment," forthcoming 1971.

R. G. Bodkin, "Real Wages and Cyclical Variations in Employment," *Can. J. Econ.*, Aug. 1969, *2*, 353–74.

R. Clower, "The Keynesian Counter-Revolution: A Theoretical Appraisal," in F. H. Hahn and F. P. R. Brechling, eds., *The Theory of Interest Rates*, London 1965.

E. O. Edwards, "Classical and Keynesian Employment Theories: A Reconciliation," *Quart. J. Econ.*, Aug. 1959, *73*, 407–28.

H. I. Grossman, "Money, Interest, and Prices in Market Disequilibrium," *J. Polit. Econ.*, forthcoming 1971.

J. Hicks, *Capital and Growth*, New York, 1965.

J. M. Keynes, *The General Theory of Employment, Interest, and Money*, New York 1936.

———, "Relative Movements of Real Wages and Output," *Econ. J.*, Mar. 1939, *49*, 34–51.

E. Kuh, "Unemployment, Production Functions, and Effective Demand," *J. Polit. Econ.*, June 1966, *74*, 238–49.

A. Leijonhufvud, *On Keynesian Economics and the Economics of Keynes*, New York 1968.

D. Patinkin, "Involuntary Unemployment and the Keynesian Supply Function," *Econ. J.*, Sept. 1949, *59*, 360–83.

———, *Money, Interest, and Prices*, 1956: 2d ed. New York 1965.

D. H. Robertson, *Banking Policy and the Price Level*, London 1926.

R. M. Solow and J. E. Stiglitz, "Output, Employment, and Wages in the Short Run," *Quart. J. Econ.*, Nov. 1968, *82*, 537–60.

R. Vicker, "USSR: Rising Income, Black Markets," *The Wall Street Journal*, Apr. 21, 1970.