THE CONCEPT OF ECONOMIC SURPLUS

By KENNETH E. BOULDING*

Economic surplus may be said to be present whenever a seller makes a sale for a sum greater than the least sum for which he would have been willing to make the sale, or whenever a buyer makes a purchase for a sum smaller than the greatest sum for which the buyer would have been willing to make the purchase. If I am able to sell an article for $10 which I would be willing to sell for $8.00, then $2.00 represents economic surplus. Likewise, if I am able to buy an article for $10 for which I would be willing to pay $13, then $3.00 represents the economic surplus. This concept of an economic surplus has played an important part in economic theory, whether in a simple or in an extended form. It is the basis of the Ricardian theory of economic rent and of the Marshallian theory of consumers' surplus, and is an important concept in welfare economics. It lies at the root also of the Marxian theory of surplus-value.

Economic surplus can arise only where there are differences among the various buyers or sellers of an identical article in respect of their willingness to buy and sell. What is the same thing in other words, it is a phenomenon necessarily associated with less than perfectly elastic demands and supplies. If all the sellers of a given commodity were willing to sell it at a price of $10, the supply would be perfectly elastic within the range of sellers, and no matter what the demand within this range the price would always be $10 and there would be no economic surplus. Similarly, if all buyers were willing to buy a commodity at a price of $10, the demand would be perfectly elastic within the relevant range and, no matter what the supply, the price would always be $10 and there would be no economic surplus. Suppose, however, that some sellers are willing to sell at $9.00, some at $10, and some at $11. If the demand is such that the $9.00-sellers can supply all that is necessary, the price will be $9.00 and there will be no economic surplus. If, however, the demand rises so that the amount which the $9.00-sellers are willing to supply is insufficient to satisfy the buyers at that price, the price must rise to $10 in order to attract the $10-sellers into the market. Then the $9.00-sellers receive an economic surplus of $1.00, for they would be willing to sell for $9.00, but in fact receive

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\$10. If the demand rose still further, so that the \$11-sellers had to be brought into the market, the price would rise to \$11, the \$9.00-sellers would have an economic surplus of \$2.00 and the \$10-sellers of \$1.00.

Similarly in the case of demand, if there are some buyers willing to buy the commodity for \$11, some for \$10 and some for \$9.00, and if the supply is so small that at a price of \$11 all that sellers will offer will be taken by the 11-dollar buyers, the price will be \$11 and there will be no economic surplus on the buyers' side. If, however, the supply is larger, so that the price must be brought down to \$10 in order to attract the \$10-buyers, the \$11-buyers will receive an economic surplus of \$1.00. If the supply is still larger, so that the price falls to \$9.00 in order to bring the \$9.00-buyers into the market, the \$11-buyers will receive \$2.00 economic surplus and the \$10-buyers will receive \$1.00 economic surplus. Economic surplus on the sellers' side may be called "sellers' surplus" and on the buyers' side, "buyers' surplus."

The principle is illustrated in a familiar diagram in Figure 1. The "buyers' curve," $B_1 \ldots\ldots b_n$, shows what quantities buyers are just willing to buy at various prices. Thus, at a price OB_1 there are buyers just willing to buy B_1b_1; at a price ON_2, there are buyers just willing to buy an amount B_2b_2; and so on. The total amount that will be bought at the price ON_2 is, of course, $B_1b_1 + B_2b_2$, or N_2b_2, and, as the same principle applies all the way down the curve, the "buyers' curve" is also the demand curve. The demand curve is essentially the *cumulative frequency distribution* of the amounts that people are just willing to buy at various prices. Similarly the "sellers' curve," $S_1 \ldots\ldots s_n$, shows what quantities the sellers are just willing to sell at various prices. It is the cumulative frequency distribution of the amounts that people are just willing to sell at various prices.

The equilibrium price, ON, is that at which all sellers can find buyers for the amounts desired—*i.e.,* at which the quantity offered is equal to the quantity sold. Then the total buyers' surplus at the equilibrium price is measured by the area NB_1P and the total sellers' surplus by the area S_1NP. The buyers' surplus measures the difference between the total amount actually paid by the buyers ($ONPM$) and the total amount which they would have been willing to pay if perfect price discrimination could have been practiced—(*i.e.,* if each unit had been sold at the highest price that anyone was willing to pay for it)—which would be the area OB_1PM. The sellers' surplus measures the difference between what the sellers actually receive ($ONPM$) and the least sum for which the amount OM could be obtained under perfect price discrimination—*i.e.,* if each quantity were to be paid for at a rate only just sufficient to induce the seller to part with it. This is the area

OS_1PM. The sellers' curve is similar to what Marshall called the "particular expenses curve." It is identical with the supply curve only if changes in the willingness to supply due to external economies can be neglected.

This is essentially the "classical" theory of economic surplus. The Ricardian theory of rent appears as a special case: if rent is that which is paid for the "original and inexhaustible powers of the soil," then clearly rent is being paid for something that is perfectly inelastic in supply. In the case of any commodity the supply of which is perfectly inelastic at all prices, the whole payment for the commodity is economic rent; for the commodity would be supplied even if nothing were paid for it.

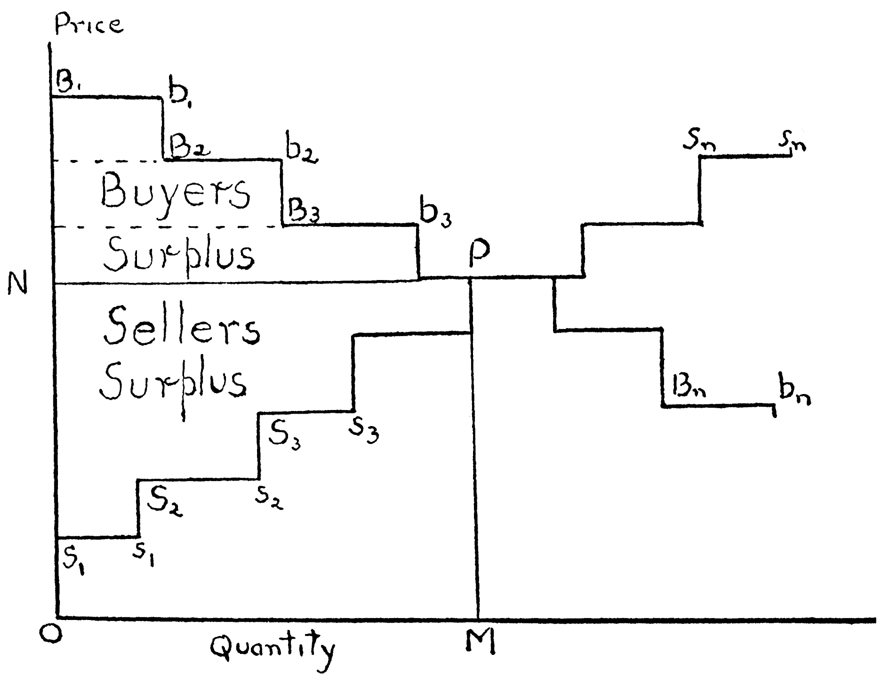

FIGURE 1

Thus in Figure 1, if the sellers' curve were *MP*, the whole area *ONPM* would be sellers' surplus—*i.e.*, economic rent. The question of whether any such commodity exists, of course, is a doubtful one: certainly most of the services of land, with the possible exception of the great river-bottoms, are neither original nor inexhaustible. Even the element of *location*, which might seem at first sight to be perfectly inelastic in supply as land cannot be other than where it is, nevertheless is significant only in relation to the location of the human population, which is perfectly capable of shifting. If, however, there exists any commodity with a perfectly inelastic supply there can be no doubt that the whole payment received for it by its owners would be economic rent.

The exposition is considerably complicated, although not changed in essence, when we consider that demands or supplies may be less than perfectly elastic for two reasons: first, because *individual* buyers and sellers will buy or sell different quantities in response to different prices; and, secondly, because a change in price may affect the *number* of buyers or sellers. This is the distinction between what used to be called, rather vaguely, the "intensive" and the "extensive" margins. In the illustration of the $11, $10 and $9.00-buyers or sellers, it was assumed that the variation in quantities offered or demanded with change in price came solely from changes in the number of sellers or buyers. In fact, of course, a rise in price may not only attract new sellers, but may also encourage each individual seller to sell more; likewise a fall in price may not only attract new buyers, but may also encourage each individual buyer to buy more. This fact is not excluded by Figure 1, where the buyers and sellers curves refer to *quantities,* not only to individuals.[1] Thus the quantity B_2b_2, which would just be bought at the price ON_2, may represent an addition to the purchases of existing buyers as well as the purchases of new buyers; and the quantity S_2s_2 likewise may represent an addition to the sales of existing sellers as well as the sales of new sellers.

For a complete analysis of the problem, then, we must consider the demand curve of an individual buyer and the supply curve from an individual seller. Fortunately, much that was previously obscure in this matter has been cleared up in recent years through the indifference curve analysis. In Figure 2A we show the indifference curves, M_0I_0, M_1I_1, etc., for a single marketer (buyer or seller, depending on the circumstances), showing his preferences between money and the commodity marketed. Quantity of money is measured along the vertical, quantity of commodity along the horizontal axis. Any one indifference curve shows those combinations of money and of commodity to which the marketer is indifferent. Any point on indifference curve M_1I_1 is preferred to any point on M_0I_0: generally, any point on M_nI_n is preferred to any point on $M_{n-1}I_{n-1}$.

We suppose that the marketer has in his possession a quantity OR_0 of commodity and a quantity R_0P_0 of money. The point P_0, therefore, represents his initial position. The problem is: Given a "market"—*i.e.,* a situation in which he can buy or sell any amount of the commodity at a given price—to what point will he move? The line showing what

[1] Marshall does not seem to be quite clear on this point in drawing his particular expenses curve.

FIGURE 2A

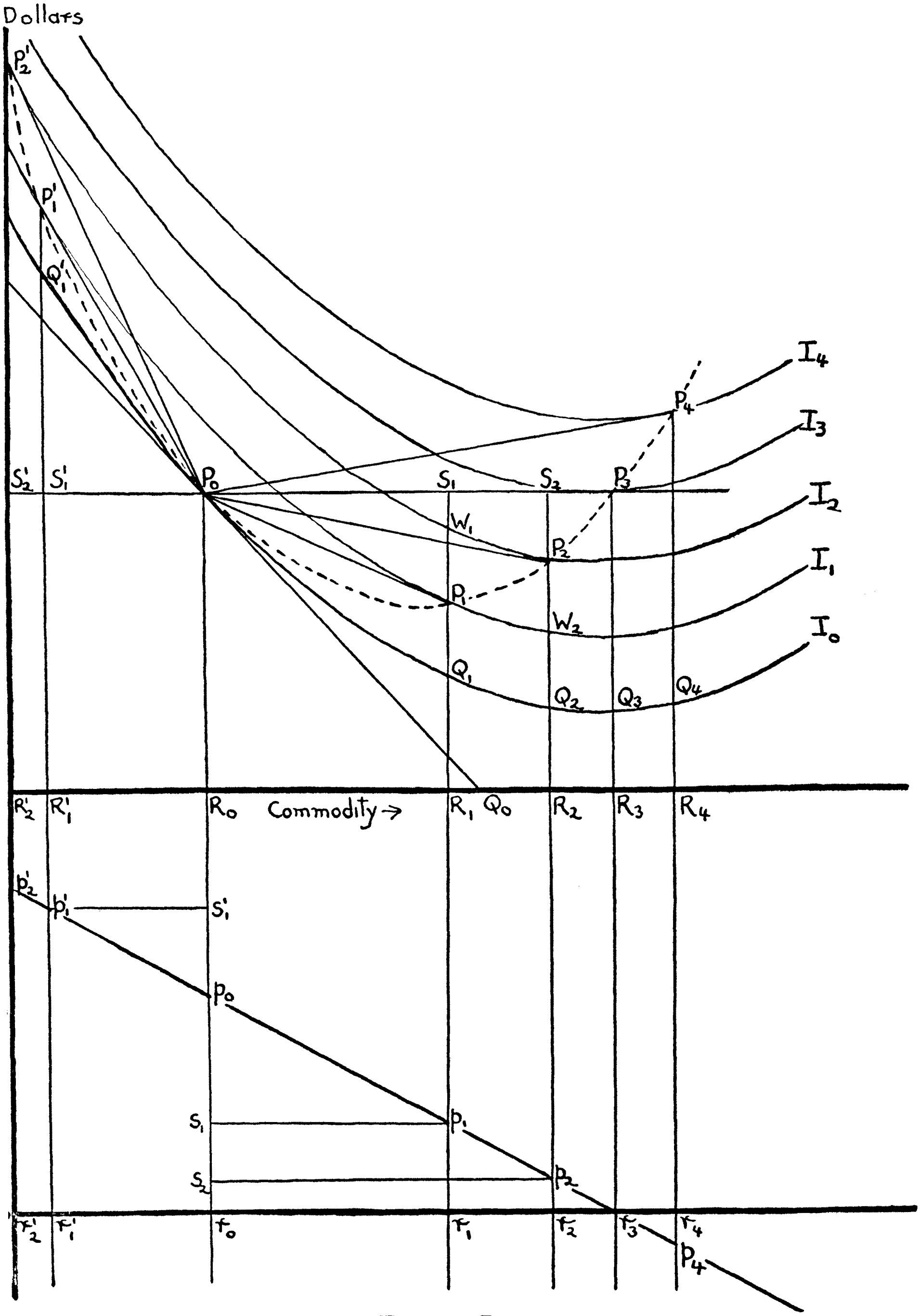

FIGURE 2B

combinations of money and commodity are open to him through exchange is his "opportunity line." At a constant price it is a straight line through the point P_0, the slope of which is equal to the market price. Thus if the price is $\frac{P_1S_1}{P_0S_1}$ the opportunity line will be P_0P_1. Moving to the right along an opportunity line means that the marketer is buying —*i.e.*, giving up money for commodity. Moving to the left means selling—giving up commodity for money. The marketer will move along his opportunity line as long as the line is cutting indifference curves, for this means that he is progressing to higher and higher indifference curves—*i.e.*, more and more preferable positions. When the opportunity line ceases to cut, but instead *touches* an indifference curve, the marketer has reached the best possible position with the given price. Thus, when P_0P_1 is the opportunity line the marketer will move along it until he reaches P_1, where the line P_0P_1 touches the indifference curve M_1I_1. He will not go beyond this point because, if he does, he will be passing to lower—*i.e.*, less preferred—indifference curves.

If the market price is equal to the slope of the indifference curve at P_0, the marketer will neither buy nor sell. His opportunity line will be $Q'_0P_0Q_0$, but no matter in which direction he moved along it from P_0 he would move to lower indifference curves. He will, therefore, sit tight at P_0: the price $\frac{OQ'_0}{OQ_0}$ (= r_0P_0 in Figure 2B) is his "null price." If the price is lower than the null price, he will buy: if the price is higher, as represented by the opportunity lines $P_0P'_1$, $P_0P'_2$, etc., he will sell. The locus of the points of equilibrium at various prices is the dotted line P'_2—$P_0P_1P_2$—P_4. This may be called the total revenue-outlay curve. From P_0 to P_3 it is a total revenue curve, showing the total amounts of money measured from the line $P_0S_1P_3$, that the marketer will receive for the sale of various amounts of commodity, measured from the line P_0R_0. Thus the point P_1 shows that at a price $\frac{P_1S_1}{P_0S_1}$, the marketer will give up an amount S_1P_1 of money and will receive in exchange P_0S_1 of commodity, leaving him with R_1P_1 of money and OR_1 of commodity. From P_0 to P'_2 the line is a total outlay curve, showing what amounts of money will be received for the sale of various amounts of commodity.

The total outlay-revenue curve can easily be turned into the marketer's demand-supply curve in Figure 2B, where the horizontal axis is identical with that of Figure 2A, and the vertical axis measures the ratio Money/Commodity. For each quantity of commodity represented by r_1, r_2, etc., we calculate the price, $\frac{S_1P_1}{P_0S_1}$, $\frac{S_2P_2}{P_0S_2}$, $(= r_1p_1, r_2p_2,$ etc.) and plot the line $p'_2p_0p_6$ accordingly. The segment p_0r_3 is the marketer's *demand curve:* it shows how much he will buy at each price. The segment p'_2p_0 is the marketer's *supply curve:* it shows how much he will sell at each price. The segment of the outlay-expenditure curve P_3P_4, and of the demand-supply curve r_3p_4 represents a situation (extremely unlikely to occur in a commodity market) where the price is negative—*i.e.,* where the marketer can increase *both* the amount of money he has and the amount of commodity at the same time. In this case the commodity has become a discommodity, as is shown by the positive slope of the indifference curves: at points such as P_4 an increase in the quantity of commodity is so distasteful that it must be compensated for by an increase in the quantity of money.

In Figure 2A the indifference curves have been drawn vertically parallel—*i.e.,* the whole system can be mapped out by moving one of the curves parallel to itself in a vertical direction. It follows that, for each quantity of commodity, the slopes of all the indifference curves are identical. The slope of an indifference curve is called the marginal rate of substitution of money for commodity: it is the amount of money which must be substituted for one unit of commodity if the individual is to feel no gain or loss. Thus, if the marginal rate of substitution (for short, *MRS*) is \$3.00 per bushel, then if a bushel is subtracted from the marketer's stock of commodity, \$3.00 must be added to his stock of money in order to leave him as well satisfied as he was before. If now the indifference curves are parallel, the *MRS* of all the indifference curves at any given quantity of commodity is equal to the price of the commodity. Thus at a quantity of commodity OR_1, the slopes of the indifference curves at Q_1, P_1, W_1, etc., are the same, and are also equal to the slope of the line P_0P_1—*i.e.,* to the price of the commodity—as P_0P_1 is tangent to the indifference curve at P_1. The *MRS* of all the indifference curves at the quantity OR_1 is therefore equal to r_1p_1 in Figure 2B. That is to say, when the indifference curves are parallel, the *MRS* curve corresponding to each indifference curve is the same as the demand-supply curve.[2]

[2] This condition of "parallel indifference curves" is essentially similar to the condition that the marginal utility of money should be constant, assumed by Marshall in his analysis of consumer's surplus. It is, however, somewhat broader than Marshall's assumption. The *MRS* at any point on an indifference curve is the ratio $\frac{\text{Marginal Utility of Commodity}}{\text{Marginal Utility of Money}}$ (see Boulding, *Economic Analysis,* p. 663). Marshall assumed that for a given quantity of commodity the marginal utility of the commodity would be independent of the amount of money, and that the marginal utility of money was likewise independent of the

FIGURE 3A

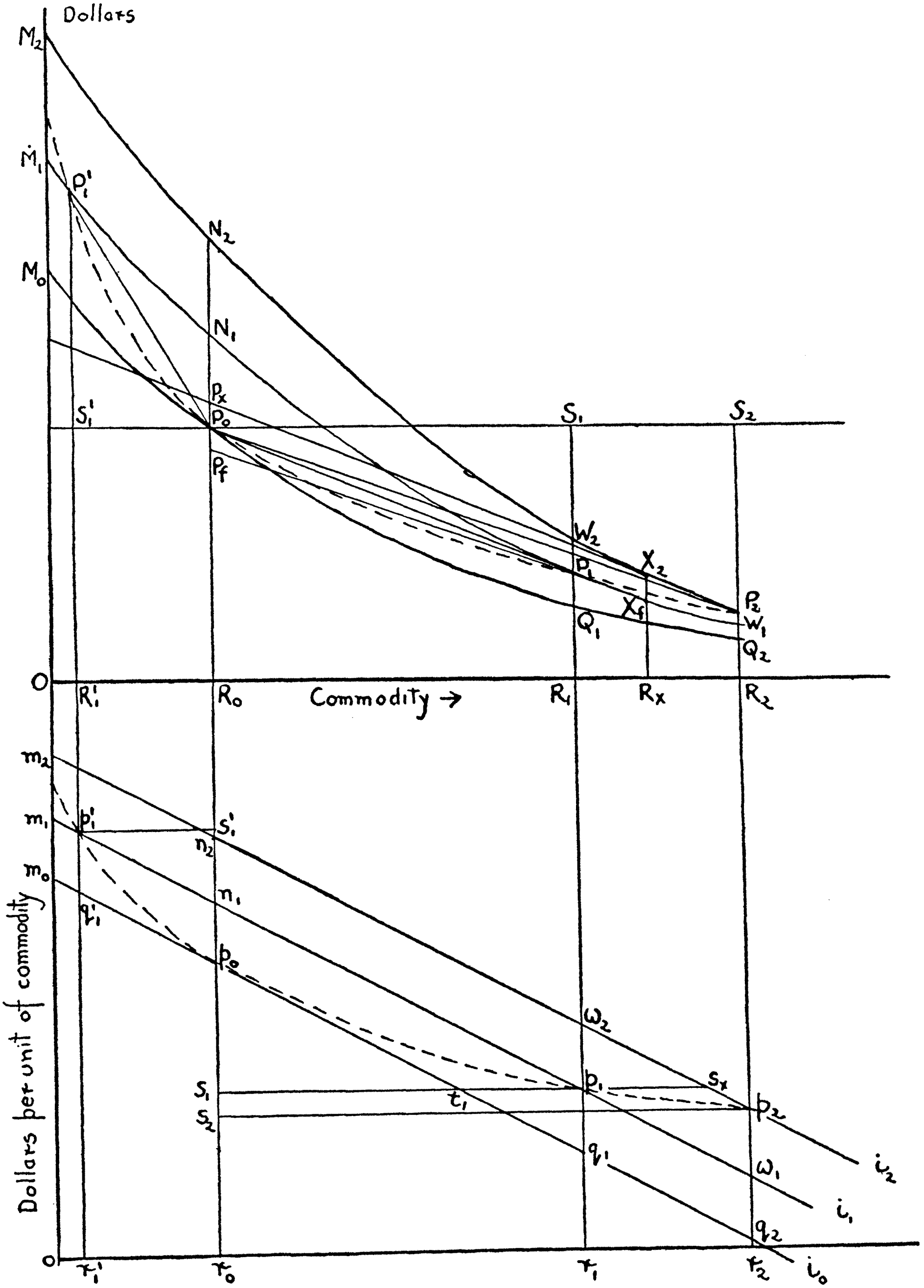

FIGURE 3B

There are several concepts of economic surplus which can be derived from this construction. Perhaps the simplest is the "buyer's surplus" and "seller's surplus," analogous to the Marshallian "consumer's surplus." The buyer's surplus is the difference between what the buyer pays for a given quantity of the commodity under the conditions of a uniform price, and what he would have paid under the least favorable conditions of differential pricing. Thus in Figure 2A the curve P_0I_0 shows the path the marketer would follow under perfect differential pricing: at a price just a little less than r_0p_0 he will buy one unit; at a slightly smaller price he will buy another unit; and so on down the curve $P_0Q_1 \ldots\ldots I_0$. Under perfect differential pricing, therefore, he will pay S_1Q_1 for a quantity R_0R_1; under uniform pricing he would only pay S_1P_1. The buyer's surplus, therefore, is P_1Q_1. Similarly, if the be shown that this is also equal to the area $s'_1p_0p'_1$ in Figure 2B. marketer buys an amount R_0R_2 at a uniform price r_2p_2, the buyer's surplus is P_2Q_2. It can easily be shown that the buyer's surplus is also equal to the triangular area under the demand curve. Thus, at a quantity R_0R_1 $(=r_0r_1)$ the total amount which the marketer would have to pay under perfect differential pricing is the area $r_0p_0p_1r_1$ in Figure 2B. This is equal to the line S_1Q_1 in Figure 2A. The total amount paid under uniform pricing is the area $r_0s_1p_1r_1$ in Figure 2B $(=S_1P_1$ in Figure 2A). The buyer's surplus in Figure 2B, therefore, is $r_0p_0p_1r_1 — r_0s_1p_1r_1 =$ area $s_1p_0p_1$.

An exactly analogous concept of "seller's surplus" can be derived from the supply curve $p_0p'_2$ in Figure 2B, and the corresponding part of Figure 2A. Thus the marketer will sell an amount $P_0S'_1$ for an amount $S'_1P'_1$ under uniform pricing. Under perfect differential pricing he can be made to sell this amount for only $S'_1Q'_1$. The seller's surplus —the difference between these two amounts—is $P'_1Q'_1$. It can easily

The next problem is to remove the limitation of parallel indifference curves. Figures 3A and 3B show a situation in which, for each quantity of commodity, the *MRS* increases as the quantity of money increases: as we move upward along any vertical line in Figure 3A we cut indifference curves of successively steeper slopes. The system of indifference curves do not now reduce to a single *MRS* curve, but in-

amount of money. This last assumption could only be even approximately true over small ranges. On these assumptions, of course, the *MRS* would likewise be independent of the quantity of money for each quantity of commodity. The *MRS* may also be constant, however, if *both* the marginal utility of commodity and the marginal utility of money change in the same proportion as the quantity of money changes. Thus as we proceed upward along any vertical line in Figure 2A, the marginal utility of money is likely to fall, as the quantity of money increases, following the familiar law of diminishing marginal utility. It is possible that the marginal utility of the commodity will also fall as the quantity of money increases, even though the quantity of commodity is held constant. This will happen if the commodity is "competitive" with money.

stead each indifference curve has its own *MRS* curve: in place of the single *MRS* curve of Figure 2B we now have a system of such curves as in Figure 3B: m_0i_0, m_1i_1, etc., corresponding to the indifference curves M_0, M_1, etc., of Figure 3A. Then at a price equal to the slope of the opportunity line P_0P_1 in Figure 3A ($=r_1p_1$ in Figure 3B) the amount bought will be R_0R_1, P_1 being the point of tangency of P_0P_1 with the indifference curve. If in Figure 3B a perpendicular from r_1 cuts the *MRS* curve m_1i_1 in p_1, r_1p_1 is the price at which the amount or_1 will be bought—being equal to the slope of the indifference curve at P_1. Similarly r_2p_2, p_2 being on the *MRS* curve m_2i_2, is the slope of the indifference curve at P_2, and is the price at which r_0r_2 will be bought. The dotted line $p_0p_1p_2$ is, therefore, the demand curve, which is not now identical with any one of the *MRS* curves, but has a flatter slope. Similarly, $p_0p'_1$ is the supply curve, derived from the outlay curve $P_0P'_1$. The supply curve in this case has a steeper slope than the *MRS* curves. It is easy to show that if the slopes of the indifference curves at a given quantity of commodity *fall* with increasing quantity of money, the *MRS* m_1i_1 will lie below m_0i_0, m_2i_2 will lie below m_1i_1, and so on. In this case the demand curve will have a steeper slope than the *MRS* curves and the supply curve a flatter slope.

The buyer's surplus does not, in this more general case, equal the triangular area under the demand curve. Thus, in Figure 3A the buyer's surplus at the quantity R_0R_1 is P_1Q_1 (S_1Q_1—S_1P_1). Corresponding to S_1Q_1 in Figure 3A, we have the area $p_0q_1r_1r_0$ under the *MRS* curve m_0i_0: corresponding to S_1P_1, we have—as before—the rectangle $r_0s_1p_1r_1$. The buyer's surplus, then, is equal to $os_1p_1r_1$, which $r_0p_0q_1r_1$— is equal to the triangle $s_1p_0t_1$ minus the triangle $t_1p_1q_1$. This is clearly less than the "demand triangle" $s_1p_0p_1$, which in this case has no meaning whatever. Similarly in the case of supply: the seller's surplus, at a quantity $R_0R'_1$, is equal to the quadrilateral area $s'_1p'_1q'_1p_0$. This is *greater* than the "seller's triangle" $p_0p'_1s'_1$. If the *MRS* became smaller as the quantity of money increased, the relations would be reversed: the buyer's surplus would be larger than the buyer's triangle, the seller's surplus would be smaller than the seller's triangle.

There is another important concept which is associated with the idea of economic surplus. This is the concept of a "compensating payment": *i.e.*, of the sum of money which would be sufficient to compensate a marketer for a given change in the price of the commodity. Thus, in Figure 3, suppose that there is a rise in price from r_2p_2 to r_1p_1. The opportunity line shifts from P_0P_2 to P_0P_1: the buyer shifts from the position P_2 to the position P_1. P_1 is on a lower indifference curve than P_2—*i.e.*, the buyer is worse off because of the shift in price. The question is, What sum of money, given to the buyer, would just compensate him for the rise in price—*i.e.*, would enable him to get back again to the indifference curve M_2? This is the sum P_0P_x, where P_xX_2 is drawn parallel to P_0P_1 to touch the indifference curve M_2 in X_2. If he had a sum R_0P_x to start with, and if the price were r_1p_1, the opportunity line would be P_xX_2, as the slope of this line is equal to that of P_0P_1: with this sum of money and at this price he will proceed to X_2, where he is just as well off as he was at P_2, X_2 and P_2 being on the same indifference curve. The amount he would buy under these circumstances is in between the amounts he would buy at P_1 and at P_2.

If the indifference curves are parallel it can easily be shown that the compensating payment is equal to the change in the buyer's surplus due to a shift in price: under these circumstances, as in Figure 2, X_2 coincides with W_2, as the slopes of the indifference curve at W_2 is equal to the slope at P_1. The change in buyer's surplus is $P_2Q_2-P_1Q_1 = W_2P_1=P_0P_x$. If the *MRS* increases with increases in money, as in Figure 3A, the compensating payment is larger than the change in the buyer's surplus.[3] It can be shown that, in terms of Figure 3B, the compensating payment for a change from p_2 to p_1 is the area $s_1s_2p_2s_x$: the change in the buyer's surplus is the area of the complex polygon $s_1s_2p_2q_2q_1p_1$. It should be observed that the compensating payment in the case of a fall in price from r_1p_1 to r_2p_2—*i.e.*, the tax which a buyer would have to pay in order to bring him to the indifference curve I_1 when the price is r_2p_2—is less (in Figure 3A) than the compensating payment in the case of a rise in price. If P_fX_f is drawn parallel to P_0P_2 to touch M_1W_1 in X_f, P_0P_f is the tax which will just balance the gain to the buyer resulting from a fall in price from r_1p_1 to r_2p_2. This is equal to the area $s_1s_2s_fp_1$ in Figure 3B. If the indifference curves are parallel, of course, the compensating payment is the same whether the movement of price is a rise or a fall.

Consider now what the payment must be to compensate the marketer for the entire loss of the market—*i.e.*, for the prohibition of buying or selling. In that case he will not be able to move from the position P_0. If the original price was r_2p_2, the payment which would be necessary to compensate for the loss of the market would be P_0N_2. This will bring the marketer up to the indifference curve to which he could have attained had he been free to buy at the price r_2p_2. P_0N_2 is equal to the

[3] For a fuller discussion of the "Compensating Payment" concepts see the following:

J. R. Hicks, *Value and Capital* (Oxford, 1939), pp. 38-41; and "The Rehabilitation of Consumer's Surplus," *Rev. Econ. Stud.*, Vol. 8 (Feb., 1941).

A. Henderson, "Consumer's Surplus and the Compensating Variation," *Rev. Econ. Stud.*, Vol. 8 (Feb., 1941), p. 117.

A. Kozlik, "Note on Consumer's Surplus," *Jour. Pol. Econ.*, Vol. XLIX, No. 5 (Oct., 1941), p. 754.

area $p_2s_2n_2$ in Figure 3B. It will be observed that this area is larger than the "demand triangle" $p_2s_2p_0$. In the case of a seller, if the price had originally been $r'_1p'_1$, the sum needed to compensate the seller for the loss of the market is P_0N_1, equal to the area $p_1s_1n_1$ in Figure 3B. This area is smaller than the "supply triangle," $p_0p'_1s'_1$.

We can apply this analysis to the consideration of the "gain from trade"—*i.e.*, the total payment which would be necessary to compen-

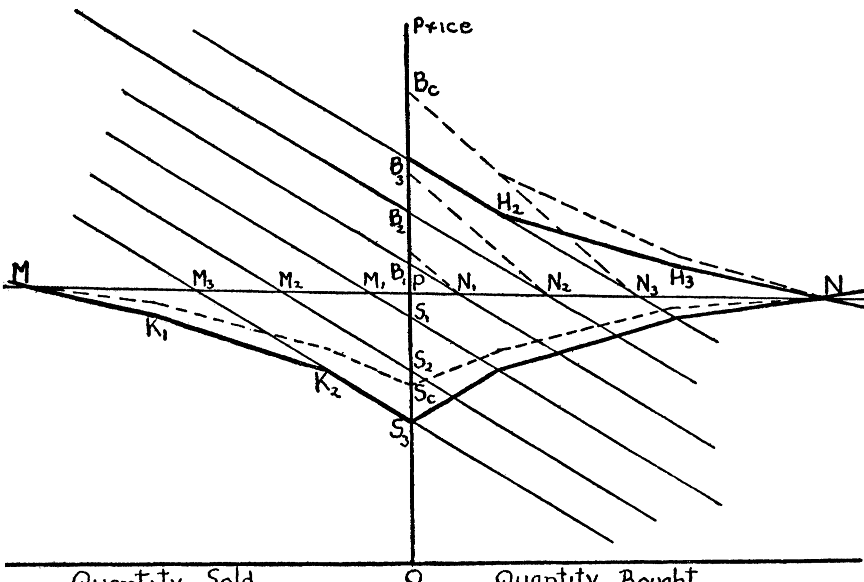

FIGURE 4

sate all the marketers for the loss of a market. In Figure 4, a group of individual demand-supply curves is shown, cutting the price axis in S_3, S_2—B_2, B_3. The market demand curve is obtained from these demand-supply curves by summing the total quantity bought at each price—*i.e.*, by adding horizontally that part of the curves to the right of the price axis: it is the curve $B_3H_2H_3N$. Similarly, the market supply curve, $S_3K_2K_1M$, is obtained by adding horizontally those parts of the demand-supply curves which lie to the left of the price axis. The market price is OP, where $PN = PM$—*i.e.*, the total quantity demanded—is equal to the total quantity offered. If now the indifference curves of the marketers are parallel, so that the "demand triangle" measures the compensating payment for each buyer, the total compensating payment to buyers is the area $PN_1B_1 + PN_2B_2 + PN_3B_3$, which is equal to the area PNB_3. Similarly, the total payment which would compensate sellers for the loss of the market is the area PS_3M. If now we draw S_3N the mirror image of S_3M, we get the familiar supply and demand figure, and the total compensating payment is the area S_3NB_3.

It is not difficult to introduce an adjustment to take care of the case where the marketers' indifference curves are not parallel. The curve B_cN is obtained by summing horizontally the *MRS* curves of each buyer passing through N_1, N_2, N_3, (shown as dotted lines in Figure 4). B_cN is an aggregate *MRS* curve for the buyers: the total compensating payment is, therefore, the area PB_cN. Similarly, MS_c is the aggregate *MRS* curve for the sellers: the total compensating payment to sellers is PS_cM. If NS_c is the mirror image of MS_c, the total payment which would compensate both buyers and sellers for the loss of the market is the area B_cNS_c. Unless conditions are very peculiar, the area B_cNS_c is not likely to differ very greatly from the area B_3NS_3, as the corrections lie in the same direction. While the assumption that the *MRS* increases with increase in the quantity of money makes the buyers' compensating payment larger, it makes the sellers' compensating payment smaller, so that the total is not much changed. If we assumed that the *MRS* declined with increase in the quantity of money, the effect would be to diminish the buyers', but to increase the sellers' payment.

We can apply the above analysis to the well-known theorem in the field of taxation, to prove that, if a tax is laid on a commodity, the total tax revenue is less than the "loss" to the marketers, as measured by the compensating payment. That is to say, even if all the revenue from a commodity tax were to be returned as a lump sum to the taxed marketers, the marketers would be worse off than before. This is shown in Figure 5, where *BP, SP* are the market demand and supply curves. If a tax equal to N_sN_b is placed on each unit of the commodity, when the market is in equilibrium buyers will pay ON_b, sellers will receive ON_s. The total tax revenue is $N_sN_b \times N_sP_s =$ the area $N_sN_bP_bP_s$. If indifference curves are parallel, the sum that would have to be paid to buyers to compensate them for the rise in price is NN_bP_bP: the corresponding sum for sellers is NPP_sN_s. The total payment required to compensate for the tax is $N_sN_bP_bPP_s$: this is greater than the total tax revenues by an amount equal to the area P_sP_bP. If now we introduce a correction for increasing *MRS*, PH_b and PH_s are the aggregate *MRS* curves for buyers and for sellers, and the total payment required to compensate for the tax is $N_sN_bH_bPH_s$. This is greater than the total tax revenues by an amount equal to the complex area of the polygon $P_sP_bH_bPH_s$. This area will not differ greatly from the area P_sP_bP.

Up to this point we have considered the concept of economic surplus only in relation to the pure market phenomenon in which there is no production or consumption, only transfers of money and commodity among the marketers. The application of the concept to long-run problems is beset with many difficulties, largely because it is impossible to treat such cases realistically without reference to uncertainty. A distinction can be made between those surpluses (or deficits) which are the results of uncertainty—*i.e.*, the result of the "disappointment"

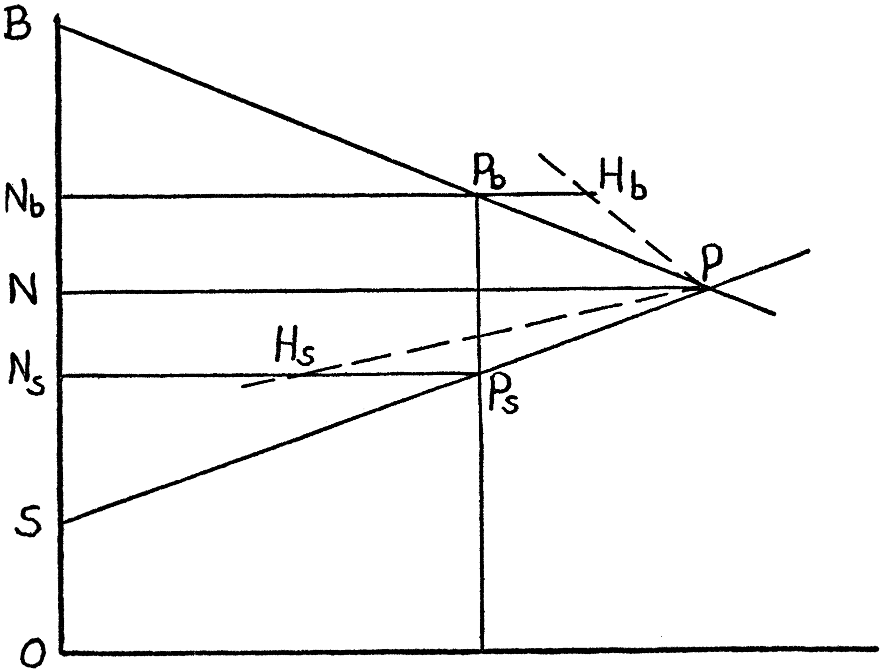

FIGURE 5

of expectations in a favorable or unfavorable direction—and those which are in some sense part of the permanent structure of economic life. This seems to be the basis for the Marshallian distinction between "true"—*i.e.*, permanent—rents and "quasi-rents." Marshall observed that a supply curve which was highly elastic in the long run might be quite inelastic in the short run. Hence for limited periods the rewards of a factor such as durable equipment might be much diminished, or even completely taken away, without affecting the output of its services. Such a reward has something of the nature of a surplus, or "rent." Because, however, the services of the factor would not be forthcoming indefinitely at low or zero rewards, Marshall called its return a "quasi-rent."

Quasi-rents, however, can exist only because the future is uncertain:

if, for instance, the potential owners of a durable good knew at the outset that the returns were going to be lower than the long-run supply price, the good would not be produced. Disappointment, therefore, is of the essence of a quasi-rent. What we know too little about, however, is the relation of a succession of disappointments to the long-run supply price itself. Long-run supply and demand curves are a useful cloak to cover up a vast complexity of inter-temporal relationships and, while they may enable us to perceive the broad shape of these complexities more clearly, they frequently hide the real dynamic structure of the system. Thus the application of the economic surplus concept to long-run demand and supply curves is beset with difficulties, and may not be very fruitful. The concept cannot be used, certainly, to justify the thesis of Marshall and Pigou regarding taxing industries of increasing supply price to subsidize industries of decreasing supply price—quite apart from the question of whether these categories are "empty boxes."

Nevertheless, as applied to a particular "industry" or sector of economic life, the concept has some meaning: in fact, several possible meanings. We may ask ourselves, "What is the greatest amount that could be extracted from this industry by price discrimination, without change in output?" Thus by price discrimination consumers could be forced to pay more for the present output, and producers could be forced to receive less. The economic surplus, in this sense, represents that theoretical maximum which the state might get out of an industry by discriminatory taxation, without affecting output. Another possible meaning of economic surplus in this case is the sum of money which would be just sufficient to compensate the individuals of society for the loss of the industry. These correspond to the two concepts already described. There is small likelihood, however, that these concepts will coincide, or that either of them can be measured by the area between the demand and supply curves.

The problem of applying the economic surplus concept to the economy as a whole is of the utmost importance, yet tantalizingly difficult. The "compensatory payment" concept here is quite meaningless: obviously no sum of money, or purchasing power, could compensate for the loss of the whole volume of production. The alternative concept, however, of the amount that might be extracted from the society without a diminution of output is of very great importance, for it represents that part of the total product which is "available"—either for redistribution, or for the extravagance of the state or for the pursuit of military power. For Marx, of course, the whole produce of society above the subsistence of the working class was "economic surplus" (*i.e.*, surplus-value); for by the labor theory of value the subsistence of the working class is all that is necessary to call forth the total product. Marx undoubtedly went too far in this, for the process of production is not merely a mechanical transformation of acts of labor into product, but is a subtle complex affected by innumerable institutional and psychological factors. How much can be expropriated from society without destroying productive activity depends a great deal on the manner of the expropriation. Thus the economic surplus of the whole economy is not a very clear concept. There are indications that in modern industrial society it may be very large, and the experience of the war shows what a great proportion of current output can be diverted to "unproductive" uses without any serious impairment of productivity.

The indifference curve analysis used earlier can throw some light on this problem. In Figure 6 we show, for an individual, indifference curves between money and a factor of production. We will suppose, to fix our ideas, that the factor is labor: then OR_o is the amount of labor at the person's disposal—say, 24 hours per day; R_oP_o is the amount of money in his possession at the beginning of the day; P_oP_1 is the opportunity line at zero wages (as we have drawn the indifference curve with a positive slope at P_o, indicating that in small quantities labor is positively pleasurable, the individual will give up an amount P_oP_1 of labor even at zero wage). P_oP_2, P_oP_3, etc., are the opportunity lines at successively higher hourly wage rates: the locus of their points of tangency with the indifference curves, $P_oP_1P_2$ . . . . is the total receipts curve, measured from the line P_oP_1. From this curve, the supply curve for labor can be derived just as the supply curve was derived in Figure 2. It will be observed that the curve is re-entrant: *i.e.,* above a certain wage, represented by the slope of P_oP_3, an increase in the wage results in a decline in the amount of labor offered. This is the familiar "backward sloping" supply of labor.

Suppose now that a flat-rate income tax is laid on the individual when his wage was equal to the slope of P_oP_4. The result of the tax is simply a reduction in the effective hourly wage: the opportunity line less tax falls to, say, P_oP_3. Because the supply is negatively elastic in this region, there is actually a rise in the amount of work done because of the tax, from R_oR_4 to R_oR_3. The gross income earned is then $S_3P'_4$: the total tax collected is $P_3P'_4$. If the tax were laid in a region where the supply was positively elastic, as between P_3 and P_2, it would cause a fall in the amount of work supplied.

Some interesting conclusions can now be drawn as to the theory of progressive or regressive taxation. A progressive tax is one where the proportion of income paid in taxes rises with rise in income. The opportunity line after tax therefore bends downwards—*i.e.,* its slope becomes less and less with increasing work done. Where the tax rate increases by "brackets" of income, the line will be a series of straight lines of diminishing slope. Thus P_0T represents the opportunity line

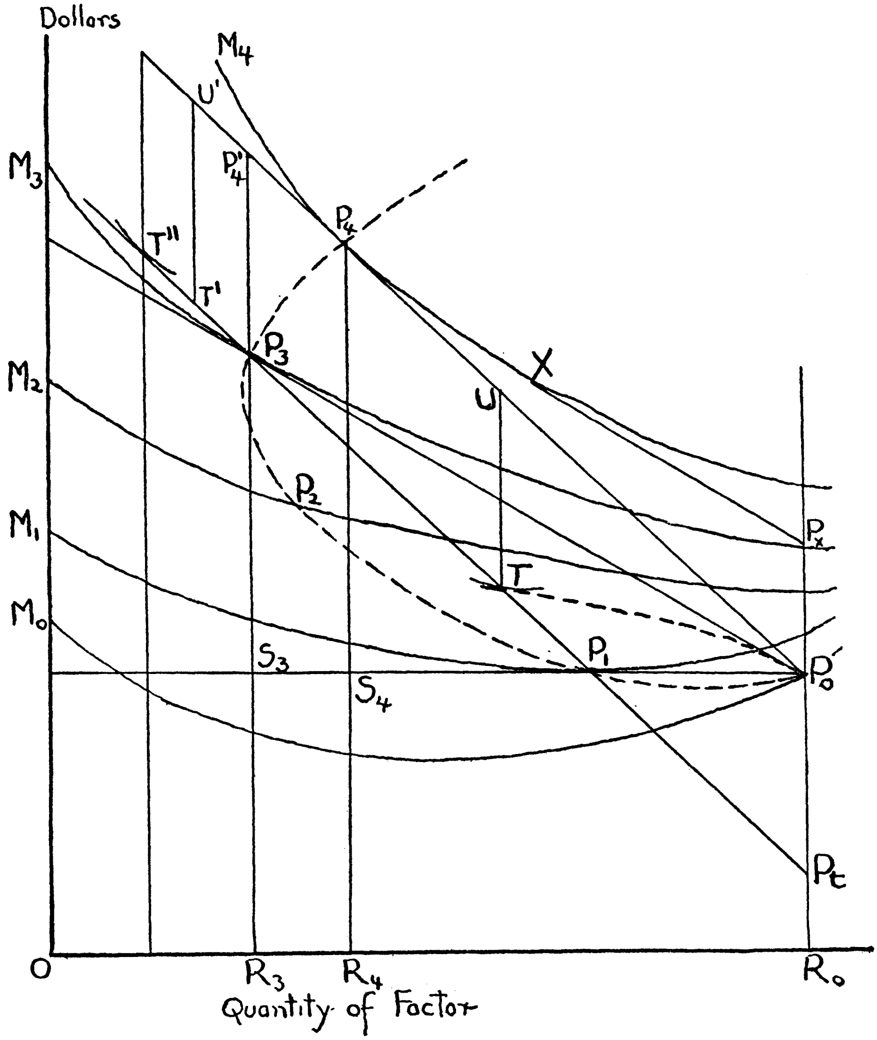

FIGURE 6

after a progressive tax is deducted from the income of P_0P_4. It touches an indifference curve at T, and has been drawn so that the total tax paid, TU, is equal to the tax paid under a flat rate tax, $P_3P'_4$. It will be seen that the effect of raising a given revenue from an individual by a progressive rather than a flat-rate tax is to lower the amount of work done, to lower net income after tax, and to make the individual relatively worse off, as may be seen by comparing the position at T with the position at P_3. Raising the same revenue by a regressive tax, on the other hand, results in an expansion of output and of income, and makes the individual relatively better off, as may be seen by comparing T' with P_3, T' being a point where a net opportunity line from P_0 after a regressive tax (not shown on figure) touches an indifference curve. A regressive tax has somewhat the same effect as "overtime" pay—*i.e.,* it increases the marginal return, and so spurs the individual to greater effort. It is interesting to note that an even better way of collecting a given amount of taxes from an individual is to assess him a lump sum which is independent of his income. His net opportunity line is then $P_tTT'T''$, which touches an indifference curve at T''—the highest indifference curve attainable to the individual, whose gross income opportunity is given by the line P_0P_4 and who has to pay a tax equal to P_0P_t.

It is interesting to note that, under the assumptions of Figure 6, the compensating payment would be less than the tax paid in all cases except that of the fixed tax. Thus under the proportionate tax discussed above, $P_3P'_4$ is the amount of tax paid. If now XP_x is drawn parallel to P_0P_3, touching the indifference curve M_4 at X, P_0P_x is the "compensating payment"—*i.e.,* is the lump sum which, if given to the taxpayer, would make him just as well off as he was before the tax. P_0P_x, under the conditions of Figure 6, is less than $P_3P'_4$. It must be observed that this conclusion depends on the assumption that the MRS increases with increase in the quantity of money. The backward-sloping supply curve also can only exist on this assumption.

Some conclusions for tax policy follow from this analysis. If there is no serious unemployment problem we can assume that the objective of policy is to increase production by all possible means. Then the deleterious effect of progressive taxes on the supply of factors must be taken into consideration. A desirable situation would be one in which taxation was progressive as between individuals, but regressive for each individual. The best system—if it were administratively possible—would be one in which each individual had to pay a lump sum tax based on his "wealth"—*i.e.,* on his earning *power*—but independent of his income—*i.e.,* independent of the degree to which he put his earning power to use. To some extent the property tax is of this nature; and, although one hesitates for political reasons to advocate extending the principle of the property tax to the property that we have in our minds and bodies, real economic benefits might follow.

In the presence of an intractable unemployment problem, however, it is by no means certain that a "property tax" would be even theoretically the most desirable. In such a condition we might wish to repress the labor supply rather than encourage it, and there might then be a case for diminishing the labor force through progressive taxation, even though this might seem a counsel of despair.

The moral of this analysis would seem to be that the concept of economic surplus, while it can be defined to have a good deal of meaning, is not a sufficiently accurate analytical tool for the solution of problems of policy. As an instrument for the analysis of welfare problems it is much inferior to the more general device of indifference curves. It is a concept capable of much ambiguity and, in hands that are not highly skilled, its use can easily lead to false or misleading results. Nevertheless, it is a useful expository device and has a long and interesting history. Even if it occupies a relatively subordinate place in modern economics compared with the central position it once occupied, it is by no means to be discarded. And the student who appreciates its full significance will understand a great deal about the problems which both the classical and the modern economics seek to solve.