

A SURVEY OF SOME NON-MARKET-CLEARING
MACROECONOMIC MODELS

by

MICHAEL WAYNE WATSON

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A MASTER'S REPORT

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requirements for the degree

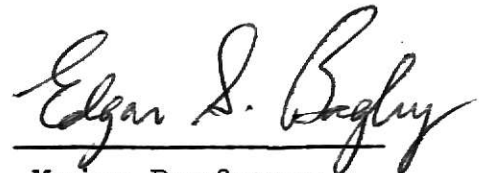
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INTRODUCTION

The objective of this paper is to review the development of macroeconomic models when markets do not clear. The essence of the models is the denial of the classical assumptions of the automatic adjustment of markets when they are out of equilibrium¹. How quantities are determined when markets do not clear and whether or not this disequilibrium is permanent are the issues involved. The question of the permanence or "stickiness" of disequilibrium is essentially an evaluation of the validity of Walras' law (i.e. if there is excess supply in one market there must necessarily be excess demand in one or more other markets equaling the excess supply).

In the classical theory there is assumed a tâtonnement process whereby various prices are reviewed until an equilibrium price is established and economic activity is conducted. There is an "auctioneer" who at no cost organizes transactions until all markets clear². Allowing notional demand to mean the quantity desired to buy or sell and effective demand meaning actual quantities transacted, there is no difference between notional and effective quantities in a Walrasian system. The Walras tâtonnement process is, in effect, identical to Edgeworth's concept of recontracting where buyers and sellers are allowed to compare their desires to buy and sell at different prices until a final contract is agreed upon that will clear the market³. In other words, before any exchange takes place the equilibrium price has already been determined. Equilibrium is taken to mean market-clearing throughout this paper.

Similarly, Alfred Marshall assumed instantaneous price adjustments for his

static analysis.⁴ He did, however, realize that the economy never operated as in his model but he believes that it would tend to move in the direction suggested by his model.

So, up to the time of Keynes economic theory operated on the basis of these assumptions of instant or eventual price adjustments. There could be no long term disequilibrium condition because the economy would always move to eliminate excesses in any particular market (via Walras' law) and do this quickly (tâtonnement or the "auctioneer" theory). Only institutional barriers would prevent an otherwise inevitable equilibrium to exist.

John Maynard Keynes challenged this approach in 1936 in his famous book, The General Theory. He maintained that it was possible for unemployment to persist indefinitely and suggested demand oriented policies to combat it. With the interpretation of Keynes by Hicks⁵ in particular, and by Hansen⁶ and others, Keynesian theory became the generally accepted economic doctrine of the post WW II era. His theory, however, according to Robert Clower, has been defined within the framework of general market equilibrium and this has led to misunderstanding the true significance of the theory. What Clower in his 1965 article "The Keynesian Counter-Revolution: A Theoretical Appraisal"⁷ means by this is that the interpreters of Keynes assume that planned transactions are always realized, thereby assuring the validity of Walras' law and a tendency toward general market equilibrium. Clower, and later his colleague at UCLA, Axel Leijonhufvud⁸, assert that the importance of Keynesian theory is the implication of a failure in one market to clear on the other markets. This, they believe, is what truly separates Keynes from those who preceded him.

Whether or not Keynes himself was aware of the significance of the disequilibrium analyses or if some economists are only trying to inject into Keynes' theory what was originally lacking is outside the scope of this paper.

What is included is a brief summary and review of three macroeconomic models which can produce persistent disequilibrium. An examination of why disequilibrium exists, if it is persistent, and how it differs or is similar to Keynes theory is attempted. The three different models were selected with a view toward picking models that illustrate important stages of disequilibrium development.

First I review Patinkin's model found in chapter 13 of Money, Interest, and Prices, published in 1956. This section is recognized as one of the first attempts to examine disequilibrium and, interestingly, is written by one of the better known "Counter-revolutionists."⁹ He operates in the same theoretical framework as Hicks and Hansen.

Then I examine the positions of Clower and Leijonhufvud, in particular Clower's dual decision hypothesis. These two economists originated the debate concerning what Keynes really meant and reconsidered the foundations of the Keynesian theories. This occurred with the publication of their articles in 1965 and 1967, (see footnotes 4 and 7) some ten years after Patinkin's book.

Finally a more sophisticated model is reviewed. This is one by Muellbauer and Portes¹⁰ published in 1978. Their model uses a unique graphical comparative static approach to trace the implications of non-market clearing situations.

This is included to show the operation of a non-market clearing model and how it can be used.

It should be noted before getting into the models that though they are labeled "disequilibrium" some economists dislike that term because it connotes motion whereas the argument of these theories is that the motion may be "slow, mis-directed, or non-existent."¹¹ Perhaps the terminology "temporary equilibrium with quantity rationing" is more accurate. Regardless, with this warning in mind I will refer to these theories as "disequilibrium" theories.

PATINKIN'S THEORY

Perhaps the first economist to recognize the problems associated with assuming a general equilibrium condition for Keynesian analysis was Don Patinkin in his book Money, Interest, and Prices (1956). In chapter 13 he examines unemployment in a disequilibrium context. Crucial to his model is the assumption that the market period is short enough that prices remain constant.¹² The essence of his model is that an excess supply of goods (insufficient demand) leads to involuntary employment without any consequence on the real wage rate. Patinkin writes, " While our interpretation takes off the analytical edge of Keynesian economics in one direction, it sharpens it in another, more vital one. It makes unmistakably clear--what should always have been clear--that the involuntary unemployment of the General Theory need not have its origin in wage rigidities. Indeed in this respect we are more Keynesian than Keynes."¹³

In addition to price inflexibility due to a short market period this model also assumes: The firms' objective is profit maximization constrained only by the production function; the firm believes it can hire all the labor it desires at existing wages; and the firm believes it can sell all the output it supplies at existing prices. In other words except for short-run price rigidity there is a perfectly competitive world. The following notation is not Patinkin's, but my own, to keep it similar to the notation in the other models.

Notation is as follows:

y = notional quantity of goods transacted.

$y^{s,d}$ = quantity supply and demand of goods.

$l^{s,d}$ = quantity of labor supplied or demanded (desired or notional).

w = real wages.

$\bar{y}^{s,d}$ = actual quantities transacted (effective supply, demand).

R = profit.

In the perfectly competitive environment, desired (or notional) transactions always equal actual (or effective) transactions, and the following relations are assumed:

$$R = y^s - w l^d$$

$$y = F(l) ; y^s = F(l^d)$$

$$l^d = l^d(w)$$

The partial of 'F' with respect to 'w' is w.

Now, Patinkin assumes that for some reason there is insufficient demand for the firm's output. Or, $\bar{y}^d < y^s$. Firms can no longer sell all that they produce

so they reduce their output. Since output is a function of employment, unemployment results. So their question is how many people do they hire to produce \bar{y}^s (rather than y^s). Profit is now:

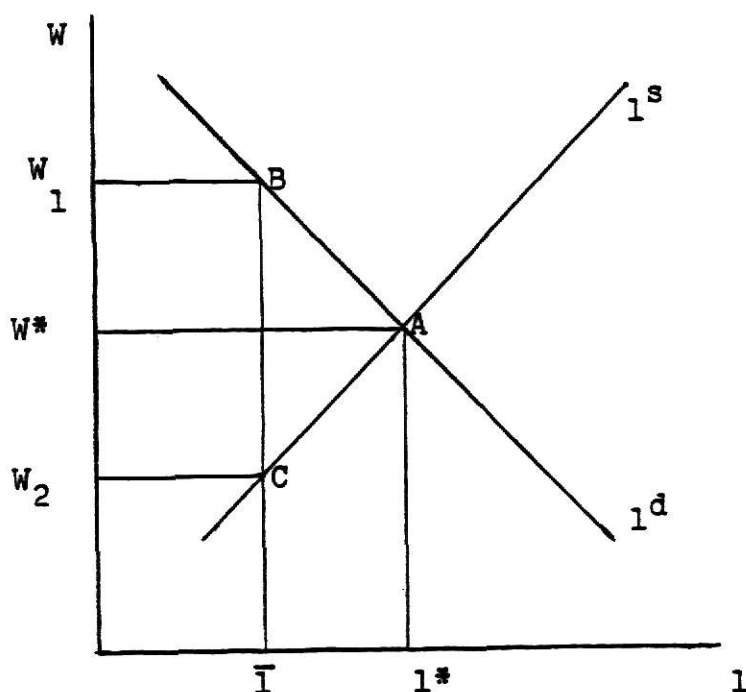
$$R = \bar{y}^s - w l^d \text{ subject to } y = F(l)$$

and $l^d = F^{-1}(\bar{y})$ for the partial of 'F' with respect to labor is greater or equal to the real wage.

This implies that effective demand for labor can vary even with the real wage fixed. In other words the employment question has switched from "we will employ up to the point where the marginal product of labor equals their real wage" to "we will employ only as many people as it takes to produce \bar{y}^s output." Effective demand for labor varies with output, not with real wage, until effective demand for output equals notional supply ($\bar{y}^d \rightarrow y^s$).

Graphically it can be represented as such:

Figure 1



Originally, all was at equilibrium and l^d , l^s represented the labor demand and labor supply functions. Then, for some reason, there arises insufficient demand. Firms can no longer sell all that they supply. As a result they cut back output (notice: this occurs only in the short run. Given enough time prices will adjust giving rise to the wealth effect, increasing demand and all will readjust itself to equilibrium levels). What we have in this model is the possibility of unemployment varying without wages changing. In fact wages and unemployment could easily move together.

Suppose aggregate demand declined. Firms lay off workers until T is hired rather than l^* . If real wages are reduced to w_2 then technically involuntary unemployment has been eliminated, but the economy is not operating where it would like to. Conceivably, wages could have risen to w_1 and employment would be at T . Assuming wages drop to w_2 , as demand is increased (presumably through the wealth effect) employment increases as well as real wages. This is contrary not only to classical theory but to Keynes as well.

Another point with Patinkin's model is that the inability of a firm to sell all its output at the going prices violates the original premise of a perfectly competitive environment. How this would effect the model and the various functions is omitted.

Similar to Keynes, Patinkin viewed involuntary unemployment as a result of insufficient demand. Keynes, through his liquidity trap, inelastic investment demand function and more importantly his downward inflexible wages, viewed this as a persistent state. Patinkin, in his neo-classical framework, believed the

problem to be a short term phenomena.

ROBERT CLOWER -- 1965

Robert Clower is generally regarded as being the groundbreaker in disequilibrium economics.¹⁴ Clower's question in his now famous article "The Keynesian Counter-Revolution: A Theoretical Appraisal" concerns what the purely formal differences are between Keynes and the Classics.¹⁵

From this perspective Clower asserts that Keynes fundamentally challenged the orthodox theory of household behavior. And he believes that the entire argument rests or falls on whether or not Keynes refuted Walras' law -- and if he knew he did. As Clower says, "The conclusion which I draw from all this may be put in one phrase: either Walras' law is incompatible with Keynesian economics or Keynes had nothing fundamentally new to add to orthodox economic theory."¹⁶ The validity of the orthodox theory of household behavior is what Keynes really challenged. If his theory can be proved to add nothing new to household behavior theory then Keynes added nothing new to economic theory on this subject -- his was merely a special case of a more general theory.

So the logical place to begin an exposition of Clower's hypothesis is with Clower's interpretation of the theory of household behavior. The assumptions:

Two mutually exclusive classes of commodities:

- (a) those supplied by firms and demanded by households,
- (b) those supplied by households and demanded by firms.

Those in (a) are noted by numerical subscripts $i = 1, \dots, m$

Those in (b) are noted by numerical subscripts $j = m+1, \dots, n$

Quantities supplied and demanded by firms are denoted as s_1, \dots, s_m
 d_{m+1}, \dots, d_n .

Quantities demanded and supplied by households are denoted as

$d_1, \dots, d_m, s_{m+1}, \dots, s_n$.

Prevailing market prices expressed in units of commodity n are denoted
 by p_1, p_2, \dots, p_{n-1} ($p_n \equiv 1$), P represents the vector of p 's.

All households have the same utility function $U(d_1, \dots, d_m; s_{m+1}, \dots, s_n)$

All firms represented by an aggregate transformation function:

$$T(s_1, \dots, s_m; d_{m+1}, \dots, d_n) = 0$$

Firms maximize profit, r , $r = p_i s_i - p_j d_i$

The demand function of the household is: $d_i(P, r)$.

The supply function of the household is: $s_i(P, r)$, r being fixed.

Assuming that business profits all flow to households, then the classical argument goes as follows: If prices are such that demand differs from supply in any market then at least some individuals cannot carry out their trading plans. Under these circumstances it is asserted the prices will vary over time, rising in markets where demand is greater than supply and falling when demand is less than supply. The economy is in a temporary state of disequilibrium. Once prices adjust, markets are in equilibrium.

From household behavior we know that:

$$\sum p_i \bar{d}_i - \sum p_j \bar{s}_j - r = 0 \quad (1)$$

That is, total expenses - total income = 0, assuming $r = 0$.

From the theory of business behavior we know that:

$$\sum p_i \bar{s}_i - \sum p_j \bar{d}_j - \bar{r} = 0 \quad (2). \quad \bar{r} \text{ is business profit.}$$

This equation essentially says that what a firm sells will cover its costs.

Subtracting (2) from (1) we get

$$\sum p_k [\bar{d}_k - \bar{s}_k] = r - \bar{r} \text{ which leads to Walras' law on assumption that } r = \bar{r}.$$

$$\sum p_k [\bar{d}_k(P) - \bar{s}_k(P)] = 0.$$

Or, the sum of the price of all transactions will be zero.

Clower asserts, "I shall argue that the established theory of household behavior is, indeed, incompatible with Keynesian economics, that Keynes himself made tacit use of a more general theory, that this more general theory leads to market excess-demand functions which include quantities as well as prices as independent variables and, except in conditions of full employment, the excess demand functions so defined do not satisfy Walras' law."¹⁷

Orthodox theory assumes that market excess demands are independent of current transactions. This implies that, "income magnitudes do not appear as independent variables in the demand or supply functions of a general equilibrium model; for incomes are defined in terms of quantities as well as prices, and quantity variables never appear explicitly in the market excess-demand functions of traditional theory."¹⁸

The importance of this statement is that the Keynesian consumption function involves income as an independent variable and this could never have been derived from any existing theory of general equilibrium because the existing theories all assume, as did the classical economists, that notional demands are realized. In other words since planned transactions would always be realized, only prices would enter into demand functions as an argument. This is what Clower calls a 'unified decision hypothesis.'

But since realized transactions, according to Clower, may be less than what was planned then income enters in as an argument of the demand function and there is a "dual decision hypothesis." Since effective demand is less than notional demand the form of the consumption function differs and consumers must make their decision based on income and prices.

The critical question is this: are the unrealized demands giving signals to the market so that it will adjust? If not then Walras' law is violated and chronic or persistent disequilibrium will result. If the market does receive proper signals from non-cleared markets then Walras' law remains true and Clower fails to distinguish Keynes from the "counter-revolutionists."

In order to see how this works out it is necessary to remember that there are four markets (goods, money, labor and bonds) and that Walras' law states that if three markets are in equilibrium the fourth market must be also. It is conventional that the bonds market be dropped from the macro-models.

If it is asserted that the labor market does not clear then the fourth

market cannot be excluded or else one must conclude that Walras' law is invalid.

At this point I refer to the analysis in chapter 8 of Macroeconomic Systems by Krish Bhaskar and David Murray.¹⁹ Their chapter summarizes primarily the work of Leijonhufvud and gives an illustration of how his explanation of Clower's theory works out in a little table. Leijonhufvud's work which pertains to this paper is chapter 2 of On Keynesian Economics and the Economics of Keynes. In this chapter on unemployment disequilibrium Leijonhufvud explains Clower's contribution while adding some tables to clarify the relationship between excess demand, excess supply and Walras' law.

Assume that all four markets are initially in equilibrium (i.e. no excess supply or demands in any of them). Now suppose that business expectations are gloomy. Investment declines (excess supply in the goods market) and therefore the supply of bonds decline (excess demand in the bonds market). They will sum to zero. This is stage one in table one below. Because there is excess demand in the bonds market the price of bonds will rise until equilibrium is restored. When the price of bonds increases, interest rates decline, sparking an increase in the speculative demand for money, thereby creating excess demand in the money market (stage two in the table). The excess supply in the goods market means that the aggregate demand curve has shifted to the left, reducing the price level and real income (see figure two). A reduction in prices and incomes reduces the transaction demand for money. The money market then clears. The goods market clears but the labor market has an excess supply. The falling price level shifts the labor supply curve upward (see figure 3). The money wage will fall until the excess supply of labor disappears. This process is traced

out in the following table.

TABLE 1

	Labor	Goods	Money	Bonds	Sum
Initially	0	0	0	0	0
Stage One	0	ES	0	ED	0
Stage Two	0	ES	ED	0	0
Final Equilibrium	0	0	0	0	0

Figure 2

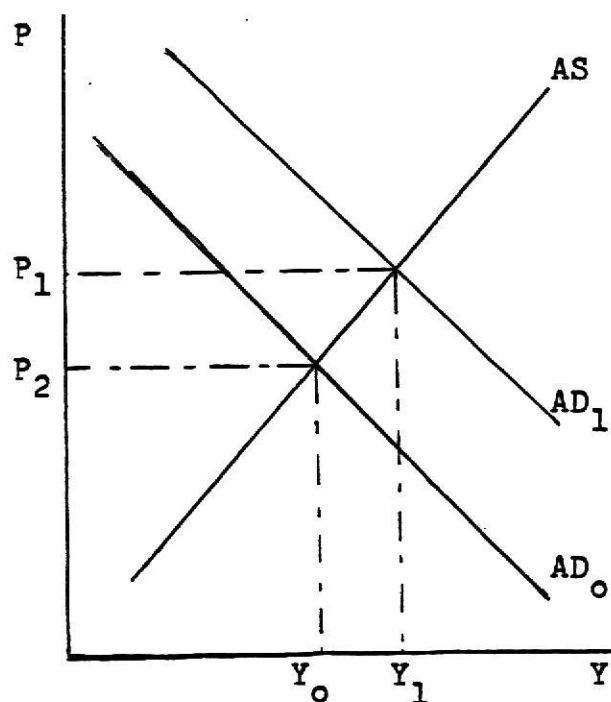
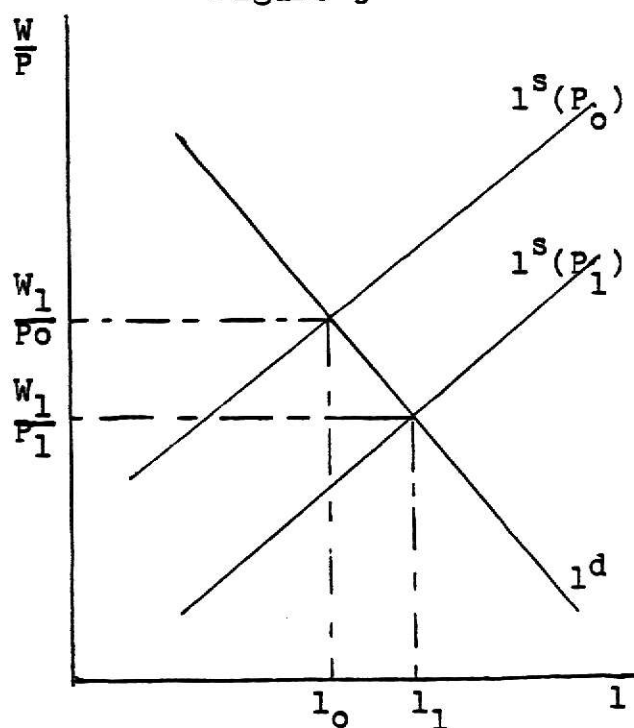


Figure 3



If rigid wages are now assumed, everything occurs as before except in the labor market. Here, because money wages cannot fall, excess supply remains, apparently contradicting Walras' law. Bhaskar and Murray write at this point, "Walras' law may, however, be applied in general when the sum of the excess sup-

plies and demand in all four markets is zero rather than only when each separate market has zero excess demands. It can be argued that in the full Keynesian model the unemployed (i.e. those who have an excess supply of labor) have a demand for money in order to buy the goods they require in order to live and that the value of this excess demand for money is equal to the excess supply of labor."²⁰ This is shown in table two.

TABLE 2

	Labor	Goods	Money	Bonds	Sum
Initially	0	0	0	0	0
Stage One	0	ES	0	ED	0
Stage Two	0	ES	ED	0	0
Final Equilibrium	ES	0	0	0	ES
or	ES	0	ED	0	0

If this excess demand for money is "effective" (i.e. finds its way to the market place) then Walras' law holds and markets will clear. If it is ineffective, Walras' law fails, unemployment persists, and Clower makes his point.

Leijonhufvud thinks that if the excess demand for money was effective then the interest rate would rise -- which does not happen in the Keynesian system. "Both Clower and Leijonhufvud argue that Walras' law is only truly applicable in a barter economy since the unemployed then have an effective excess demand for goods but in capitalist economies, money is an essential transaction medium and

this makes the result uncertain."²¹ Nevertheless, in most capitalist economies the unemployed receive some form of monetary compensation (unemployment benefits, savings, social security, welfare) which may give these unemployed persons an effective demand close to their income earning potential.

MUELLBAUER and PORTES

In 1978 Muellbauer and Portes published their own macroeconomic model under disequilibrium or with "quantity rationing" as they prefer.²² Their major innovation is the "double wedge" diagram which simplifies things, they believe. When markets do not clear through price adjustments, ". . . one has to juggle different combinations of excess supplies and demands and this becomes rather complicated."²³ Hence their analysis attempts to simplify the model and to establish a basis for empirical testing of quantity rationing theory.

(1) Definitions and Assumptions

According to Muellbauer and Portes there is a difference between quantities actually traded (purchases and sales) and demands and supplies. "Furthermore we distinguish between notional and effective demand (or supply). An agent's notional demand on a given market is that which he would express on that market in absence of any quantity constraints on his transactions in any other markets."²⁴ The notional demands depend only on initial endowments and prices. "An agent's effective demand on a given market is that which he will express on the market taking account of constraints on his transactions in other markets."²⁵ If there

are no constraints, effective demand will be notional demand. They continue to differentiate:²⁶

We therefore distinguish further between constrained and unconstrained demands: the effective demand will be the unconstrained (notional) demand if the agent does not encounter constraints in other markets, and it will be the constrained demand if he does. Notationally, taking for example l to represent the quantity of labor services actually traded, we write effective demand as l^d ; this will either be unconstrained (notional) demand given by the function l^d , or constrained demand, given by $T^d(.)$. Whereas the arguments of $l^d(.)$ will not include quantity constraints on other markets, those of $T^d(.)$ will. If the agent (firm) is not so constrained, then $l^d = l^d(.)$; if he is, then $l^d = T^d(.)$.

Also in their model the agents face given prices in the unit period, though prices can change between periods. There are three decision-makers in this economy: households, firms, and the government. Government expenditure is fixed, exogenous, and never faces constraints. There are three commodities: money, goods, and labor. There are only two markets, goods and labor. The stock of money is exogenous. There is no taxation. Labor services are the only variable input. Households supply labor and demand goods and money balances. All non-labor income is treated as exogenous. Firms demand labor and inventories and supply goods. The following notation is used (with the Greek letters being changed to English letters):

y_t = flow of output (production) per period.

x_t = sales of goods per period.

i_t = inventories held at end of period t .

c_t = flow of goods purchased by households.

g_t = flow of goods purchased by government.

l_t = flow of labor services sold by households.

$T_t - l_t$ = household leisure time.

m_t = stock of money balances at end of period t .

w_t = money wage rate.

p_t = price of the good.

s_t = flow of household savings.

r_t = profits.

d_t = dividend payments to households.

Superscripts "d" and "s" denote demand and supply, "h" and "f" stand for households and firms, and delta, Δ , is the one-period difference operator.

The model includes the following relationships:

- (1) $y_t = x_t + \Delta i_t$
- (2) $x_t = c_t + g_t$
- (3) $s_t = d_t + w_t l_t - p_t c_t = \Delta m_t^h$
- (4) $r_t = p_t x_t - w_t l_t$
- (5) $\Delta m_t^f = r_t - d_t = p_t x_t - w_t l_t - d_t$
- (6) $p_t g_t = p_t x_t - p_t c_t = \Delta m_t^h + \Delta m_t^f$
- (7) $m_t^f = r_t = d_{t+1}$

On each market the quantity traded is the minimum of effective demand and supply. The minimum conditions in their model are:

$$(8) \quad c = \min(c^d, c^s).$$

$$(9) \quad l = \min(l^d, l^s).$$

Since the quantity-constrained demand function has a different form from that of the corresponding notional demand, then whenever excess supply or demand exists in one market there is a switch from the unconstrained to the constrained functional form on the other market.

Thus not only does effective demand on the goods market depend on the quantity traded on the labor market: the effective demand function for goods depends on whether there is excess supply or demand for labor. If there is non-negative excess demand for labor, then the effective demand for goods is the notional, unconstrained demand, so the demand function for goods has only prices and initial assets as arguments: $c^d = c^d(\cdot)$. But if there is excess supply of labor, then we switch to the quantity-constrained effective demand for goods, one argument of which is the quantity of labor actually sold: $c^d = \bar{c}^d(l, \cdot)$. This switching between functional forms occurs not only for the demand for goods, but also for the supply, and for the demand for and supply of labor. The switching conditions are, indeed the essence of the Clower-Patinkin 'dual-decision hypothesis.'²⁷

Therefore there are four possible constraint regimes (the labels K, R, C and U to be explained later).

$$(10) \quad c^d < c^s, \quad l^d < l^s, \quad \text{so that } c = c^d = \bar{c}^d(l; \cdot), \quad c^s = c^s(\cdot), \\ \text{and } l = l^d = \bar{l}^d(c; \cdot), \quad l^s = l^s(\cdot)$$

(buyers rationed in both markets, K)

$$(11) \quad c^d > c^s, \quad l^d > l^s, \quad \text{so that } c = c^s = \bar{c}^s(l; \cdot), \quad c^d = c^d(\cdot), \\ l = l^s = \bar{l}^s(c; \cdot), \quad l^d = l^d(\cdot)$$

(sellers rationed in both markets, R)

$$(12) \quad c^d > c^s, \quad l^d < l^s, \quad \text{so that } c = c^s = c^s(\cdot), \quad c^d = \bar{c}^d(l; \cdot),$$

$$l = l^d = l^d(.), l^s = l^s(c;.)$$

(buyers rationed in goods market, sellers rationed in labor market, C)

$$(13) \quad c^d < c^s, l^d > l^s, \text{ so that } c = c^d = c^d(.), c^s = c^s(l;.), \\ l = l^s = l^s(.), l^d = l^d(c;.)$$

(sellers rationed in goods market, buyers rationed in labor market, U)

Figures 4 and 5 may help in understanding the interactions of the two markets.

Figure 4

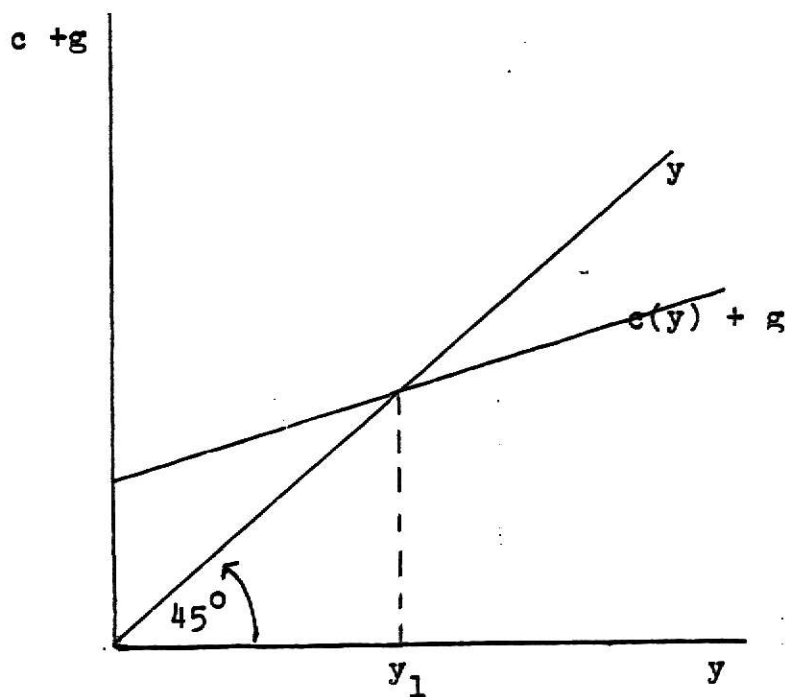


Figure 5

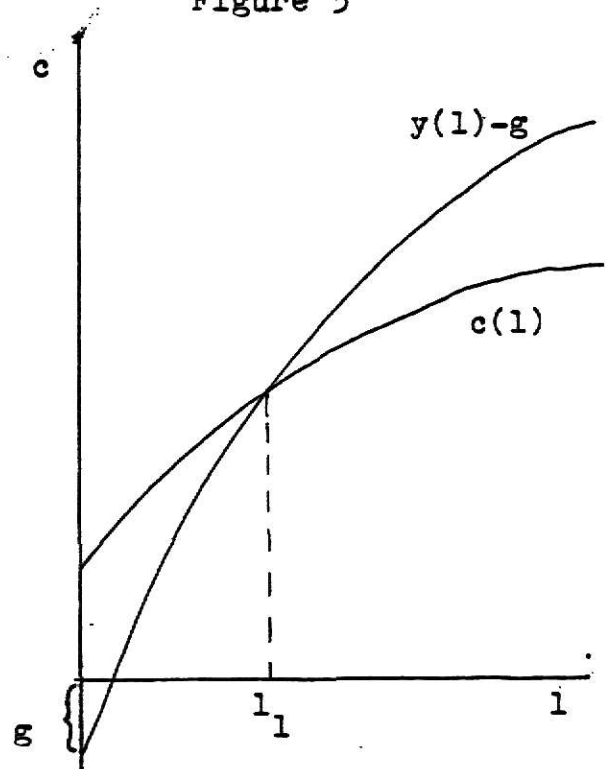


Figure 4 is the Keynesian income-expenditure diagram. The graph on the right (figure 5) makes explicit the role of the labor market by translating the axes. This shows consumption as a function of employment.²⁸ The microeconomic foundations for explaining the behavior of firms and households is necessary.

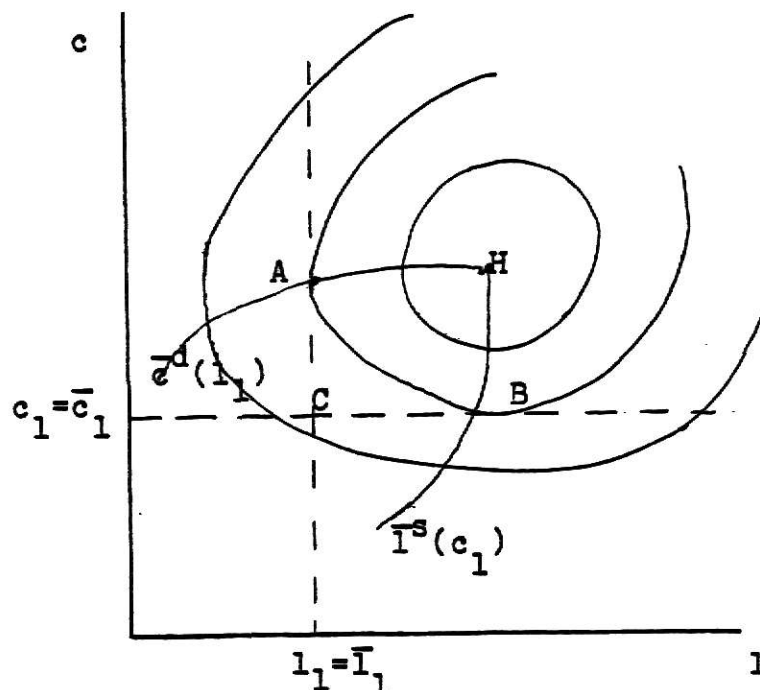
(2) Household Behavior

The authors describe three alternative behavior patterns over two distinct time periods (each with four constraint regimes) and a probabilistic expectational parameter for period two. Then, due to the complexity and disputed usefulness of all this they limit their utility functions to one time period and one "behavior" and arrive at a utility function (with the arguments pertaining to period two, T_2 , and those pertaining to the probabilistic expectational parameters being left out completely.):

$$u_H = V(c_1, T_1 - l_1, m_0 + w_1 l_1 - p_1 c_1) \quad (14)$$

If we draw a constant utility contour map in consumption-labor space and call "H" the optimal point (the maximum utility with no constraints imposed) then we have figure 6.

Figure 6



The coordinates of "H" are the unrationed goods demand and labor supply. If labor is rationed (say $l_1 < \bar{l}_1$, indicated by the dotted line tangent to the indifference curve at A) then the optimal consumption level is AA' . By

shifting the l_1 constraint rightwards to H the labor-rationed goods demand function is traced out. The unrationed goods demand and labor supply functions can be written as such (where $(.)$ represents every exogenous argument of the utility function):

$$\begin{aligned} c_1 &= c^d(.) = c_1^d \\ l_1 &= l^s(.) = l_1^s \end{aligned} \tag{15}$$

If labor is rationed then the demand for goods depends on l_1 as well as all the exogenous arguments and we have:

$$\begin{aligned} c_1 &= \bar{c}^d(., l_1) = c_1^d \\ l_1 &= T_1 < l^s(.) = l_1^s \end{aligned} \tag{16}$$

If goods are rationed the functions appear as:

$$\begin{aligned} c_1 &= \bar{c}_1 < c^d(.) = c_1^d \\ l_1 &= l^s(., c_1) = l_1^s \end{aligned} \tag{17}$$

If both goods and labor are rationed then:

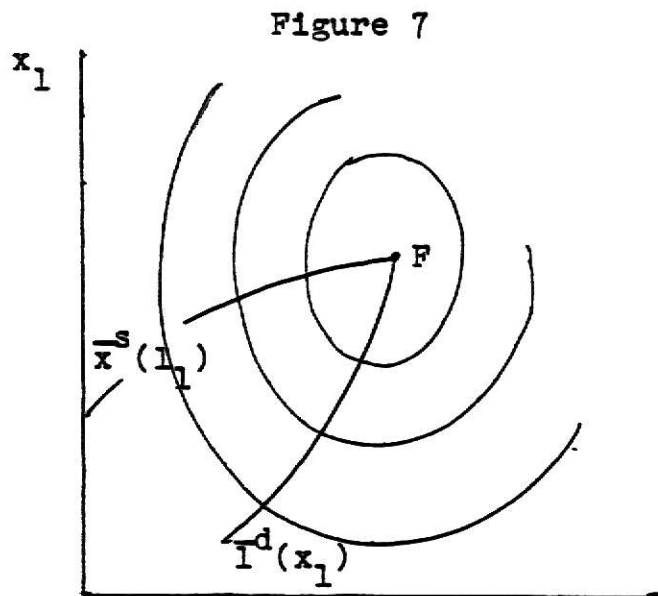
$$\begin{aligned} c_1 &= \bar{c}_1 < \bar{c}^d(., l_1) = c_1^d \\ l_1 &= T_1 < l^s(., c_1) = l_1^s \end{aligned} \tag{18}$$

The functions (15), (16), (17) and (18) are the effective demands and supplies in each of the four constraint regimes. When there are constraints in one market then the effective demand or supply expressed on the other market is the

rationed demand (16) or supply (17) rather than the notional (15) demand or supply. The difference between the forms of the consumption function in (16) and (17) is the so-called "dual-decision hypothesis." If the labor market is not rationed (i.e. clears) then consumption does not depend on current income from the sale of labor. When labor is rationed the Keynesian consumption function operates (16).²⁹

(3) Firms

The behavior of firms is analogous to that of households. In this case we will let $(.)$ represent i_1, l_1, x_1, p_1, w_1 . Figure 7 illustrates the possible behavior patterns with the point F being the optimal point where there is no rationing.



The unrationed supply function of goods and demand function for labor are:

$$\begin{aligned} x_1 &= x^s(.) = x_1^s \\ l_1 &= l^d(.) = l_1^d \end{aligned} \tag{19}$$

If labor is rationed but sales are not then we have:

$$\begin{aligned}x_1 &= \bar{x}^s(., l_1) = x_1^s \\ l_1 &= T_1 < l^d(., x_1) = l_1^d\end{aligned}\tag{20}$$

If sales are constrained but labor isn't then:

$$\begin{aligned}x_1 &= \bar{x}_1 < x^s(., l_1) = x_1^s \\ l_1 &= T_1 < l^d(., x_1) = l_1^d\end{aligned}\tag{21}$$

And if the firm is constrained in both markets:

$$\begin{aligned}x_1 &= \bar{x}_1 < \bar{x}^s(., l_1) = x_1^s \\ l_1 &= T_1 < l^d(., x_1) = l_1^s\end{aligned}\tag{22}$$

Functions (19), (20), (21) and (22) are the effective supply and demand functions of the firm under the four possible constraint regimes. Saving and inventories play a role as a buffer stock in this theory. As Muellbauer and Portes write:³⁰

. . . each period the household replans in the light of new information and consequently takes correcting action for past mistakes. The concept of equilibrium here can accommodate such buffer stock behavior within the period, as long as we take the equilibrium to be reached at the end of the period, after a process of adjustment. . . . we can think of a sequence of very short periods in which the current ration levels are interpreted as perceived levels which may start different from the actual ration levels but converge to them by the end of the sequence. This tâtonnement on quantities is part of the familiar multiplier process.

Inventories play a similar buffer stock role in this process. . . . While such a process is working itself out in the

very short run, we can say that the economy is "in disequilibrium", and this is really the only sense in which this class of models can be said to be about disequilibrium. The information generating role of buffer stocks suggests that models with quantity rationing do not, after all, require as much centralized co-ordination as Grandmont (1977b), for example, argues.

(4) Combining the Demand and Supply Functions
of the Households and Firms

The complete two-market model, algebraically is:

$$c^d = \begin{cases} c^d(.) & \text{if } l = l^s < l^d \\ \bar{c}^d(., l) & \text{if } l^s > l^d = l \end{cases}$$

$$c^s = \begin{cases} x^s(.) & \text{if } l^s > l^d = l \\ \bar{x}^s(., l) & \text{if } l = l^s < l^d \end{cases}$$

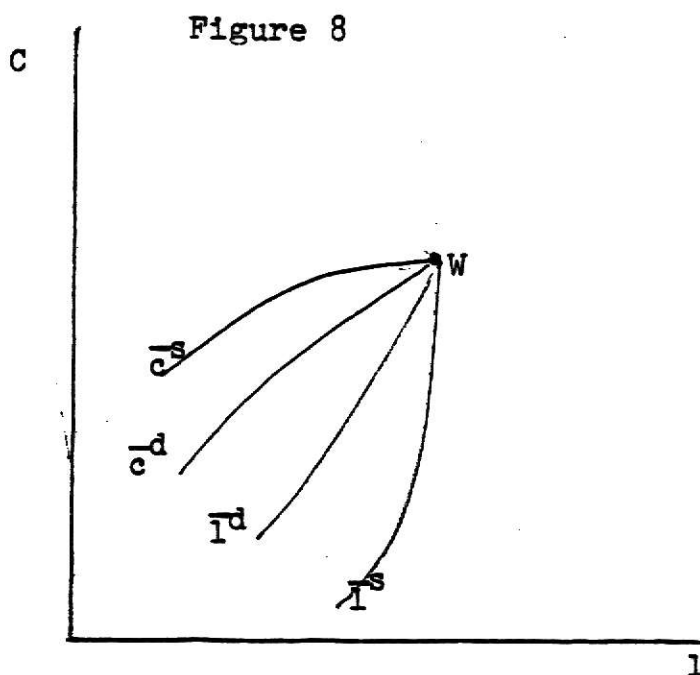
$$c = \min(c^d, c^s)$$

$$l^d = \begin{cases} l^d(.) & \text{if } c = c^s < c^d \\ \bar{l}^d(., c) & \text{if } c^s = c^s < c^d \end{cases}$$

$$l^s = \begin{cases} l^s(.) & \text{if } c^s > c^d = c \\ \bar{l}^s(., c) & \text{if } c = c^s < c^d \end{cases}$$

$$(l) = \min(l^d, l^s)$$

The minimum conditions and switch conditions make it complicated to follow what is going on. If both markets clear (no rationing) then we are in a Walrasian equilibrium. This can be seen in figure 8, which is figures 6 and 7 juxtaposed onto consumption-labor space. 'F' and 'H' coincide at point 'W'.



The slopes in this and the following figures are a result of the various assumptions made to insure existence, uniqueness and stability. There are four possible constraint regimes (recall (10) - (13)). They are diagrammed in figures 9 - 12 below.

Figure 9 - Keynesian unemployment (K)

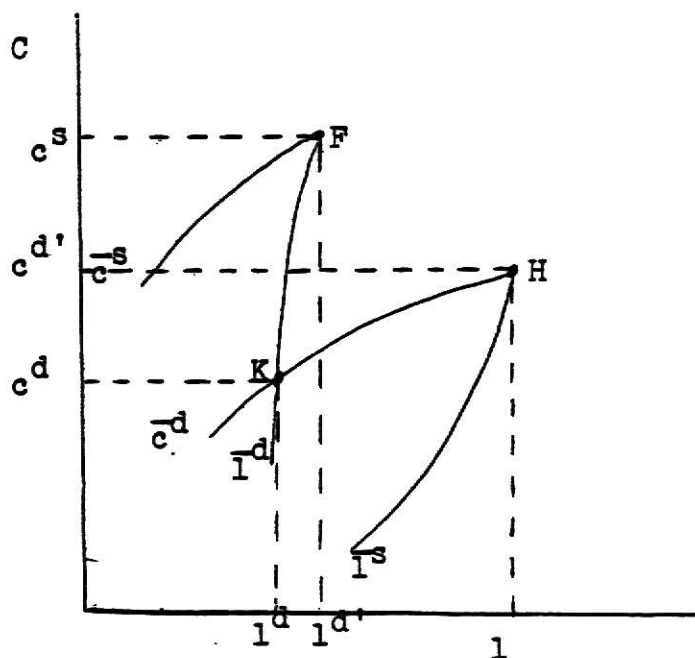


Figure 10 - Repressed inflation (R)

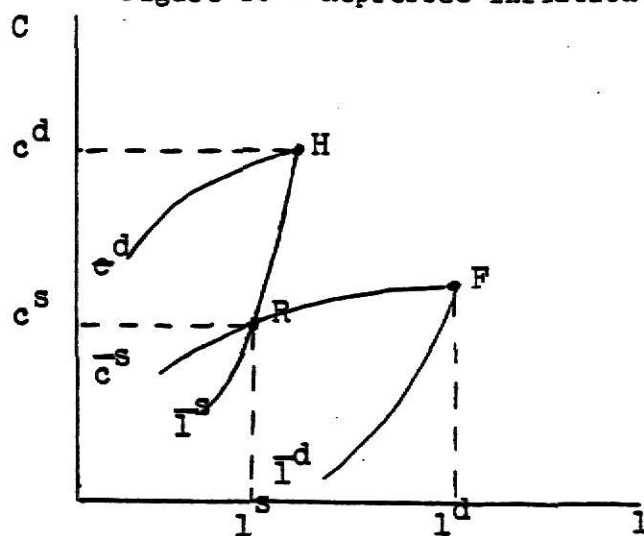


Figure 11 - Classical unemployment (C)

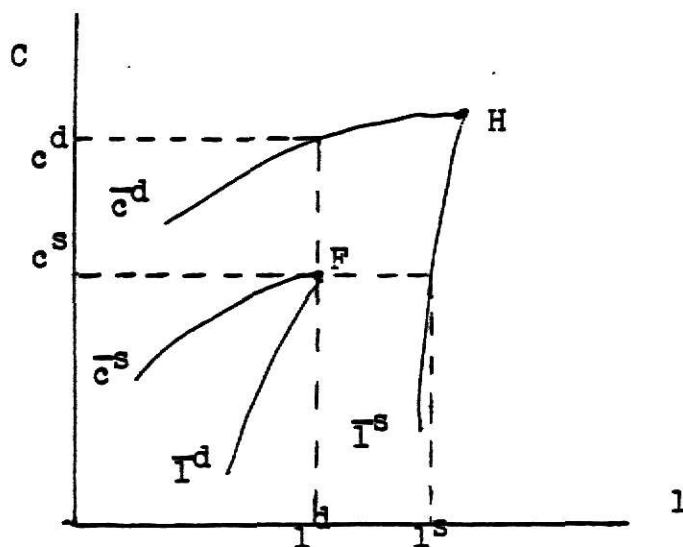
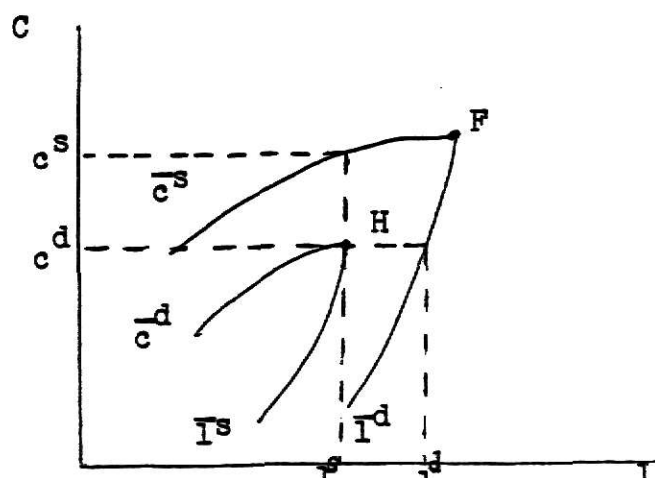


Figure 12 - Underconsumption (U)



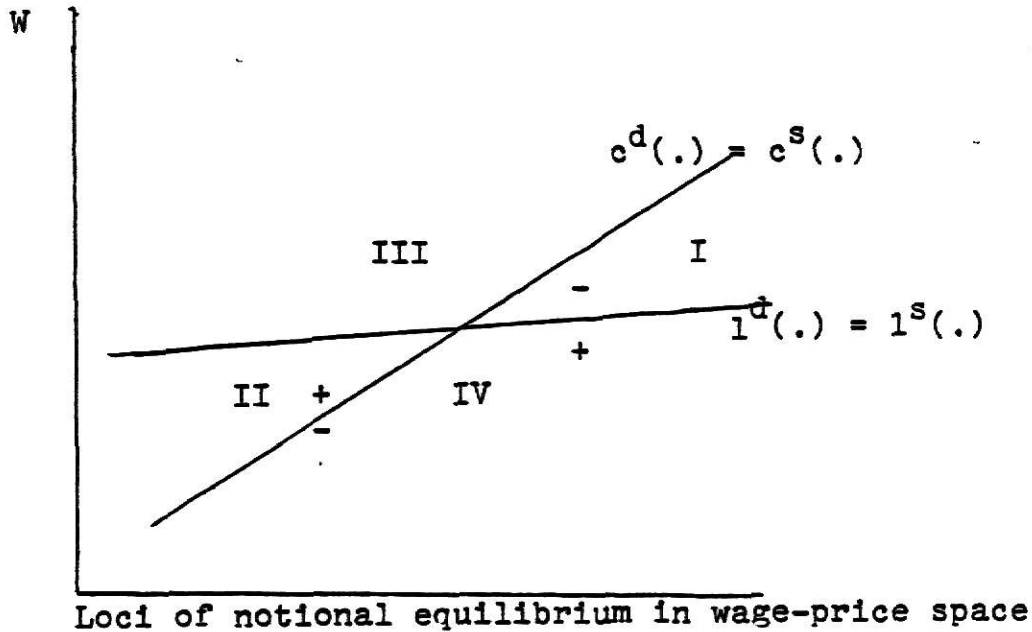
Keynesian unemployment equilibrium (k) is the intersection of the labor-constrained consumption function and sales-constrained labor demand function. Here there is excess effective supply in both markets. Repressed inflation (R), with excess effective demand functions in both markets is shown as the intersection of the consumption goods-constrained supply function for labor and the labor-constrained supply function for consumption goods. In classical unemployment (C), households are on the long side in both product and labor market. The firm realizes its notional demand functions. Firms do not hire extra labor to fulfill the excess demands because the real wage is too high -- it would cost too much. The fourth case, under-consumption (U), firms are on the long side in both markets and households satisfy their notional demands. How the various equilibrium points are reached can perhaps be explained by referring to figure 9. Let's assume the household would like to supply l^s amount of labor and buy c^d amount of goods. The firms however would only like to hire l^s amount of labor, but supply c^s amount of goods. Since households cannot sell all their labor services they will suffer an income constraint. Because of this consumption demand will decline. Because c^d declines, firms demand even less labor. The round robin effect of this process continues until both H and F coincide at point K. Here they are at equilibrium (with $l^d < l^s$ and $c^d < c^s$). In R, the repressed inflation condition, households cannot consume all they desire to and hence adjust their labor supply. They move along $T^s(.)$ substituting leisure and future consumption for the unobtainable present consumption. As labor supply falls, there is a further decline in output and hence more adjustments by households and so on until this "supply multiplier" works itself out. People save more than they would otherwise so a claim of "forced saving" could be made, but this saving is made to finance future consumption. In C, households are already

constrained to sell less labor services than they desire. So given the level of employment and consumption reduction they accumulate money balances. In K, firms can adjust employment downwards to reach their desired level of inventory accumulation, given the sales constraint. In U, firms are selling less than they would like but cannot adjust their employment.³¹ One essential question to be asked here is whether the effective demands shown on the diagrams measure the "pressure" on prices when markets do not clear. Muellbauer and Portes believe that if they do, then ". . . the endogenous forces for relative price adjustment to clear markets may be very weak. Walras's law applies for the notional demands, but it need not hold for the effective demands in a quantity-constrained equilibrium."³² If it is assumed that $g = m = 0$ and there is no inventory accumulation then the sum of the excess effective demands is $w(l^d - l^s) + p(c^d - c^s)$. In K, both terms are negative and we have generalized excess supply; in R both terms are positive and we have generalized excess demand. There are no self-correcting tendencies therefore price flexibility will not help to move the system toward a Walrasian equilibrium.³³ Apparently in the Muellbauer and Portes model the exclusion of saving and inventory will invalidate Walras' law by removing the mechanism of readjustment. Price flexibility, they believe, will be of little help. "The static system is underdetermined because behavior is overdetermined: neither households nor firms have the extra degree of freedom offered by the opportunity to hold an asset for future use. This is not to say that static models are necessarily inconsistent when wages and prices are flexible, but under sluggish wage and price adjustment, they cannot generate Keynesian effects."³⁴

What the authors dub "double wedge" diagrams may also be shown with wages

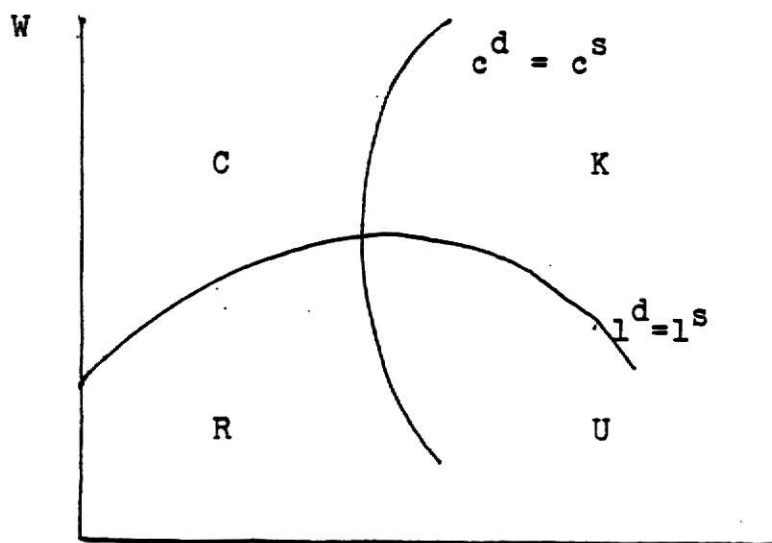
and prices as the axes. These curves show equality of notional demands and supplies.

Figure 13



The signs on either side of the curves (or lines) show regions of excess demand (+) and supply (-). Region III, for instance, would indicate $c^d > c^s$ and $l^d < l^s$. When we change from notional to effective functions, the diagram looks like those in figure 14.

Figure 14



Loci of effective equilibrium in wage-price space.

The advantage of this type of diagram is that when using comparative statics, it is easy to see what a change in W or P will do. However, the authors think that the double wedge method is more useful for econometric applications.

It is appropriate to see how comparative statics works on this model. For example, in the K (or Keynesian) graph an increase in government expenditures shifts the F system down, and the intersection of $l^d(.)$ and $c^d(.)$ moves up and to the right along $c^d(.)$. The marginal propensity to consume is c^d/c . Similar exercises can be carried out in different regimes. The role of expectations, however, should "... suggest considerable reservations about the value of such exercises. Here we have expectations not only on prices but also on quantities, and they may often dominate the simple contemporaneous effects."³⁵

Assume we start in the Walrasian system and increase money supply (m_0) or

increase government spending (g). We move from the W to R (figure 10) in two ways. If m_0 is higher than that consistent with the Walrasian equilibrium at given wages and prices, then the H wedge will move up and to the left. If ' g ' is higher, the F wedge shifts down and to the right.³⁶

Figure 15

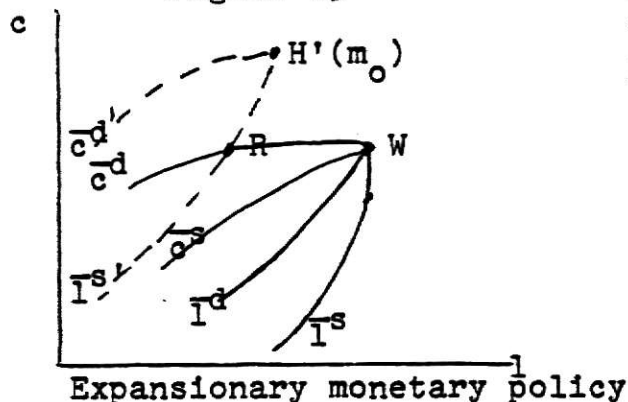
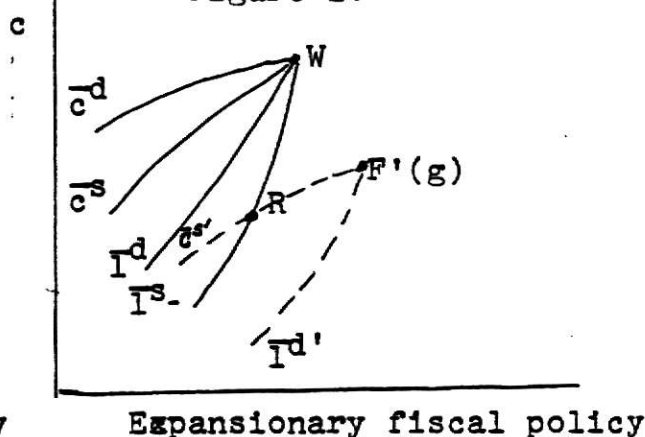


Figure 16



The table below summarizes the effects of various policy changes on employment and output in the various regimes.³⁷

TABLE 3

	K	R	C	U
W	?	?	-	+ ?
P	?	+ ?	+	0 ?
m	+	-	0	-
g	+	-	0	0

For example, a change in money wages (dw) will have an uncertain effect on employment and output in the C regime and probably increase it in the U regime.

CONCLUSIONS

In the early 1970's economists such as Robert Barro and Herschel Grossman were looking at the influence of contractual agreements on wage stickiness for support of the non-market-clearing-type models. However, as Barro concludes, ". . . the contracting model suggests that its rationale for sticky wages and prices--as far as it goes--does not explain the key features of Keynesian analysis with regard to the determination of employment and output."³⁸ And later he writes, ". . . contracting analysis suggests that-- despite the possible existence of 'sticky wages'--the continuous market-clearing model may provide a satisfactory framework for the analysis of employment and output."³⁹

Contracting theory in effect assumes that the private sector (in some aspects) is relatively inefficient compared to corrective government action. For

example, in the private sector there is sticky wages, while in the government sector there is flexible money supply, taxes, and expenditures.

What is seldom probed is the reason for the private sector inefficiency. Sticky wages may be due to imperfect information, factor immobility, or transaction costs for example. Government intervention is recommended without bothering to describe the private market failure that provoked the cry for government action. Barro writes, that ". . . the non-market-clearing approach makes government policy activism much too easy to justify. When the arbitrariness of supply unequal to demand is replaced by a serious explanation, such as imperfect information about exchange opportunities, for the failure of private markets to achieve some standard of efficiency, the case for government intervention becomes much less obvious."⁴⁰

Peter Howitt of Western Ontario writes of the non-market-clearing approach and concludes, "The main weakness of the approach is its failure to provide any satisfactory accounts of how markets are organized."⁴¹ And further along he writes, "In particular some markets, such as those for many labor services, personal credit, and heavy capital goods, are organized on a highly personal basis with individually negotiated contracts, whereas other markets, such as those for widely traded financial assets and for most consumer durables, are organized on a less personal basis by trading specialists like retailers, wholesalers, jobbers, brokers, and stock market specialists."⁴² In addition he points out that there is no explanation of how prices are formed even though the assumption that prices do not respond quickly enough to clear markets is the heart of the matter. No explanation is given either for why individuals should be con-

strained to trade at these prices.

Apparently, the non-market-clearing models have some validity but only in the short run when prices do not have time to adjust to market conditions. There is no satisfactory case made for supposing, however, that prices will not eventually adjust and markets clear.

The failure to examine the organizational differences of the different markets and the failure to explain why inefficiencies exist in the private sector may lead to a too hasty conclusion that government intervention is needed.

As more research is undertaken which integrates more fully information and search theory, expectations, and the theory of prices perhaps some useful trails will be blazed. Until then there is not much to suggest that current non-market-clearing theory varies significantly from orthodox theory in its conclusions. Both arrive at essentially the same conclusions but by travelling different paths.

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FOOTNOTES

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¹³ Ibid. p. 299.

¹⁴ Panayotis G. Korliras and Richard S. Thorn, eds. Modern Macroeconomics p. 287.

¹⁵ Robert Clower, "The Keynesian Counter-Revolution," pp 103,125.

¹⁶ Ibid., p. 110-111.

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A SURVEY OF SOME NON-MARKET-CLEARING
MACROECONOMIC MODELS

by

MICHAEL WAYNE WATSON

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AN ABSTRACT OF A MASTER'S REPORT

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Abstract of Master's Report

A Survey of Non-Market-Clearing Macroeconomic Models

In this paper I attempt to review the theory behind non-market-clearing macroeconomic models and look at a representative comparative static model to show how such a model operates.

The essence of classical and neo-classical theory is the assumption of instantaneous price adjustment through either the tatonnement process of Walras or through Edgeworth's principle of recontracting, both of which assure prices such that supply equals demand before any transactions take place. When prices adjust before market activity occurs, then market-clearing or equilibrium is assured in every market.

In 1936 Keynes challenged the validity of an automatic tendency toward full employment equilibrium. As interpreted by Hicks and Hansen among others, Keynes' challenge consisted of the interconnectedness of the various markets and the possibility of inflexible wages, a liquidity trap, and a possible inelastic investment demand curve.

Robert Clower and Axel Leijonhufvud assert that Keynes' attack on classical theory was even more fundamental and crucial than previously thought. They believe that when planned transactions are not realized, the very form of the demand functions change, leading to a disequilibrium condi-

tion that is not self-correcting (thus violating Walras' law).

Patinkin, in 1956, attempted to show how a different form of labor demand can lead to a conclusion that real wages may vary directly with employment rather than inversely to employment. And Patinkin writes in the same theoretical framework as the "counter-revolutionists" as Clower has dubbed those he believes have perverted the true message of Keynes.

Clower's purpose, in his article, is to show how this dichotomy of changing the form of functions is what Keynes may have been describing, and that it is this that results in the possibility of a persistent full employment disequilibrium.

Finally I describe the non-market-clearing model of Meullbauer and Portes to show how an example using comparative statics can illustrate the workings of a disequilibrium model.

In conclusion I refer to an article by Peter Howitt who thinks the failure to examine more critically the causes of the failure of the private sector to clear has led perhaps to an overly eager call for government intervention in the economy.

Further work in areas such as information search, factor mobility and expectations may provide valuable help in understanding macroeconomic theory.