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Nº 112

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Instituto de Pesquisas do IPEA
Instituto de Planejamento Econômico e Social
Avenida Presidente Antonio Carlos, 51 - 13º/17º andares
20.020 Rio de Janeiro RJ

Surplus Labor and Industrialization

Kevin M. Murphy, Andrei Shleifer
and Robert W. Vishny.*

1. Introduction

It is an old message of the theory of economic development that insufficient demand for manufactured goods could limit the extent of economic progress. This message is particularly compelling in the context of a surplus labor economy, where a significant fraction of a country's labor force is underemployed in agriculture. While getting these workers out into towns to make manufactures could significantly raise the country's output without hurting food production, the process does not start for lack of demand for manufactures.

This idea of underdevelopment for lack of demand has been introduced into economic analysis by Rosenstein-Rodan (1943). His is a striking contribution, for it incorporates in the same global vision both the surplus labor and the limited market size aspects of the story. At the same time, Rosenstein-Rodan left many parts of the story only partially developed, and the subsequent balanced growth literature cleared up many of the remaining deficiencies. Most importantly, Arthur Lewis (1954) produced a pathbreaking analysis of the labor market and of capital accumulation in the surplus labor economy, with relatively less importance placed on the lack of demand.

Subsequent implementations of the balanced growth argument attached progressively less importance to the demand side and progressively

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*Respectively, University of Chicago, Princeton University and University of Chicago. The paper was written while Mr. Shleifer was visiting IPEA/INPES in a research project financed by PNPE.

more to the supply of labor. This in particular applies to the important work of Jorgenson (1961), Dixit (1968, 1973), and Stern (1971). For an important and remarkable in its theoretical sophistication exception, see Fleming (1955). In the end, it seems like demand deficiency as a source of backwardation of a labor surplus economy has been all but forgotten.

This paper is an attempt at a return to some theoretical problems of small markets in a labor surplus economy. The particular angle taken here is income distribution. Specifically, the paper demonstrates that progress of industry relies on the presence of a sufficient number of consumers whose resources enable them to afford manufactures. In a poor country, where interest in manufactures is a matter of having relatively high income, some inequality must be necessary to generate manufacturing demand. A relatively dramatic manifestation of this phenomenon is the fact that complete equality could yield no demand for manufactures at all, and therefore complete absence of industrialization. Complete equality thus spells equal distribution of misery.

The model used to illustrate the impact of income distribution on demand is extremely simple. Accordingly, many of the assumptions are made not so much for their realism, as for their usefulness in delivering simple results. In Section 2, we lay out these assumptions and suggest in what way they drive the results. In Section 3 we exhibit the solution of the model and note the role of inequality. Finally, Section 4 offers some concluding remarks.

Section 2: The Model

Our model of agriculture is a rather simple minded version of the surplus labor story, but one that is close to what is often said. We assume

that there is 1 unit of agricultural output (corn) available and that (within the range of interest) this output can be obtained independent of labor input. This assumption is a stark way of saying that the marginal product of labor in agriculture is zero, since it also sets average product of labor to zero. This is clearly an unrealistic assumption, which is much stronger than those used by Lewis (1954) or Sen (1965). It does, however, capture the Rosenstein-Rodan notion that labor on the farm is a wasted resource. Furthermore, while it makes our results simpler and more striking, it is by no means necessary. Its effect is to trivially yield the conclusion that getting labor off the farm is socially desirable. As long as more complicated versions of surplus labor give the same result (as they should), they would likewise work in our analysis.

The reason that getting labor off the farm might be difficult is the distribution of property rights in agriculture. We assume that the one unit of corn output is divided into fraction β, to which there are well defined property rights, and fraction $(1-\beta)$, to which such rights are poorly defined. We call the first type of corn private and the second communal. Ownership rights of private corn is the source of heterogeneity of incomes in this economy. We assume that a smooth distribution function $\sigma(\gamma)$ describes this distribution of claims, and that, on average, $\gamma=1$. Thus a man owning γ shares of private corn would be entitled to $\frac{\beta\gamma}{L}$ units of it (recall the normalization of γ). The best way to think of such corn is as rent, and the owners of claims as rentiers.

Communal property, in contrast, is equally divided between all those who stay on the farm and don't go into the city to produce manufactured goods (called shoes). When of the population of L people L_o remain on the farm,

each of them gets $(1-\beta)/L_O$ units of corn. This formulation in motivated by "squatters rights" model of surplus labor described in Lewis (1954). Lewis in particular talks about beggars in Calcutta crowding the streets in pursuit of a constant amount of donations. Similarly, he describes street peddlers crowding the street in competition for the same sales. These examples have the character of rent-seeking behavior, where property rights to donations or to sales are poorly defined. A beggar cannot sell his location on the street, nor can a peddler trade in his position in a market. The key point is that leaving the street or the market entails the loss of rents. This is the key assumption of our formulation as well: leaving the farm entails the loss of a share in communal corn. Poorly defined property rights enter as the inability of a farm dweller to sell his rights to communal corn as he goes to the city; he can only abandon them. In at least some writings on development, this is the model of the reservation wage on the family farm.

The implication of the assumption that some agriculture is communal is the divergence of marginal product of a laborer in agriculture from his reservation wage. In particular, as we mentioned earlier, the marginal product of a laborer in agriculture is zero (we say laborer rather than labor to avoid a rather futile debate on this issue that emerged in 1950's; in our context laborer makes more sense). In contrast, his reservation wage is given by the value of the claim he must abandon if he leaves for the city, i.e. $(1-\beta)/L_O$. Of course he does not abandon his private claim γ. Poorly defined properly rights in agriculture thus introduce a wedge between private and social cost of labor.

Letting the manufacturing wage be w and the price of corn be x numeraire, an agent's income can be written as:

$$(1) \quad I = \frac{\gamma\beta}{L} + \text{Max } (W, \frac{1-\beta}{L_o})$$

This assumes that private claims to corn are portable, that communal ones are not, and that the agent will choose manufacturing over agriculture only if the former buys him more corn than the latter. In particular, we overlook the differential price levels on the farm and in the city, as well as the disutility of manufacturing work as compared to farming. These modifications could be introduced without much difficulty; ours is just the simplest model of choice between rural and urban employment.

When the choice is based on relative compensation, farmers will flow into manufacturing until the reward to leaving and staying are equalized. Labor mobility ensures that in equilibrium:

$$(2) \quad W = \frac{1-\beta}{L_o} .$$

This theory of wage determination is inconsistent with some basic facts of the labor market in a less developed country. First, urban unemployment is absent here and second, compensation in the factory does not exceed that on the farm, contrary to the evidence. More realistic models of migration, such as Harris-Todaro (1970) or efficiency wages, would replace (2) with a more complicated equilibrium condition. Again, while these are useful extensions, they are not central, although they will affect the income distribution. For now, however, since we are interested primarily in the implication of surplus labor, we keep the migration story as simple as possible.

Equation (2) has some interesting implications that underscore the impact of assuming surplus labor. As more workers leave the farm, the remaining $1-\beta$ units of corn get divided between fewer people, whose reservation wages therefore rise. There is thus an upward sloping supply

curve of labor into manufacturing, even though from the social viewpoint all labor should leave the farm. The upward sloping supply curve appears as a contrast to Lewis (1954) and Fei and Ranis (1964) who take it as essentially horizontal. Note however, that when L is very large and most labor is on the farm, the impact of one departure on the reservation wage of others is very small. In this sense, the supply curve for an almost completely agrarian economy is nearly horizontal. Alternatively, one could imagine individual farms and labor being drawn one worker from each, in which case the supply curve will again be nearly horizontal.

The other noteworthy implication of equation (2) is that when $\beta=1$, so that all corn is private, the wage is zero and all labor leaves the farm. This of course is the social optimum, which serves to show that poorly defined property rights to communal corn are indeed the source of excessive labor retention by agriculture in our model.

When (2) is plugged into (1), the budget equation becomes

$$(3) \quad I = \frac{\gamma\beta}{L} + W \; .$$

We are interested in analyzing the implications of the fact that the relatively well-off are the primary consumers of manufactures. To this end, we make the further simplifying assumption that each person spends the first I^* of his budget or all of his budget when $I < I^*$ on corn, and all the rest on shoes, whatever the prices. The marginal propensity to consume corn is therefore one until the consumer obtains I^* units of it, after which it falls to zero. This is a particularly discontinuous version of the realistic assumption that the budget share of food declines with income.

We assume for the moment that our manufacturing good - shoes - is

made from labor using a one for one constant returns to scale technology, so that the price of competitively produced shoes is always equal to W (in section 4, we look at the case of increasing returns and its implications). A consumer with income I then demands $q = \max(0, \frac{I-I^*}{W})$ of shoes. Importantly, this is a unit elastic demand curve which disallows substitution into corn. Also of importance is the assumption that all shoes are the same so that the very rich just buy more shoes than the not-so-rich. Getting them to buy different shoes would be an interesting and profitable extension; more on that in Section 4.

Using the individual demand function for shoes, we can now sort consumers into those who buy shoes and those who don't. Combined with (3), the demand function suggests that consumers with $\gamma \leq \gamma^* = \frac{(I^* - W)L}{\beta}$ spend all of their incomes on corn, whereas the consumers with share $\gamma > \gamma^*$ spend the first I^* of their incomes on corn, and all the rest on shoes. We shall losely refer to the first type of consumers as the poor, and the second as the rich, recognizing that there is a multitude of income classes in each category. What distinguishes the two types is that the rich wear shoes, while the poor do not.

In summary, our analysis so far has given us all the aspects of individual behavior, including the migration decision and the demand for food and shoes. To determine equilibrium sizes of agriculture and manufacturing, we need to intersect the supply and demand for shoes. This is the subject of the next section.

Section 3: Analysis

Equilibrium demand for shoes is computed by aggregating individual demands of all shoe buyers. Specifically,

$$(4)\quad Q^D = \frac{L}{W}\int_{\gamma^*}^{\infty} \left(\frac{\gamma\beta}{L} + W - I^*\right) d\sigma'(\gamma).$$

In this expression, Q^D is equal to the total income of shoe buyers net of I^*, divided by the price of shoes, W.

Since the amount of labor used to produce shoes is L-Lo, we can use the migration equilibrium condition (2) to derive the supply curve of shoes, namely

$$(5)\quad Q^S = L - Lo = L - \frac{1-\beta}{W}$$

Equilibrium in the shoes market is given by the equality of supply and demand. For our purpose, it will be convenient to express both in corn values, and to speak of equality of WQ^D and WQ^S. The equilibrium condition then becomes:

$$(6)\quad LW - (1-\beta) = L\int_{\gamma^*}^{\infty} \left(\frac{\gamma\beta}{L} + W - I^*\right) d\sigma'(\gamma) \equiv L \cdot M(W),$$

where M(W) is defined as the per capita demand for manufactures. We shall refer to the two sides of (6) as supply and demand, recognizing that, in fact, these are corn values and not quantities.

Figure 1 draws the two sides of (6) as function of W for wages exceeding $\frac{1-\beta}{L}$, which is the minimum needed to get the first labourer off the land. The "demand" curve is upward sloping here since it is the income available for shoe purchases as a function of the wage.

Straightforward examination of (6) shows that supply is linear in W but demand is not. In fact, a simple calculation shows that:

$$(7)\quad M'(W) = [1 - \sigma(\gamma^*)] < 1.$$

(8) $M'' (W) = \frac{L}{\beta} \sigma' (\gamma^*) > 0.$

Thus the demand curve is convex and has a slope less than L, which is the slope of the supply curve.

The reason that the slope of the demand curve is below L can be intuitively understood as follows. If we raise W by a unit, every person's income will rise by a unit, whether they are on the land or in manufacturing. However, the $\sigma (\gamma^*)$persons who are not yet satiated with corn spend all of that extra income on corn, whereas the rest of the population spends all of their extra income on shoes. The slope of the demand curve is thus the number of the rich, who by definition are interested in shoes only (we should emphasize that our use of shoes as the good demanded by the rich was inspired by the classical paper of Rosenstein-Rodan and <u>not</u> by Imelda Marcos). The number of the rich rises as W grows, but of course never exceeds L.

The demand and supply curves intersect whenever demand at $W = (1 - \beta)/L$ exceeds supply, which is true as long as, at this wage, <u>any</u> income is spent on shoes. A necessary and sufficient condition for this is that the richest man's income exceed I^*, or

(9) $\frac{\bar{\gamma}\beta}{L} + \frac{1-\beta}{L} > I^*$,

where $\bar{\gamma}$ is the richest man's share of private corn. When (9) holds, the first man can be taken out of agriculture, paid $\frac{1-\beta}{L}$, and asked to make shoes. The shoes are then sold to the richest man, who by (9) is interested in buying them. This gets the process going until equilibrium is reached at W^*, Q^*. Given (7) and (8) such an equilibrium is unique, with positive shoe output. When (9) fails, the demand curve for shoes

starts below the supply curve and is everywhere flatter. The two curves do not intersect and the output of shoes is zero. Absent any demand, the population stays barefoot on the farm.

Since (9) is a necessary condition for industrialization to get going, it warrants several remarks. Multiplying (9) by L and regrouping terms, we can write it as:

(10) $(\bar{\gamma} - 1)\ \beta > LI^* - 1.$

The right hand side of (10) is the difference between the amount of corn necessary to get the whole population interested in shoes and corn supply. It therefore measures the wealth of a country. Whereas a wealthy country might have enough food to get I^* to everyone, so $LI^* - 1 \leq 0$, in a poor country food supply falls short of what is necessary to make everyone a shoe buyer. Thus in a poor country, such as the one we are studying, the right hand side of (10) is positive.

The left hand side measures the difference in rents of the richest and the average person (remember the mean of γ is 1). Of course it is non-negative. For equilibrium shoe production to take place, the rich must be rich enough to get beyond the point of a sole interest in food. When $\bar{\gamma}$ is high, this is likely to be satisfied. However, take the case of complete equality, i.e., $\bar{\gamma} = 1$. In this case, the left hand side of (10) is zero, and in a poor country (10) is violated. Complete equality in this economy entails the equilibrium with the lowest possible level of income (i.e., 1), in which the whole population stays on the farm. The market for shoes does not exist, nor can it get off the ground for lack of demand. As there is no one in this economy rich enough to buy shoes, the whole population crowds the farm sector in pursuit of corn. In a poor country - but not in a

rich country where $LI^*-1<0$ - equal distribution spells equal distribution of misery.

Equations (9) and (10) convey another message. Recall that β is the share of corn output to which property rights are well defined. If $\beta = 0$, so that the "squatters rights" model governs the division of the whole food output, then clearly in the case of a poor country there is no demand for shoes. Farm output is equally divided, but there is not enough to get I^* for everyone. Since private corn is the only source of inequality, and inequality is necessary to get industrialization going, greater amounts of private corn would help. Indeed, as β rises, equations (9) and (10) are more likely to be satisfied. Even when $\beta = 1$, however, the country might be too poor for industrialization. In this case industrialization is not efficient, since labor is available to manufacturing at zero wage.

Suppose now that (9) is satisfied, and consider some of the properties of an interior equilibrium. This equilibrium is clearly inefficient. Since no labor is needed to make corn, the social optimum dictates that all farmers go make shoes. The absence of well-defined property rights to communal corn, however, keeps some of the population from leaving the farm, since they must give up a progressively more valuable claim as L_0 falls. If each man could take $\frac{1-\beta}{L}$ units of corn to the city, equilibrium would be efficient, with farmers splitting the available corn and then going to work for the zero wage making shoes. The poor distribution of property rights keeps men on the farm and keeps income down from its potential maximum of 1 + L.

It is reasonable to ask which interventions would raise the standard of living in this economy. The first one is of course a land reform, which takes all the land under "squatters rights" cultivation away, and assigns property

rights to it. Each farmer then gets an additional share of rents equal to his previous claim to communal corn. The cost of leaving the farm in this case drops to zero. As a result, the manufacturing wage drops to 0 and income jumps to 1 + L, as the whole population gets busy making shoes. There is an important caveat, however, to this land reform, concerning the welfare of the workers who were employed in manufacturing and who watch their wage drop from W to zero. To keep these workers equally well off, one must redistribute shares to them from the rich shoe buyers, who now see the price of shoes drop to zero. Since no one is worse off in the end and income is higher, a land reform supplemented by appropriate rent transfers is a Pareto improvement.

While less effective than a land reform, an expansionary fiscal policy can also improve matters in this economy. Moreover, it has a nice multiplier associated with it, arising from the fact that a man's departure from the farm leaves those remaining richer and possibly more interested in shoes. To see how this works, suppose some outside authority gave 1 unit of corn to each person in the population (say as an external grant). Of this income, $1 - \sigma(\gamma^*)$ will be spent on shoes, which will raise the wage and hence the income of manufacturing workers (and, by arbitrage of farmers) by $1 - \sigma$. Of that new income, $1 - \sigma$ will again be spent on shoes, and so on. The total effect of giving 1 unit of income to every person is to raise aggregate income by $\{(1 - \sigma) + (1 - \sigma)^2 \ldots\} = 1/\sigma(\gamma^*)$. There is a multiplier of $1/\sigma(\gamma^*)$ on exogenous shifts in demand, since the resulting wage increases push the idle farm labor into the city. The exact mechanism of how this works is illustrated in Figure 2.

We see therefore, how insufficient demand for shoes promotes stagnation of this economy and how certain interventions can have highly beneficial

effects. One must either destroy the agricultural arrangements that tie the idle farm labor to the land, or else make it attractive for such labor to leave. The latter is accomplished by raising the deficient shoe demand, which can be done by raising everyone's income, raising income of shoe buyers only or even possibly redistributing income in favor of shoe buyers. No matter how one gets the labor off the farm and into manufacturing, one can effect a Pareto improvement as long as those hurt in the process are properly compensated.

4. Further Remarks

There are a number of important aspects in which the model outlined above is too simple and perhaps in part misleading. Most importantly, we made all the shoes alike, and therefore any income in the hands of those satiated with corn contributed alike to demand. For example, a dollar in the hands of someone buying his first pair of shoes contributed as much to demand for shoes as a dollar in the hands of a millionaire who spends it on shoes anyway. In practice millionaires might not be as good spenders from the viewpoint of industrialization as the middle class. They might buy imports, or very high quality hand-made goods or hire servants. If the demand for shoes is what is lacking, then resources in the hands of the very rich might not contribute to it as do resources spread more evenly through the middle class. The conclusion of the model that a dollar in the hands of anyone who is beyond buying corn is equally good must be modified to account for the peculiar spending patterns of the rich.

Another important element of our specification - and one that conflicts with Rosenstein-Rodan and other writers on balanced growth - is the use of constant returns to scale in manufacturing. This raises the question of why

the shoe-making technology does not come to the farm, so that people could retain their communal food while making shoes. Indeed, there are historical precedents of such activities, particularly in the making of cloth. To address this objection in our framework, we must follow Rosenstein-Rodan and others and talk about an increasing returns to scale technology for making shoes. Because such technologies require a minimum scale of operation, the issue of market size and insufficient demand looms much larger. This was of course recognized by balanced growth theorists.

To illustrate this point, suppose that the minimum scale of operation in shoemaking is S, where S < L. This yields the constraint that revenues must exceed SW for manufacturing to emerge. Figure 3 depicts the additional constraint. With the minimum scale restriction, the likelihood that the equilibrium has no manufacturing is much greater. In fact, the equilibrium wage must exceed $(1-\beta)/(L-S)$, so that at most L-S men remain on the farm. This might require very substantial inequality to provide enough stimulus for shoe production. Of course, these remarks are only intended to be suggestive and are not a substitute for analyzing scale economies in detail, which inevitably brings in imperfect competition.

It is easy to imagine other aspects in which the model is too rudimentary. We hope to have given the reader a warning about interpreting some aspects of the inequality results. Nonetheless, we believe the model has offered some insight into the observation that insufficient demand can limit industrialization. This granted, we offer in conclusion some more general remarks in the spirit of the model.

First, the analysis sheds light on the empirical observation that a country with one very strongly developed sector may fail to industrialize if

the returns from that sector are too narrowly distributed. For example, if an oil exporting country distributes the dividends (in the form of either profits or wages) to only a small group of people, these people would spend their windfall on imports or other fancy items, without generating a broad enough pattern of demand to accommodate industrialization. Benefits should be widely spread for market size to grow. On a more general level, this is an argument for diversification of sources of surplus, Brazilian style.

Second, if demand is too small, integration of markets across countries could be helpful. For example, if two countries combine their markets, and each specializes in the production of some goods, then the demand faced by producers would be much larger. This is particularly advantageous when scale economies are available. A merger of markets by the two countries is just like creation of a larger middle class.

Lastly, this paper is an argument for export promotion (although we studied a closed economy) in two ways. First, if exports in one sector are a source of surplus, they would contribute to the demand in the other sectors, and would thus allow their expansion and withdrawal of surplus labor from agriculture. Second, there is the direct effect, in that opening of the world market allows the expansion of domestic industry, again in the case where the social opportunity cost of labor might be low. These of course are well known prescriptions of the balanced growth literature.

While these examples do not exhaust the list of possibilities, they offer a flavor of the kinds of implications that our analysis yields. Measures that promote the growth of demand for industrial goods benefit a country, since large markets allow productive utilization of otherwise idle labor.

Figure 1

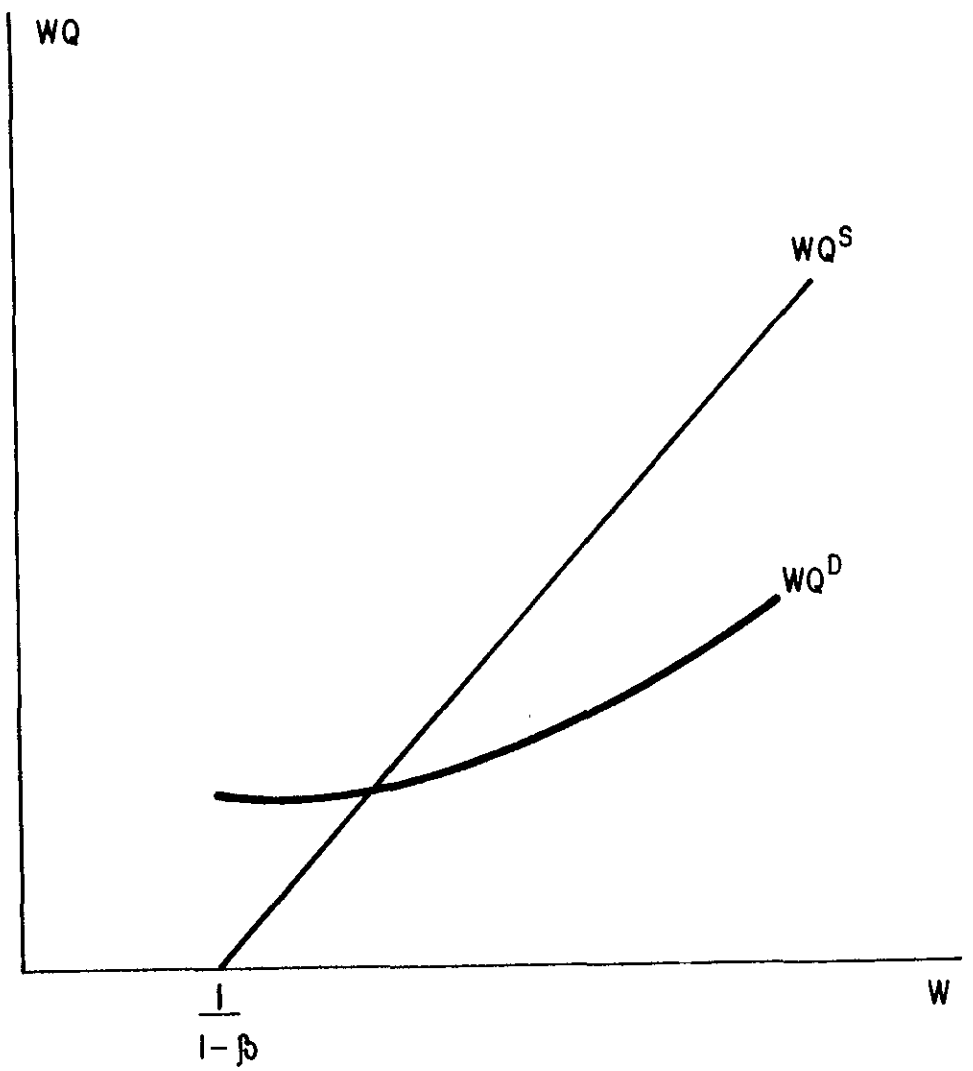


Figure 2

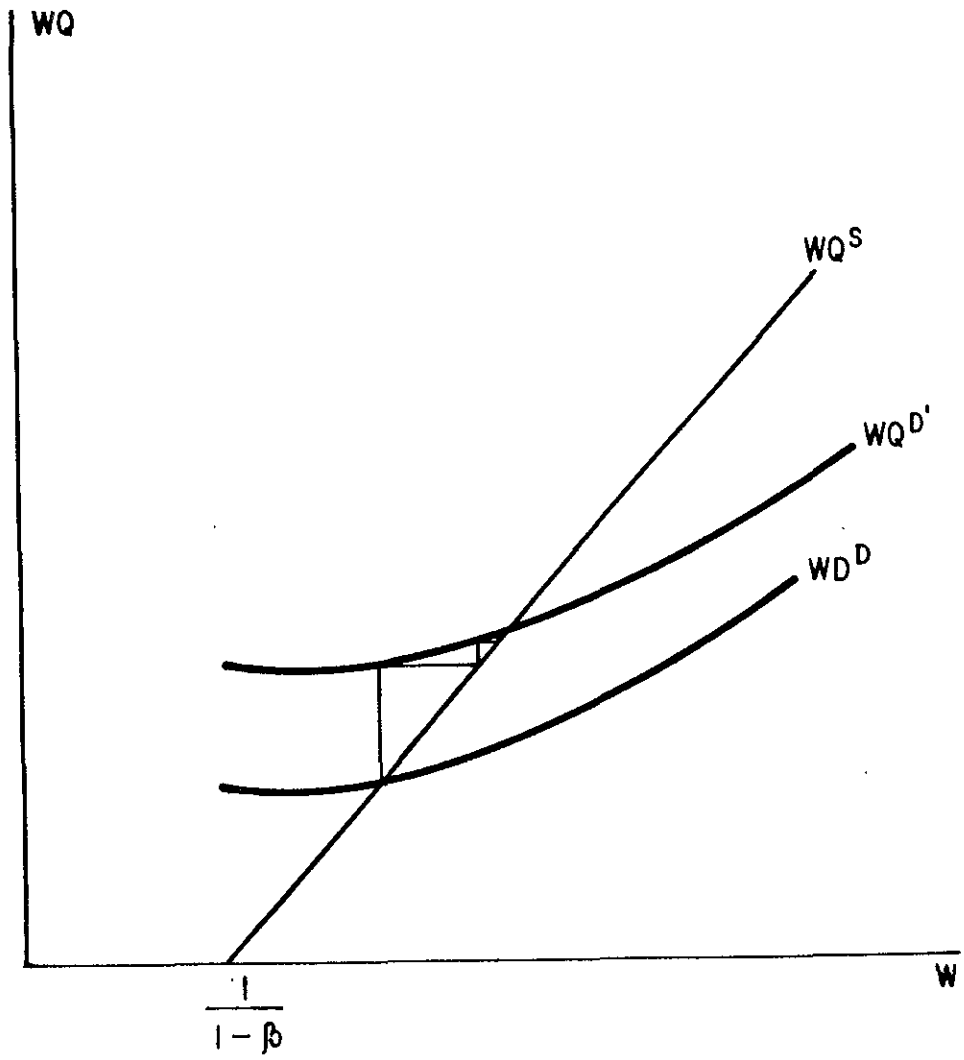
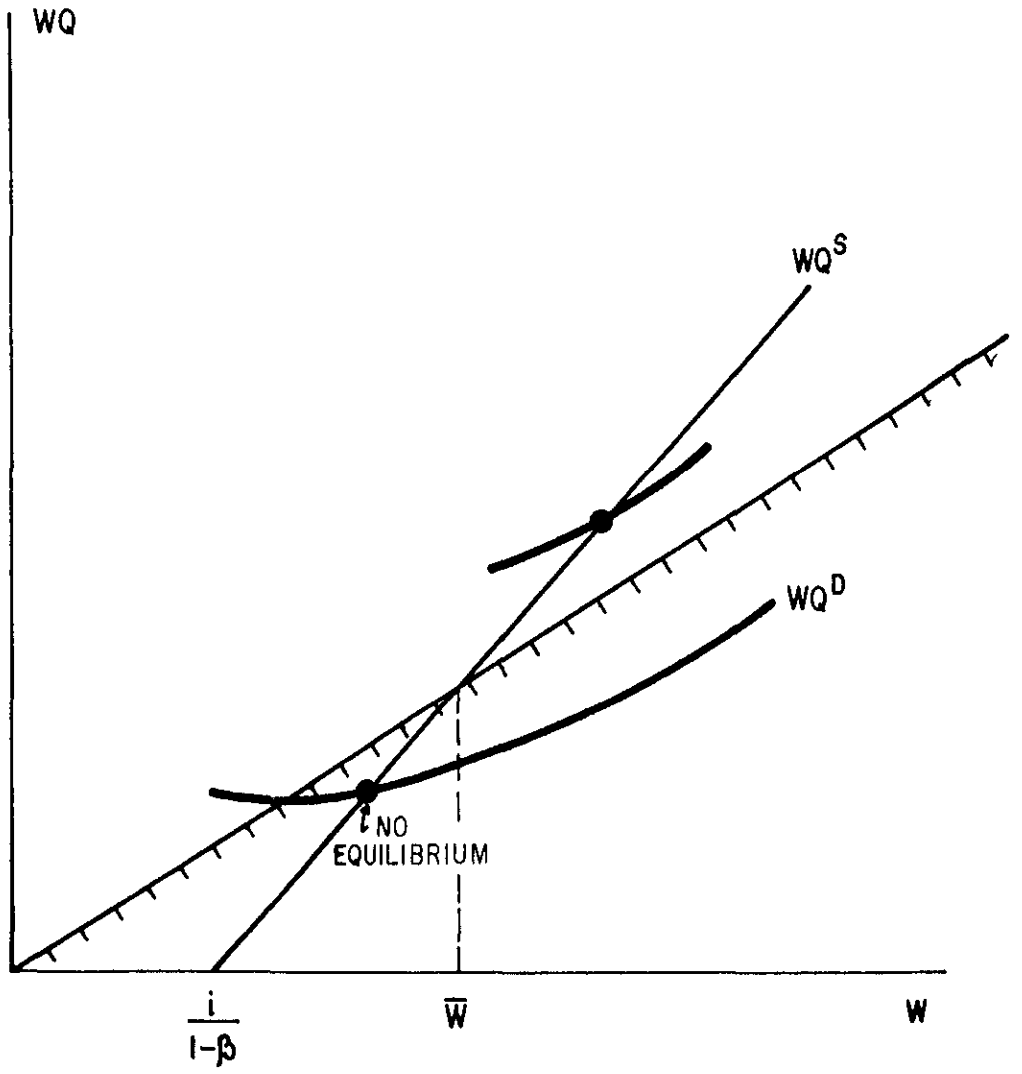


Figure 3



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