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--- Excess Demand, Queueing and Macroeconomic Models with Quantity Rationing

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In recent years, macroeconomic models with quantity rationing have assumed that product and labour markets do not clear when the economy is in disequilibrium. Specifically, in conditions of (positive) excess demand for commodities, workers determine the labour they wish to supply subject to the constraint specifying the amount of commodities with which they are being supplied and are able to purchase. These models assume—or imply—that the existence of excess demand for commodities induces a reduction in the labour supplied, making the effective labour supply less than the notional one at any given wage rate.

These models do not generally specify the process by which the quantity supplied is to be distributed among the potential buyers under conditions of excess demand for commodities. It seems quite reasonable to assume that the impact of excess demand for commodities upon labour supply will depend upon the procedure which is adopted or otherwise comes into being for allocating the limited amount of commodities among the potential buyers. In general, these models do not assume that any specific procedure is adopted, say by the government or the suppliers, so that the allocation would tend to evolve into a first-come-first-served basis which is likely to degenerate into queues. It is, therefore, relevant to examine if allocation by queuing justifies the assumption of these models that the excess demand for commodities will, in fact, lead to a reduction in labour supply. This paper considers this examination, using the assumption that consumers/workers maximize their utility in making decisions about the purchase of commodities for current consumption, savings and leisure. The purchase of commodities requires payment of their (monetary) price to the seller, as well as standing in a queue to make the purchase. Standing in queues requires the allocation of time, so that the cost to the purchase of commodities includes a monetary component and a time component. The latter is evaluated at the queue's wage rate.

It is a well-known phenomenon in countries which suffer significant amounts of excess demand and queueing for commodities, that the higher-income groups tend to employ lower-income workers, designated as servants in this paper, in order to become the queues for the former. Our analysis, therefore, distinguishes workers by income groups and examines the

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--- We have primarily in mind models of the type specified by Barro and Grossman (1975), 1976) and M-P (1978). Barro and Grossman will be designated as B-G and M-P, respectively. (For example, see M-P, 1978, p.792.)
labour supply behaviour of different groups. It also examines the net addition to the demand for labour through the demand for servants created by queuing.

Our analysis shows that the assumptions of the quantity-constrained macroeconomic models of the B-G variety do not hold in the general case. In particular, if queuing by servants is allowed, labour may not reduce its supply in response to the excess demand for commodities. Further, the demand for labour as servants increase is a result of the excess demand. These results cast serious doubt on the B-G and M-P type of generalization of Clower’s (1965) dual decision hypothesis to the case of the excess demand for commodities, without affecting Clower’s own analysis of the excess supply of labour case.

I. Choices when Queuing One Self

To analyze what is in value in the queuing process we classify workers into different wage groups on the basis of the wage rates and rank the wage groups from those with the lowest wage rate to those with the highest wage rate. Group 0 will then be the lowest wage-rate group. The workers in each jth group, j = 0, 1, . . . , G, are assumed to be identical.

Assume that each worker makes a choice between commodities for current consumption, savings (a proxy for future consumption) and ‘leisure.’ The amount of ‘leisure’ will equal the total number of hours H available to the worker in the period in question less the number of hours worked and the amount of time he has to stand in queues. The latter will be called as queue-time or queue-hours. The worker in the jth income-group is assumed to maximize

$$U_j = U(x_j, z_j, y_j)$$

where \(x = \text{quantity of commodities (for current consumption)}\)

$$z = \text{savings (in real terms)}$$

$$y = \text{leisure (in hours)}$$

The subscript j on a variable refers to a worker of the jth income-group.

Since our concern is with the commodity and labour markets, we have ignored the demand for money balances. Further, assuming for simplification, that the worker does not have any initial assets inherited from past periods and that he does not anticipate having to stand in queues when he spends in future periods what he saves in the current one, the worker’s budget constraint is,

$$p_x x + q_z z = y$$

where:

$$p = \text{price of commodities}$$

$$q = \text{price of savings}$$

$$w = \text{nominal wage rate}$$

$$y = \text{income in nominal terms}$$

$$x = \text{time (in hours) spent in queues}$$

$$z = \text{maximum number of hours during the period}$$

It also seems reasonable to assume that for

$$(x' - x) > 0$$

$$z' < z$$

where \(x'\) and \(x\) are the demand and supply of commodities. \(z'\) is zero for the excess supply case and positive for the excess demand case. We are only concerned with the latter case in this paper. This case could occur even if suppliers are very efficient in selling their output once they open for business since buyers could line up before opening-up time. The allocation schemes by firms may limit the amount each customer purchases on any one turn in the queue and explain the possible dependence of \(z'\) on \(x\).

We simplify by assuming that,

$$U_j = x_j z_j y_j$$

and

$$y_j = w_j (H - z_j)$$

where \(y_j\) and \(z_j\) are positive functions of the market excess demand for commodities. We also assume that there are a sufficiently large number of buyers in the market such that the purchases by any given buyer do not affect the market excess demand significantly enough to change \(y_j\) and \(z_j\).

The optimizing problem then becomes,

$$\text{maximize } U_j - x_j z_j y_j$$

subject to \((p + w_j x_j) x_j + q + w_j x_j = w_j (H - z_j)\)

The first order conditions for maximization are:

$$a U_j x_j z_j = -\lambda (p + w_j x_j) - b$$

$$b x_j = \lambda$$

$$c U_j x_j z_j = -\lambda q$$

Where: \(a = \alpha - b + c\)

$$x_j = a$$

$$w_j (H - z_j) = b (H - k_j)$$

$$z_j = a$$

$$c U_j x_j z_j = -\lambda q$$

$$s_j = c (H - k_j)$$

Since \(U_j\) the supply of labour in hours by the jth worker, equals \((H - s_j)\).

II. Choices with Queuing by Servants

Now consider the possibility that one does not have to stand in queues oneself to make one’s purchases but can employ others to do so. Assume that the amount of time required for standing in queues is the same whether one stands in line oneself or hires someone else to do so and that the latter—servants—cannot lump the purchases of different ‘employers.’ If the servants' nominal wage rate is \(w_s\) then the cost \(C(x)\) to the jth worker of employing a servant to buy \(x_j\) of commodities is

$$C(x) = (k_j + z_j x_j) w_s$$

Assuming workers to be cost minimizers, workers will employ a servant if and only if, \(w_s < w_j\).

The analysis for the case where the worker stands in line himself was presented in the preceding section. This would apply when \(w_s > w_j\). The analysis for the case where a servant is employed is as follows.

The jth worker now has a utility function

$$U_j = x_j z_j y_j$$

If \(z'\) is a legal restriction that each person, from the President to the poorest, must stand in line himself to purchase the items meant for his own consumption, then the marginal cost or effective price of a given commodity will vary with each wage group. This cost is \((p + w_j x_j)\), which increases with \(w_j\). Such a worker is not, then, truly a competitive one.
subject to,
\[ pX_j + w_0 L^0_j + q_j y_j = y_j \]
\[ y_j = w_0 (H - s_j) \]
\[ L^0_j = k_0 + k_s x_j \]

where \( w_0 L^0_j \) is the queuing cost of \( x_j \), and \( L^0_j \) is the demand for the zeroth type of workers as servants by standing in queues by the \( j \)th kind. The budget constraint implied by the above is,
\[ (p + w_0 k_0) x_j + q_j y_j + w_0 y_j = w_0 (H - w_0 k_0) \]  
(15)

Solving the first order conditions for maximization yields demand functions such as,
\[ x_j = \frac{a}{\alpha p + w_0 k_1} (w_0 H - w_0 k_0) \]  
(16)
\[ y_j = \frac{b}{\alpha q} \]
\[ x_j = \frac{c}{\alpha} (H - k_0) \]  
(17)
\[ y_j = \frac{d}{\alpha} \]

where \( a = 1/(\alpha + b + c) \) and since \( L^j = H - s_j \).
\[ L^0_j = \frac{1 - c}{\alpha} H + \frac{c}{\alpha} k_0 \]  
(19)

Further,
\[ L^0_j = k_0 + k_s \frac{a}{\alpha p + w_0 k_1} (w_0 H - w_0 k_0) \]  
(20)

Assume that servants are the lowest paid of all workers so that \( w_0 < w_j, j = 1, \ldots, G \). This is a fairly realistic assumption. Then the effective aggregate demand functions are,
\[ x^* = \frac{a}{\alpha p + w_0 k_1} \]
\[ \frac{1}{\alpha} (w_0 (H - k_0) n_0 + \sum_{j=1}^{G} (w_0 H - w_0 k_0) n_j) \]  
(21)

where \( x^* \) is aggregate demand for goods (excluding servants’ services), \( n_j \) is number of workers in the \( j \)th group, \( G \) is number of wage-groups, \( N \) is total number of workers, and \( z \) is savings.

The demand for commodities in (21) is affected by the queuing cost required for the purchase of commodities. This effect has two components. One operates through the constant term \( k_0 \) required to join the queue and which is allocated, as shown by (10) to (12), through a reduction to the overall hours which the individual worker allocates to leisure and to his purchases of commodities and savings.

The other component operates by raising the effective marginal cost or price of commodities in the queuing case to \( (p + w_0 k_0) \). Assuming that the commodity market clears, even though the price \( p \) is given, the amount of queuing time will be that which will equate the demand and the supply of commodities. The quantity supplied will, of course, have been determined by the fixed price \( p \) and is shown as \( X_t \) in figure 1. The quantity demanded in equilibrium will also have to be \( X_t \). The cost of queuing will be such as to shift the effective demand curve from commodities from \( x^0 \) in the absence of queues to \( x^* \), where \( x^* \) is drawn for that amount of queuing costs which eliminates the excess demand \( (N^* - X^*) \). The effective demand curve will differ for different amounts of excess demand and queuing costs.

It is relevant to note that our analysis differs from that of B-G (1971, 1976) and M-P (1978). In our analysis, the commodity market clears through an appropriate change in queuing costs while it does not clear in theirs. In ours, effective demand adjusts as a consequence of queuing costs and differs from its notional level (without queuing costs). In B-G and M-P, the demand for commodities does not change, so that the effective and notional demands for them are identical. This is a major analytical difference between the two approaches. For B-G (1976, Ch. 2) and M-P (1977, p. 791), emphasis the demand in the market in which excess demand exists is the notional demand and is not a quantity-constrained one if the other markets clear. This excess demand constrains the demands in the other markets, producing a divergence between their notional and effective demands.

Walras’ Law does not hold in the disequilibrium or quantity-constrained equilibrium analyses of B-G and M-P (1978, p. 809). In contrast, Walras’ Law does hold in our analysis in terms of the effective- and notional-demand and supplies which take account of queuing costs.

Equation (22) implies that savings would decrease. This contrasts with the B-G and M-P implication that the frustrated excess demand for commodities would be partly channelled into savings and would, therefore, increase savings.

The demand and supply functions for labour are,
\[ L^j = L^j - \sum_{j=1}^{G} \frac{a}{\alpha} (H - k_0) n_j \]  
(23)

where,
\[ \sum_{j=1}^{G} \frac{a}{\alpha} (H - k_0) n_j = k_s (N - n_0) \]

\[ + \frac{\alpha}{\alpha p + w_0 k_1} \sum_{j=1}^{G} (w_0 H - w_0 k_0) n_j \]  
(23')

\[ L^* = L^0 n_0 + \sum_{j=1}^{G} \frac{a}{\alpha} (H - k_0) n_j \]  
(24)

where,
\[ L^0 n_0 = \frac{1 - c}{\alpha} \frac{a}{\alpha p + w_0 k_1} \]
\[ (H - k_0) n_0 \]  
(25)

\[ \sum_{j=1}^{G} \frac{a}{\alpha} (H - k_0) n_j = \frac{1 - c}{\alpha} (H + \frac{c}{\alpha} k_0) \]  
(26)

where, \( L^* \) is aggregate demand for labour; \( L^j \) is demand for labour excluding the services of servants;
\[ L^j = \text{aggregate supply of labour by the } j \text{th type of worker, } j = 0, 1, \ldots, G \]
\[ (N - n_0) = \text{number of workers in the non-servant groups} \]
As (23) and (23) show, the aggregate demand for labour increases by the amounts of servants' time demanded for queueing. The supply of labour by servants decreases, as (25) shows. But the supply of labour by the other wage-groups rises, as shown by (26), in order to earn the income to pay the servants. There are likely to be many more income groups which hire servants than the income group or groups which serve as servants for queueing. However, the servants' group may be numerically larger than any of the servant-hiring groups. It is, therefore, not clear whether the overall supply of labour will increase or decrease. But there is a strong possibility that it will increase. This compares with the analyses of B-G and M-P, in which the aggregate supply of labour must fail in the presence of the excess demand for commodities.

The preceding results—equations (20) to (26)—were obtained using specific forms of the utility function and of the cost function for queueing. Other assumptions could change the results. To illustrate: (1) If the log-linear utility function is retained, but the queueing-cost function is modified to eliminate its fixed cost component—that is, setting $c_0 = 0$—then the aggregate savings, from (22), are not influenced by the excess demand for commodities and queueing costs.

This result differs from that of B-G and M-P which assumed that the supply of servants—or money balances in their analysis—would increase in the presence of the excess demand for commodities. (2) If the utility function of servants is changed such that each servant wishes to purchase a certain minimum amount of commodities and this—or a lesser amount—is all that he is able to purchase, the presence of queueing costs will not lead him to reduce his commodity purchases or his supply of labour. Queueing-time will come out of his demand for leisure in the absence of queueing.

In such a case, there is an unambiguous increase in the aggregate supply of labour. (3) Focusing on families, in which one member—usually the wife or a teenage child—does not have a job outside the home and has some 'spare time,' such a person would be the one to stand in the queue so that those working outside the home will not change the amount of labour that they supply nor would they employ servants. This might also apply to the servants' group.

In such a case, for such families, there would not be any impact of the excess demand for commodities upon the supply of labour and upon the demand for commodities. The reduction in the market's effective demand for commodities must come from a reduction in this demand from those job-holders who must stand in line themselves or from those who employ servants.

There are other possible cases also. But enough has been said to show that the excess demand for commodities, in the presence of market-clearing queueing, does not necessarily reduce the supply of labour. It may even increase the latter.

**Conclusion**

Macroeconomic models with quantity rationing often assume that the excess demand for commodities will reduce the supply of labour, so that the effective labour supply will be less than the notional one. These models do not specify the mechanism by which the limited supply of commodities will be allocated over the larger demand at the given market price. It is likely that in the absence of a ration card scheme or other direct controls on demand, the commodity market will develop queues. The amount of queueing will be that which will clear the commodity market.

This paper has shown that queueing, along with the use of the servants to stand in queues in one's place, need not reduce the aggregate supply of labour. It may even increase this supply.

The question arises whether it is reasonable to assume queueing in the context of macroeconomic models with quantity rationing. Such models do not specify the chronological time frame of reference. They often use the concepts of 'temporary equilibrium' or 'momentary equilibrium.' The period is often specified as the Hicksonian 'week' or the Robertsonian 'day.' These concepts are analytical ones and do not give any guidance on how long the period of analysis will be in chronological time, though B-G (1971, p.91) did refer to wartime conditions and also cited market conditions in the Soviet Union as cases of chronic excess commodity demand in which the household may increase leisure by reducing its supply of labour. If the period of analysis is long enough to justify the usage of the term 'chronic,' then, in the absence of the direct rationing type of restrictions on demand, queues and the use of servants for queueing are likely to develop as a result of the excess demand. Such queueing may not reduce the supply of labour. It may even increase this supply. In particular, the demand for leisure falls, for our specific assumptions, rather than increases as B-G assumed, as the queueing time increases. This seems to be the experience of many under-developed countries in which excessive queueing is required for commodity purchase. Wives, old family members and children who do not work outside the home, as well as servants, are the ones normally found standing in queues. Those with jobs normally work a full working-day, which is substantially longer than in richer economies and which does not seem to vary with the length of queues in the market place.

However, if the chronological period of analysis is assumed to be 'momentary' or so short that queues cannot develop, then it is unrealistic to assume that labour has had enough time to revise its work-leisure choices. It is, therefore, unrealistic to assume that the supply of labour falls and the demand for leisure rises as a result of the excess demand for commodities. Such a short chronological period of analysis would also leave unanswered the question of how the limited supply is to be allocated among the buyers within a very limited time.

If it is unrealistic for macroeconomic models with quantity rationing to assume on a general basis that the excess demand for commodities will lead to a fall in the supply of labour, the generalization that B-G and others tried to give to disequilibrium macroeconomic models does not hold. Such models assume that the excess supply of labour, as in Clower (1965), will act as a quantity constraint on the demand for commodities and will lead to a reduction in the latter from its notional levels. The generalization that B-G offered was that the excess demand for commodities will, in converse, lead to a reduction in the supply of labour from its notional level. Since the generalization does not hold, the two types of disequilibrium situations would seem to require different kinds of analysis.

There are also other, fundamental and
The Methodologies of Economists: A Survey

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I. Introduction

Methodology performs two functions. One is to guide the researcher in his quest for knowledge. The second function is to encourage one’s colleagues and a wider public to accept the validity of the researcher’s findings. The economist’s forecast of GNP may be no more accurate than those of an astrologer, yet the vast majority of people will place greater weight on those of the economist precisely because they believe he is following a more reliable methodology.

The need to appeal to a methodology to legitimize research findings is particularly strong in the social sciences where it is difficult to distinguish cause and effect and the number of significant variables operating in any specific situation are normally large in number. Furthermore, it is difficult to demonstrate dramatically, as the natural sciences have done, that the economic knowledge that has been acquired has facilitated an increased mastery over the environment. In spite of the importance of methodology to the economist, its formal study has almost disappeared from the economics curriculum of universities and it is left to a group of specialists in the philosophy of science.

Most economists never formally study economic methodology. Their knowledge of how to formulate hypotheses about economic behavior and how to verify them is largely acquired informally through a process of intellectual examples (“paradigms”). Most economists believe they are applying the scientific method without clearly defining this method or recognizing that there is no unique scientific method but rather several competing methodologies, each of which leads to a different way of formulating hypotheses about economic behavior and different criteria for their acceptance or rejection.

If economics has become the most advanced of the social sciences under a loose but methodological rigor, is there any need for change? There is some reason to believe, based on recent evidence, that the answer to this question is affirmative. Either economic science has reached a region of sharply diminishing returns in response to further research inputs or there is something wrong with the way economists are developing their science. The enormously higher level of inputs into economic research in the postwar period, which is perhaps, equal, in quantitative terms, to the total prior input since Adam Smith, has not been matched by a correspondingly higher rate of theoretical advance.

Economics is in theoretical disarray. Important economic questions remain unresolved after decades of debate. For example, is it valid to apply neoclassical economics to non-competitive markets? How valid is it to continue to employ production functions employing diminishing returns to scale when most empirical studies show firms are operating in areas constant or increasing returns? If constant or increasing returns at the margin are general, what is the validity of statements derived from general equilibrium theory for

References