90-F-15

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and Producers' Surplus

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June 1990 '

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The economics of Marshall was originally called the neo-classical economics, although recently many of us rather regard Walrasian tradition as neo-classical.[1] While it cannot be denied that Marshall's partial equilibrium analysis is an indispensable complement to Walras's general equilibrium analysis in forming the foundations of current mainstream economics, there is a danger that something originally Marshallian might be lost if we see it through Walrasian looking glass. A typical example is Marshall's proposal of taxes on decreasing return industries and bounties on increasing return industries, which is different even from similar proposal of Pigou, Marshall's successor in Cambridge.[2] While the latter was rightly criticized and correctly modified by later day economists, the former has not been properly interpreted so far. Perhaps, as we shall see below, one explanation of this might be that Marshall was concerned with long run stationary equilibria in which the role of producers' surplus is quite limited,[3] while neo-Walrasians are more interested in short run or temporary equilibria.

We start in section (2) with Samuelson's view of Marshall's proposal that the latter forgot to consider the producers' surplus. Section (3) is devoted to examine Marshall's concepts of producers' surplus and particular expenses curve. Marshall's tax proposal is vindicated in section (4) for a manufacturing industry of diminishing returns caused

by Marshallian external diseconomies, while his correct analysis of the case of agriculture is explained in section (5). Section (6) vindicates Marshall's proposal of bounties on industries of increasing returns due to Marshallian external economies. Finally, we consider in the last two sections the case of industries of increasing returns caused by internal economies which are compatible with competition.

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Let us start with Samuelson's view, which represents contemporary economists' interpretations and criticism of Marshall's proposals of taxes upon industries of diminishing returns and bounties upon those of increasing returns.

"Because Marshall (<u>Principles</u>, Book V, Ch. XIII, pp. 467 - 470) made an elementary mistake in his graphical reckoning of consumers' surplus, forgetting to take into account producers' surplus -- an odd omission for a chap who always insisted correctly that there are two blades in the scissors of supply and demand -- he came up with what seems like an exciting policy theorem: <u>Tax to contract increasing cost industries; subsidize to expand decreasing cost industries.</u>"[4]

Can you believe that Marshall was such a careless "chap" who forgot to consider changes in producers' surplus? Was he so stubborn to insist on such a "false theorem" (Samuelson (1972), p. 26) throughout so many editions of <u>Principles</u>? There must be some difference between what Marshall really meant and what later day economists believe Marshall did. It is true that in Figures 30 - 32 of <u>Principles</u>[5] Marshall merely compared changes in consumers' surplus with the receipts from a tax or

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the cost of a bounty and no consideration is given to changes in the producers' surplus, before he conclude that "these results throw light on the doctrine of <u>maximum satisfaction</u>," i.e., "the general doctrine that a position of (stable) equilibrium of demand and supply is a position also of <u>maximum satisfaction</u>" (Marshall (1961), I, p. 470).

For example, Figure 1 is a reproduction of a part of Marshall's Figure 31, where the level of output is measured horizontally, and the price and cost, vertically. Curve DD' is the demand curve for the industry, and curve SS' is the supply curve of the industry, which obeys the law of diminishing return. Suppose that the imposition of a tax raise SS' to ss' and the old equilibrium A is shifted to the new equilibrium a. The rate of tax is aE on each unit of the product and the gross receipts of the tax will be cFEa, since Oh, that is, CK units are produced in the new equilibrium. Marshall argued that, the loss of consumers' surplus being cCAa, the gross receipts from the tax will be greater or less than the loss of consumers' surplus as CFEK is greater or less than aKA. In the case of Figure 1, as in Marshall's Figure 31, it is much greater.

Even so, however, it is hardly possible to persuade those who knows the fundamental theorem of welfare economics that this implies the non-optimality of the competitive equilibrium A. If the production possibility set is strictly convex so that the supply curve is rising as is SS', there exists producers' surplus SAC, which is reduced by the imposition of the tax to SEF. The combined loss of consumers' and producers' surplus is, then, greater than the tax receipt by AaE. Why did Marshall not consider such a loss of producers' surplus and argued for taxes upon industries of diminishing returns?

As a matter of fact, Marshall clearly recognized the existence of producers' surplus and considered its significance very deliberately in his _Principles_. For example, see Appendix H in _Principles_, which is apparently attached to Book V, Chapter XIII, where Marshallian tax-bounty proposal is discussed. Figure 2 is the exact reproduction of Marshall's Figure 39 in Appendix H (Marshall (1961), I, P. 811). The area AFS is called producers' surplus by Marshall himself.

As in the case of Figure 1, the product of an industry is measured along Ox, and its price along Oy. The curve DD' is, of course, the demand curve for the industry. Thus, Figure 2 seems similar to Figure 1 and we are tempted to consider that the area ACS in Figure 1 corresponds to the area AFS in Figure 2. There is, however, a very important difference between two figures. While the curve SS' in Figure 1 is called the supply curve, SS' in Figure 2 is called by Marshall as the particular expenses curve.

"Now the difference between the particular expense curve and a normal supply curve lies in this, that in the former we do, and in the latter we do not, take the general economies of production as fixed and uniform throughout. The particular expenses curve is based throughout on the assumption that the aggregate production is OH, and that all the producers have access to the internal and external economies which belong to this scale of production; and, these assumption being carefully borne in mind, the curve may be used to represent a particular phase of any industry, whether agricultural or manufacturing: but they cannot be taken to represent its general conditions of production. That can be

done only by the normal supply curve, in which PM represents the normal

expenses of production of the OMth unit on the supposition that OM units

(not any other amounts, as OH) are being produced; and that the available

economies of production external and internal are those which belong to

a representative firm where the aggregate volume of production is OM"

(Marshall (1961), I, p. 811).

Marshall distinguished workers' surplus and savers' (waiters')

surplus, which are included in the area SAHO in Figure 2 as producers'

expenses, from "the excess of earning of an appliance of production over

the prime cost of its work" (Marshall (1961), I, pp. 830 - 832). The

latter surplus is, of course, due to the limited supply of such an

appliance used by producers. Since Marshall is concerned with a long-

run equilibrium, only where producers have full access to the external

economies, however, only the rent of land used by producers may be left

to be shown as the area AFS in Figure 2.

"All appliances of production, whether machinery, or factories with

the land on which they are built, or farms, are alike in yielding large

surpluses over the prime costs of particular acts of production to a

man who owns and works them: also in yielding him normally no special

surplus in the long run above what is required to remunerate him for his

trouble and sacrifice and outlay in purchasing and working them (no

special surplus, as contrasted with his general worker's and waiter's

surplus). But there is this difference between land and other agents

of production, that from a social point of view land yields a permanent

surplus, while perishable things made by man do not."[6]

Let us consider the case of a manufacturing industry, in which the effect of land used by producers is negligible. Suppose that there exist Marshallian external diseconomies and that cost curves of individual producers are raised by the general expansion of the industry as a whole. Then the industry is subject to diminishing returns to scale and the long run supply curve of the industry is upward sloping. To demonstrate this, it is convenient to work with the representative firm, which is a small replica or miniature of the industry and whose cost of production is a function of its level of output as well as the level of output of the industry.[7]

In Figure 3, both the output of the representative firm and the corresponding output of the industry are measured horizontally along Ox, with, of course, different scales, and costs and prices are measured vertically along Oy. Curves DD' and dd' are demand curves for the industry, and curve CC' is the supply curve of the industry in the long run. Curves SMC and SAC are, respectively, short run marginal cost curve and short run average cost curve of the representative firm. SMC plays also the role of the short run supply curve of the industry.

Suppose the demand curve is DD', which intersects with SS' at point A. Point A signifies the long run equilibrium of the industry with free entry. SAC curve of the representative firm, which corresponds to the industrial output OM, reaches the minimum at point A, so that point A is also on the curve SMC. Since "the normal supply price of any amount of that commodity may be taken to be its normal expenses of production (including gross earnings of management)" (Marshall (1961),

I, pp. 342 - 343), the representative firm is earning the normal profit included in the cost at point A, and the volume of the industrial output remains unchanged.[8]

"In a rigidly stationary state in which supply could be perfectly adjusted to demand in every particular, the normal expenses of production, the marginal expenses, and the average expenses (rent being counted in) would be one and the same thing, for long periods and for short" (Marshall (1961), I, p. 497).

If the demand curve is shifted to dd', the equilibrium is shifted first to point B, at which dd' intersects with SMC. Gradually, however, the cost curves of the representative firm are shifted upward by the external diseconomies caused by the expansion of industrial output due to the price being higher than the normal supply price at point B. The long run equilibrium is again established at point a. The rising supply curve SS' passes equilibrium points like A, a, etc. It is, however, different from particular expenses curve. If the level of industrial output is OH, the latter curve is a dotted horizontal line Ca.

If we interprete that the curve SS' in Figure 1, i.e., curve SS' in Marshall's Figure 31, is the curve SS' in Figure 3, then, the area SAC in Figure 1 is not the producers' surplus. Since the particular expenses curve corresponding the industrial output OH is the dotted line AC, there exists no producers' surplus in this case. Marshall did not forget "to take into account producers' surplus." He was right to point out the possibility that point A is not optimal, when the industry is subject to diminishing returns caused by external diseconomies like the congestion in the free use of specific natural resources or specific public factors of production.

It is necessary to make these free resources or public factors specific to the industry in question, since, as was pointed out by Sraffa, we assume "that the conditions of production and the demand for a commodity can be considered, in respect to small variations, as being practically independent, both in regard to each other and in relation to the supply and demand of all other commodities" (Sraffa, 1952, p. 184). In his famous criticism on Marshall, Sraffa concluded that "the imposing structure of diminishing returns is available only for the study of that minute class of commodities in the production of which the whole of a factor of production is employed" (Sraffa, 1952, p. 185). In the case of free resources or public factors, however, we are not sure whether such a class of commodities is minute or not.

If we consider the case of an agricultural industry, however, there is a possibility that the area SAC in Figure 1 represents producers' surplus which has to be taken into consideration. Suppose there are no Marshallian external economies or diseconomies, but the industry is subject to diminishing returns caused by the limited supply of lands adapted only for the use in this industry. Then, curve SS' in Figure 1 is the supply curve as well as the particular expenses curve, exclusive of rent for the owners of lands. The area SAC represents landlords' rent as producers' surplus.

As a matter of fact, Marshall considered this case in Figure 33 in his Principles, which is a reproduction of his Figure 31, a partial reproduction of which is our Figure 1. "SS' being the supply curve before the imposition of a tax, landlords' rent is represented by CSA. After the tax has been imposed and the supply curve raised to ss' the landlords' rent becomes the amount by which cOha, the total price got for Oh produce sold at the rate ha, exceeds the total tax cFEa, together with OhES the total expences of production, exclusive of rent, for Oh produce: that is, it becomes FSE. Thus the loss of landlords' rent is CFEA; and this added to cCAa the loss of consumers' surplus, makes up cFEAa, which exceeds the gross tax by aAE" (Marshall (1961), I, pp. 473 - 474).

Far from "forgetting to take into account producers' surplus," Marshall considered it deliberately when it is necessary to do so, and rightly pointed out an exception to his proposal of a tax upon industries of diminishing returns. But, why is this the only case in which Marshall

did take into account producers' surplus? In the long run surplus in the production accrue only to the primary factors of production, i.e., labor and land. Why, then, did Marshall consider only the landlords' rent?

Let us recall the basic assumption in the application of consumers' surplus analysis that the marginal utility of money is constant and identical for all the consumers. Here money represents all the goods which can be bought by money, except the product of the industry in question. Labor service is also represented by money, so that its marginal disutility (marginal utility of leisure) and its marginal productivity in other industries remain unchanged irrespective of the level of output in the industry in question. What remains to be considered as producers' surplus is, then, the rent for land which is assumed to have no direct utility and not to be used in other industries.

(6)

Marshall recommended a bounty on a commodity which obeys the law of increasing return. "A bounty on such a commodity causes so great a fall in its price to the consumer, that the consequent increase of consumers' surplus may exceed the total payments made by the State to the producers; and certainly will do so in case the law of increasing return acts at all sharply" (Marshall (1961), I, p. 469).

He demonstrated this by using Figure 32 in his Principles, which we partly reproduce here as Figure 4. As in the case of Figure 1, the output of the industry is measured along with Ox, and prices and cost, along with Oy. The position of the supply curve before the granting of

the bounty is ss' while the position after it is SS'. The increase of
consumers' surplus is cCAa, and the direct payments made by the State
under the bounty are represented by RCAT. In the case of Figure 4, the
former is larger than the latter (See Marshall (1961), I, pp. 469 - 470).

Again no explicit mention is made on producers' surplus and Marshall
emphasized "the fact that a fall in price due to improvements benefits
consumers without injuring producers." "The doctrine of maximum satisfaction
assumes that every fall in the price which producers receive for the
commodity, involves a corresponding loss to them; and this is not true
of a fall in price which results from improvements in industrial organization"
(Marshall (1961), I, p. 472).

Marshall can be vindicated by the consideration of an industry of
increasing returns caused by Marshallian external economies. Consider
the representative firm as in Figure 3. Suppose that the long run
equilibrium a is located below the long run equilibrium A, since cost
curves of individual firms are shifted downwards by the general expansion
of the industry. Then, the supply curve SS' which passes equilibrium
points like A, a, etc. is downward sloping as ss' curve in Figure 4.

Although the supply curve ss' is downward sloping in Figure 4, the
particular expenses curves are horizontal, since the representative firm
on the supply curve yields only the normal profit which is included in
the cost. If point a is a long run equilibrium, the particular expenses
curve is ac, since firms are enjoying external economies corresponding
to the industrial output Oh. If point T is an equilibrium, it is TR,
since firms are enjoying external economies corresponding to the industrial
output OH. There exists no producers' surplus to be taken into account,
and Marshall was right to point out the possibility that point a is not

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optimal when the industry is subject to increasing returns caused by

external economies.

<center>(7)</center>

In spite of Samuelson who argued that "it was a <u>competitive</u> decreasing

cost industry we were talking about, a contradiction in terms if the

increasing returns are <u>internal</u> to the firm. So Marshallians hasten to

say that it must be, of course, decreasing cost due to <u>external</u> economies

that was meant, and which ought to be subsidized" (Samuelson, 1972, p.

26), it is well known that Marshall insisted on a possibility of the

compatibility of increasing returns due to internal economies and competitive

equilibrium. It is based on his life-cycle theory of private firms.

Internal economies may not be fully exploited by an individual firm

since its life-span is limited. Like an individual tree in a forest, an

individual firm in an industry grows and decays, although the forest and

industry remain stationary.

"Rapid growth of firms in some trade which offer great economies to

production on a large scale ---- But long before this end [monopoly]

is reached, his [a new businessman's] progress is likely to be arrested

by the decay, if not of his faculties, yet of his liking for energetic

work."[9]

In Figure 5, where output is measured along Ox and prices and

costs, along Oy, the curve SAC is the short run average cost curve of a

firm with a plant of a given scale. SAC is shifted downward to the

right by investment and upward to the left by disinvestment. The dotted

curve LAC is the envelope of the short run average cost curves at different

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scales of the plant. Since the long run average cost curve LAC is downward sloping, there exist internal economies. According to the life-cycle theory of firms, a young firm's SAC is located below relative to the price of the product, but is shifted to the above as it gets older.

Young firms are expanding the scale of their plants, since the price is higher than SAC including the normal profit at the level of output where the short run marginal cost SMC is equal to the price of the product, while old firms are reducing the scale of their plants, since the price is lower than SAC at the level of output where SMC is equal to the price. The aggregate output of the industry remains, however, stationary and the representative firm is at equilibrium A in Figure 5, yielding just the normal profit.

To see this, let us denote SAC of a firm in short run equilibrium by x and the price of the product of the industry by p.[10] It is assumed that the rate of change in output caused by the changes in the scale of the plant is proportional to the difference between p and x. Let $y(x)$ be the total output of firms with the value of the same x. Furthermore, let $D(x)$ denote changes in y. Then,

(1) $\qquad D(x)/y(x) = p - x.$

Since the industrial output remains unchanged, i.e.,

(2) $\qquad \int y(x)dx = \text{constant},$

from (1),

(3) $\qquad \int D(x)dx = \int (p-x)y(x)dx = 0.$

From the right hand side of (3), we have

(4) $\qquad p = \int xf(x)dx$

where $f(x) = y(x)/\int y(x)dx.$

Since (4) implies that the value of the total sale of the industry is equal to its total cost including normal profit, the representative firm as the miniature of the industry is at A in Figure 5, yielding just the normal profit, when the expansion of young firms is balanced by the contraction of old firms. The expansion of young firms does not last long, since they soom become old and replaced by new firms. If ss' curve in Figure 4 is interpreted as SS' curve in Figure 5, Marshall was right to point out the possibility that point a is not optimal when the industry is subject to increasing returns caused by internal economies.

(8)

Although Marshall's life-cycle theory of firm gives a realistic picture of nineteenth-century industry, however, the question remains as to its relevancy after the great development of joint-stock companies. Marshall himself was well aware of this problem. "As with the growth of trees, so was it with the growth of business as a general rule before the great recent development of vast joint-stock companies, which often stagnate, but do not readily die. Now that rule is far from universal."[11]

To get rid of this difficulty, we may consider that a capital asset with embodied technology has a limited life, since wages rise as a result of technical progress, instead of Marshall's supposition that the life-span of an individual firm is limited. In other words, we may replace Marshall's theory of the life-cycle of a firm in a stationary equilibrium with a theory of the life-cycle of technology in a balanced growth equilibrium. While Marshall considered economic growth with both population and wealth growing proportionally as a "modification of the

fiction of a stationary state" (Marshall (1961), I, p. 368), we are going to consider the growth of physical wealth with technical progress and unchanged population. In view of the so-called stylized facts of economic growth that real wage and capital-labor ratio are rising while the relative shares of capital and labor remain unchanged,[12] however, it is evident which plan will "bring us nearer to real life and help to break up a complex problem" (Marshall (1961), I, p. 368).[13]

In Figure 5, let us suppose that SAC is the short run average cost curve of a plant of given scale composed of capital assets in which today's technology is embodied. Although its LAC is downward sloping and SAC can be shifted downward by enlarging the plant, the scale of the plant would remain limited, since SAC will be shifted upward in the future when real wage is raised by the dominance in the economy of newer capital assets embodied with more efficient technology of the future. Consider a competitive firm with several plants of different vintages. While the profit from new plants with new technology is much higher than the normal profit, profit from old plants with old technology falls short of the normal. At equilibrium, the firm's position is indicated by point A in Figure 5, yielding only the normal profit which is included in its SAC.

If the firm is the representative firm of the industry, and its SS' curve of Figure 5 is considered as curve ss' in Figure 4, we can vindicate Marshall's proposal of bounties on industries of increasing returns due to internal economies, without assuming that the life-span of an individual firm is limited.

It was often argued that "truly reversible decreasing cost industries associated with external economies are perhaps a _curiosum_" (Samuelson, 1972, p. 28) and that "those economies which are external from the point of view of the individual firm, but internal as regards the industry in its aggregate, constitute precisely the class which is most seldom to be met with" (Sraffa, 1952, p. 186). If so, we must admit that the only remaing case worth considering is the case of industries of increasing returns due to economies which are internal from the point of view of individual firms. Provided that this case is compatible with the competition, however, we need not admit "supply curves showing decreasing costs are not to be found more frequently than their opposite" (Sraffa, 1952, p. 186).

Footnotes

1) See Aspromourgos (1986), Spiegel (1983), p. 565, Leijonhufvud (1976) and Gide and Rist (1926), p. 616.

2) As for Pigou's proposal, see Feiwell (1987), p. 210 and Ellis and Fellner (1952).

3) Though otherwise confusing, Mishan (1968) is right in this respect. See Negishi (1989), pp. 355 - 363 for consumers' and producers' surplus in general.

4) See Samuelson (1972), p. 25. Originally, it is in p. 112, <u>Monopolistic Competition Theory: Studies in Impact</u>, ed., by R.E. Kuenne, John Wiley, 1967.

5) See Marshall (1961), I, pp. 467 - 469. Figures 30, 31 and 32 correspond, respectively, to the cases of constant returns, diminishing returns and increasing returns.

6) See Marshall (1961), I, p. 832. See also pp. 499, 501 - 502.

7) For the representative firm, see Frisch (1956), Negishi (1983) and (1989), pp. 352 - 354, 365 - 367.

8) Gross earnings of management is defined by Marshall as the sum of "the supply price of business ability and energy" and "the supply price of that organization by which the appropriate business ability and the requisite capital are brought together" (Marshall (1961), I, p. 313).

9) Marshall (1961), I, pp. 285 - 286. See also Marshall (1921), pp. 315 - 316.

10) For the details, see Negishi (1983) and (1989), p. 367.

11) Marshall (1961), I, p. 316. It was in the sixth edition of <u>Principles</u> (1910) that Marshall first added a reservation clause on joint-stock companies (Marshall (1961), II, p. 343). See also Marshall (1921), p. 316.

12) The stylized facts are originally due to Kaldor (1961). See Burmeister (1980), pp. 46, 291.

13) For the details of the following arguments, see Negishi (1984), (1985), pp. 45 - 56, and (1989) pp. 369 - 375.

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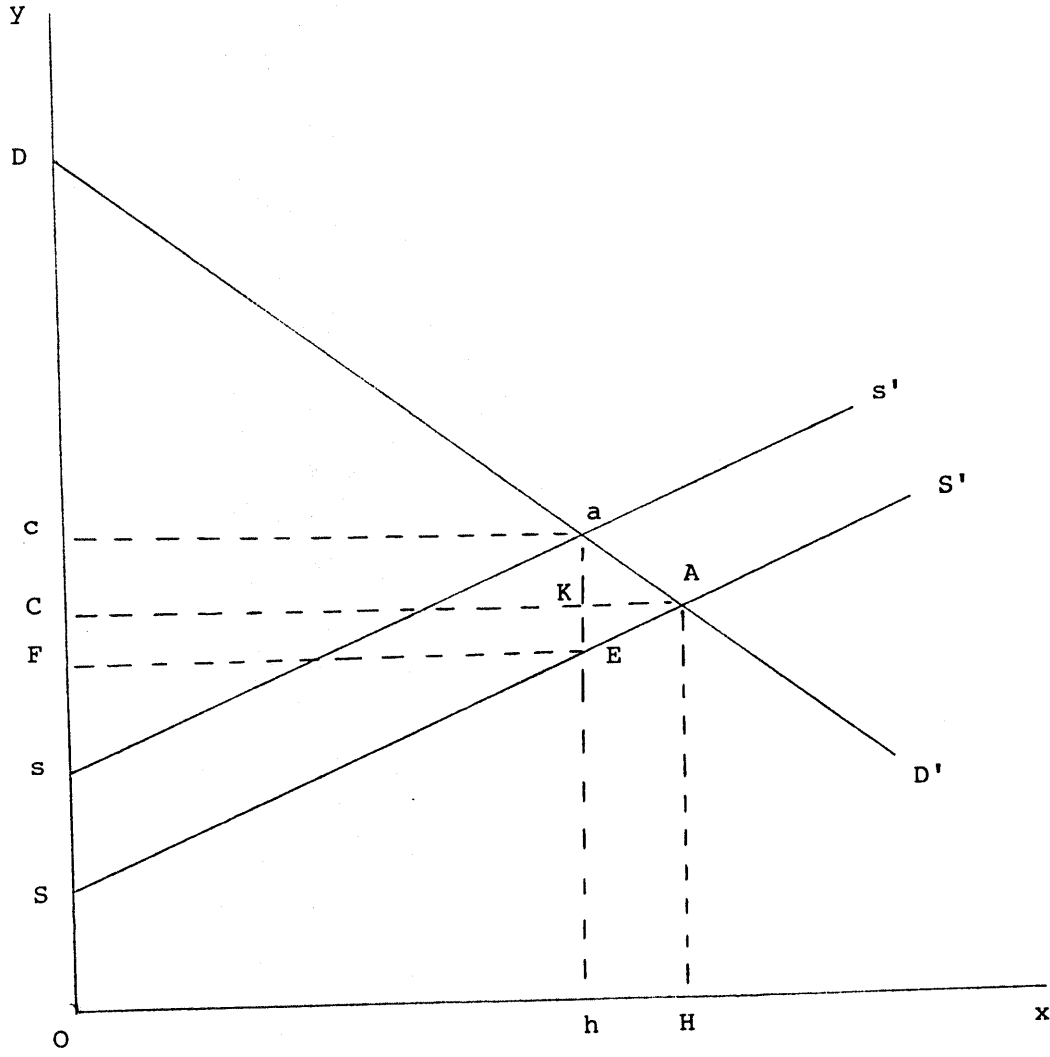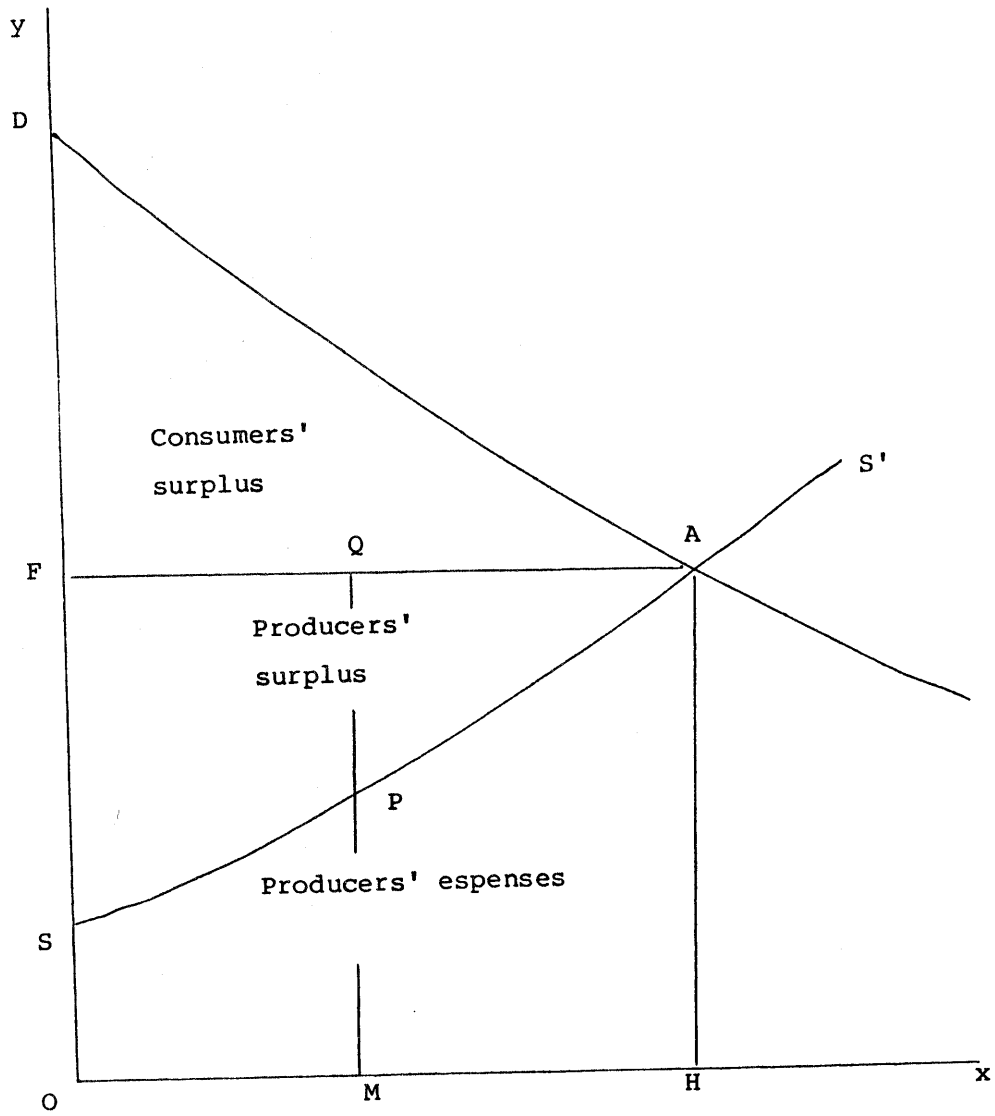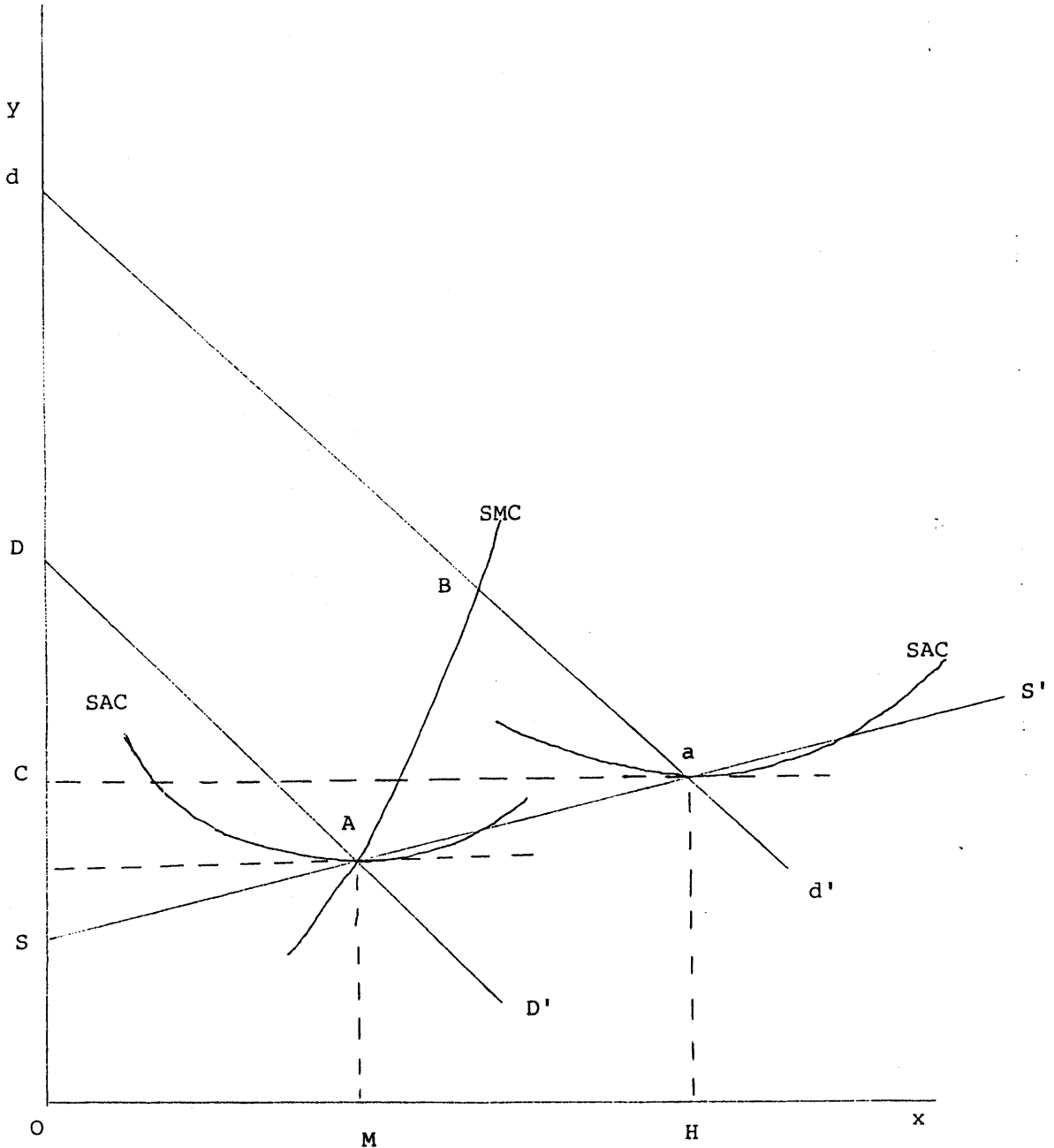
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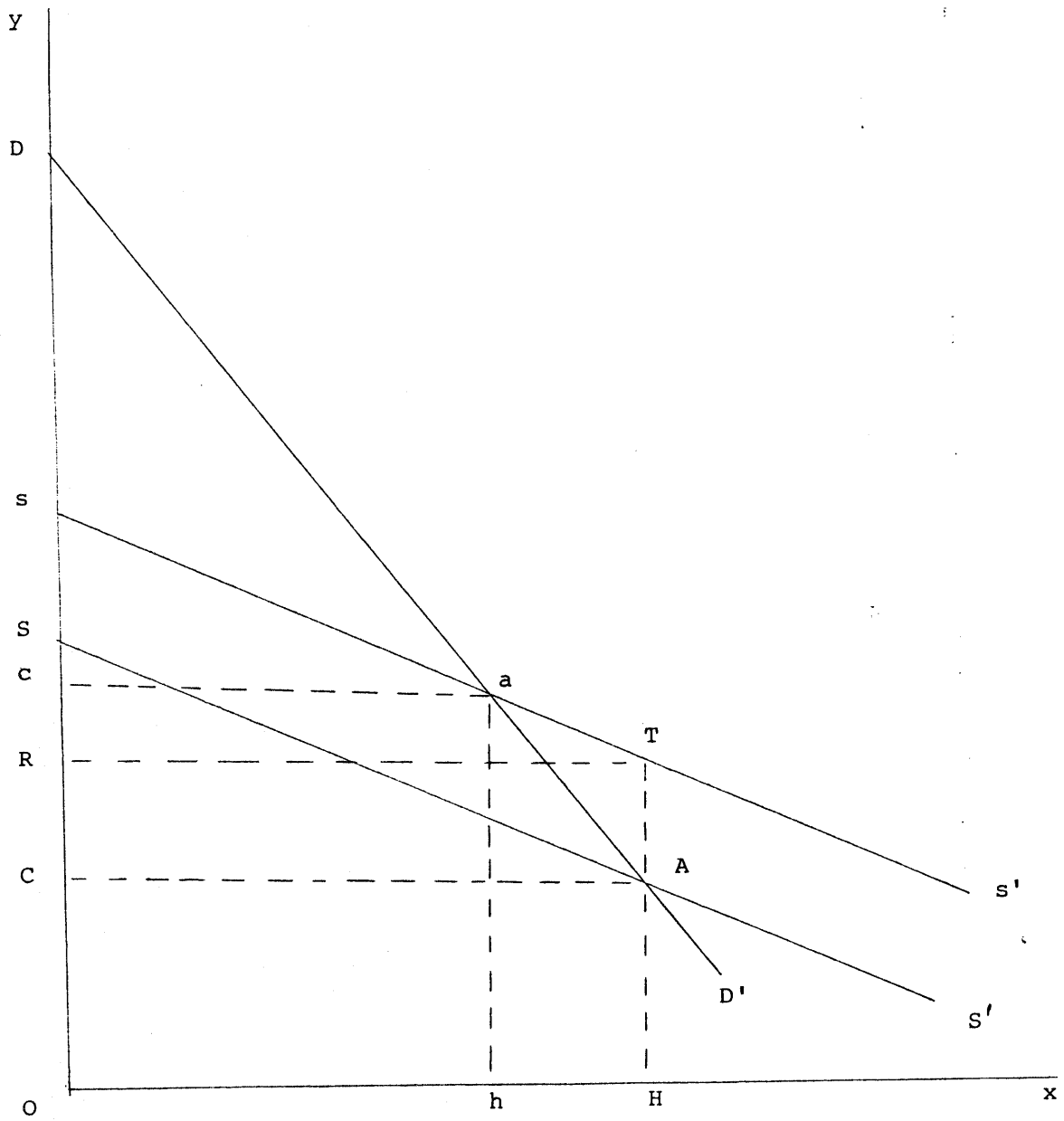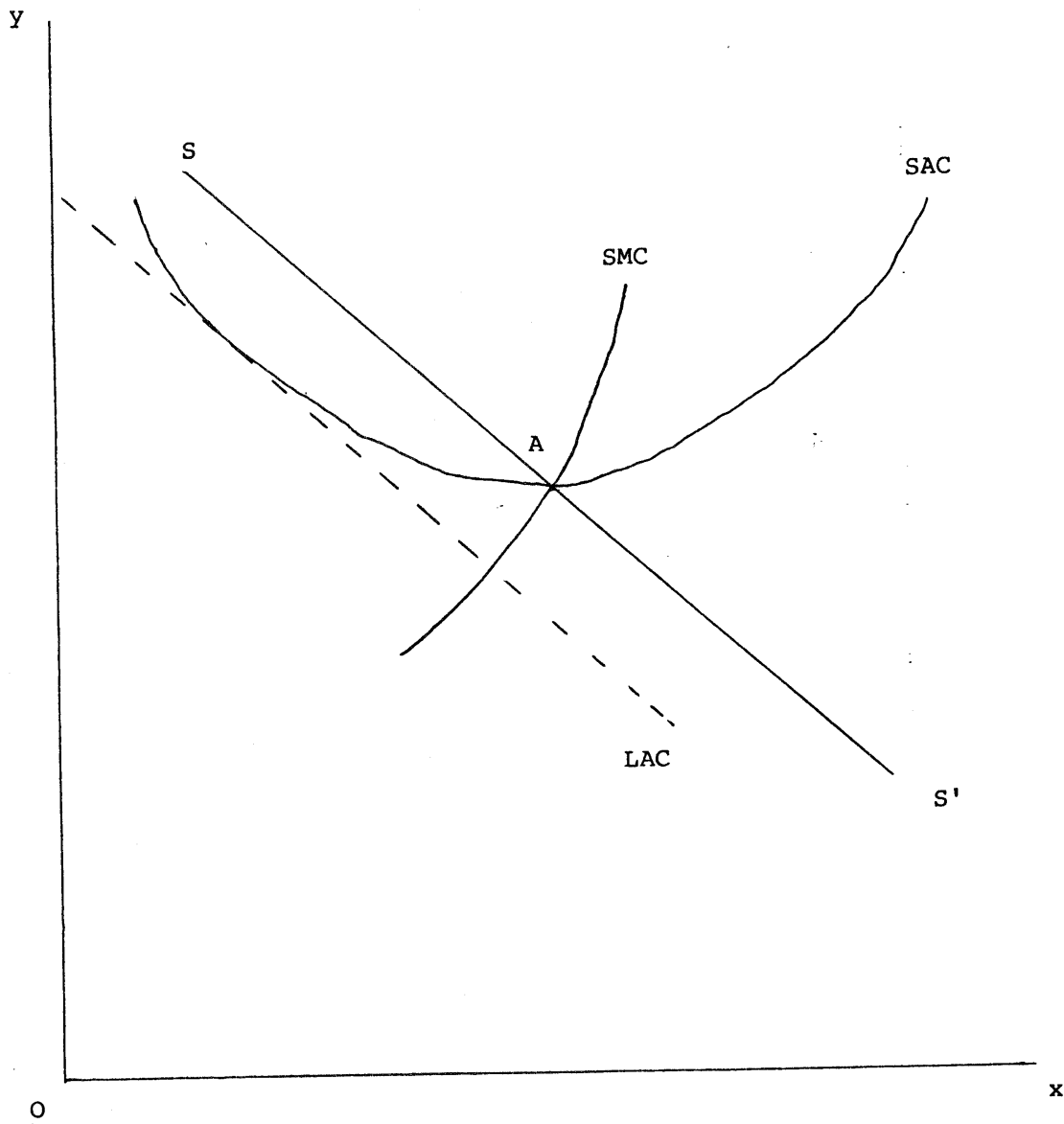
Figure 1

Figure 2

Figure 3

Figure 4

Figure 5