REDISTRIBUTIVE EFFECTS OF CORRECTIVE TAXES, SUBSIDIES, AND OTHER MEASURES

ABSTRACT

The effects on the distribution of income of various methods of correcting a resource misallocation are analysed. Methods discussed include a Tax, Subsidies, and combined tax-subsidy schemes. The magnitude and direction of income transfers associated with the different measures are quite varied. The cost of reducing redistributive effects would seem to be great administrative complexity, but it is shown that tax-subsidy schemes have quota-scheme analogues that are relatively simple to implement.

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The raising and spending of public funds typically give rise to small triangles of social loss or gain at the ends of large rectangles of transferred income. A major preoccupation of public finance theorists is how to raise or disburse a given amount of public funds in such a way as to minimize the size of the little triangles. In this article I look at the opposite problem: how to minimize - or otherwise modify - the large rectangles associated with a given set of little triangles. The problem will be examined in a specific context, viz. the use of taxes, subsidies, or other measures to correct a resource misallocation associated with an external diseconomy.

Assume that production or consumption of a good gives rise to an external diseconomy of constant amount per unit sold. In Figure 1 Ss is the supply curve of the good, representing its private marginal cost. $S's'$ is the social marginal cost. $S's'$ lies above Ss by the amount $ef = ad = bc$, the cost of the externality. In the absence of other divergences, OQ' is the socially optimal output, but if private production and/or consumption is unchecked, actual output will be OQ. Various measures - listed below - can be taken to correct the private output, so that it conforms to the social optimum. Some of these schemes will seem - and, indeed, some are - far-fetched. The reader is urged to suspend disbelief, however, since, as will be shown, some are administratively more feasible than they appear to be at first sight.

1. Levy a tax of ef on production of the good. This is the most obvious course of action.

2. Subsidize producers for not producing the good. Each producer's base-period output would need to be ascertained. A subsidy of bc per unit reduction in output below the base-period level would be paid. The effective supply curve would become $S'bcs$: producers would choose levels of output such that marginal cost plus subsidy forgone per unit equalled price.

3. Subsidize consumers for not consuming the good. In this case consumers' base-period purchases would have to be ascertained; and a subsidy cj paid per unit reduction in purchases. The demand curve would become $D'jcd$.

4. A combination of 1 and 2; i.e. both tax producers for producing and subsidize them for not producing the good. To bring about the requisite reduction in output, the sum of the tax per unit produced and the subsidy per unit not produced would have to equal ef. By proper choice of the rates of tax and subsidy the scheme could be made self-financing, with tax collections just equal to subsidy disbursements.
This would be achieved with a tax of $\frac{Q'Q}{OQ}(ef)$ per unit produced and a subsidy of $\frac{OQ'}{OQ}(ef)$ per unit reduction in output, and is illustrated in Figure 2.

5. A combination of 1 and 3; i.e. tax producers for producing the good and subsidize consumers for not consuming it. The scheme is identical to 4 except that consumers would receive the subsidy.

6. A combination of 2 and 3; i.e. subsidize producers not to produce and consumers not to consume the good. To bring output back to OQ', the sum of the two rates of subsidy would have to equal ef. If the consumer subsidy were eg and the producer subsidy gf, the equilibrium price would remain unchanged at Og.

7. A combination of 1, 2, and 3; i.e. tax the good and simultaneously subsidize reductions in both production and consumption. An appropriate correction to output would require that the sum of the tax rate and the two rates of subsidy equalled ef. These rates could be chosen so that the tax collections equalled the subsidy payments; also, so that the part of the tax borne by producers exactly offset the subsidy they received, and similarly for consumers. These desiderata would be met by a tax rate of $\frac{Q'Q}{OQ}(ef)$ (as in scheme 4), a subsidy of $\frac{OQ'}{OQ}(ge)$ per unit reduction in consumption, and a subsidy of $\frac{OQ'}{OQ}(fg)$ per unit reduction in production. This case is illustrated in Figure 3.

All of these schemes have the same 'real' effects: output is reduced from OQ to OQ'. As valued by consumers, this forgone output is worth $acQQ'$, while its costs of production that are saved are equal to $dcQQ'$. There is therefore a net loss of surplus equal to acd, of which ach is consumers' surplus and hcd producers' surplus. But externally-imposed costs equal to $abcd$ are also saved, leaving a net social benefit of abc. Where the schemes differ is in the magnitudes and the directions of the transfers among the government, producers, and consumers that accompany the 'real' changes. These income-redistributive effects of the various schemes are set out in the table.

Schemes 1, 2, 3, and 6 involve transfers between the government, on the one hand, and producers and consumers of the good, on the other. If the corrected output is more than half as large as the uncorrected output, the transfer to the government under scheme 1 (the tax collected, *eadf*) is greater than the transfer from the government (the subsidy *abcd*) to producers and/or consumers under schemes 2, 3, and 6.

Under scheme 1, the consumers' and producers' surpluses *eahg* and *ghdf* respectively are transferred to the government. With schemes 2 to 5, consumers' surplus is transferred to producers, or vice versa. With schemes 6 and 7, these surpluses remain undisturbed.

If the desired correction is small relative to total output, the schemes are listed in the table in rough descending order of the total amount of redistribution each entails - counting as redistribution any between-group transfer, but disregarding within-group transfers. I say 'rough', because the amount transferred depends on the relative magnitudes of the consumers' and producers' surpluses *eahg* and *ghdf* (which in turn depends on the relative slopes of the demand and supply curves) as well as on the relative sizes of the tax *eadf* and the subsidy *abcd*. (Consider, for example, the extreme cases of perfectly elastic demand or perfectly elastic supply. In the former *eagh* becomes zero and *ghdf* equals *eadf*, while the ranking of the measures in descending order of the amount transferred (assuming *eadf* > *abed*) becomes 3, 1=5, 2=6, 4=7; in the latter, *ghdf* disappears, *eagh* equals *eadf*, and the ranking becomes 2, 1=4, 3=6, 5=7). However, 4 will always entail a smaller transfer than 2, and 5 a smaller transfer than 3. With 7, there are no transfers at all.

INCOME-REDISTRIBUTIVE EFFECTS OF VARIOUS CORRECTIVE MEASURES

Corrective Measure	Net Effect of Measure on Income Of			Sum Trans-ferred	Transfer	
	Government *(G)*	Producers* *(P)*	Consumers** *(C)*		from	to
1. Tax of ef on output	$+ eadf$	$- ghdf$	$- eahg$	$eadf$	P,C	G
2. Subsidy of ef for reducing production	$- abcd$	$+ abcd$ $+ eahg$	$- eahg$	$abcd$ $+ eahg$	G,C	P
3. Subsidy of ef for reducing consumption	$- acjd$ $(= - abcd)$	$- ghdf$	$+ acjd$ $+ ghdf$	$abcd$ $+ ghdf$	G,P	C
4. Combination of 1 & 2: tax rate of $\frac{Q'Q}{OQ}(ef)$ subsidy rate of $\frac{OQ'}{OQ}(ef)$	-	$+ eahg$	$- eahg$	$eahg$	C	P
5. Combination of 1 & 3: Same tax and subsidy rates as in 4	-	$- ghdf$	$+ ghdf$	$ghdf$	P	C
6 Combination of 2 & 3: Subsidy of ge per unit reduction in consumption Subsidy of gf per unit reduction in production	$- abcd$	$+ \frac{gf}{ef}(abcd)$	$+ \frac{eg}{ef}(abcd)$	$abcd$	G	P,C
7. Combination of 1,2, & 3: tax rate of $\frac{Q'Q}{OQ}(ef)$ Subsidies of $\frac{OQ'}{OQ}(ge)$ and $\frac{OQ'}{OQ}(gf)$	-	-	-	-	-	-

* Omitting the item $- hcd$ in all cases

** Omitting the item $- ahc$ in all cases

A government strongly committed to allocative efficiency would presumably choose scheme 1 - a tax on output. Not only does the tax provide the necessary corrective to the industry concerned, but its proceeds could be used to reduce distorting taxes, or to apply corrective subsidies elsewhere in the economy. From this point of view, schemes 2, 3 and 6 would be least favoured, since, to raise the subsidies required, other distorting taxes would have to have increased, or other corrective subsidies reduced.

However, precisely because taxes and subsidies have the greatest potential for affecting allocative efficiency in the economy as a whole, they also have the greatest redistributive effects. These may be good or ill, as judged by decision makers. If they are thought to be adverse, then the allocative gains are partly, wholly, or more than wholly offset by the distributional costs, which may consist of the changed distribution per se, or of the costs of taking further measures to correct it. Some alternative scheme, with smaller, or different distributional consequences may be preferred, even if its allocative benefits are smaller and/or it is administratively more complex. Thus, despite their allocative costs elsewhere in the economy, subsidy schemes, like 2, 3, and 6, may be preferred to an output tax, if transfers to either consumers or producers (or both) are deemed to be desirable while transfers from either group are undesirable; or combined tax-subsidy schemes, like 4, 5, and 7, may be chosen because they bring about the desired allocative change with least disturbance to the existing distribution of income.

The cost of reducing redistributive effects would seem to be great administrative complexity. However, the combined tax-subsidy schemes have quota-scheme analogues which are relatively simple to implement. Consider,

first, a scheme for reducing output by issuing production quotas equal in aggregate to OQ', each producer receiving a quota of $\frac{OQ'}{OQ}$ times his base-period output, and the quotas being transferable among producers. With output restricted to OQ', consumers will bid the price up to $Q'a$. In the absence of transaction costs, competition among producers for the fixed supply of quotas would bid their unit annual rental value up to ad, the difference between the demand price and the minimum supply price of OQ' of the product. Quotas would be transferred from 'high-cost' to 'low-cost' producers, i.e. from those whose marginal costs remain relatively high, to those whose marginal costs fall rapidly, as their output is reduced. High-cost producers would thus be subsidized for making disproportionately large cuts in production, the subsidy being paid by those making disporportionately small reductions in output. This of course is the same pattern as would emerge under the tax-subsidy scheme 4; low-cost producers would pay net taxes, while high-cost producers would receive net subsidies.

The following argument shows that in the absence of transaction costs, the distributional impact among producers of the tax-subsidy scheme, and the transferable quota scheme, would be identical.

Consider the production represented by the segment dc of the supply curve. These $Q'Q$ units would cease to be produced under either the tax-subsidy scheme or the transferable quota scheme and their erstwhile producers would receive subsidy payments, or proceeds from the sale of their quota entitlement. Since the rate of subsidy is $\frac{OQ'}{OQ}(ef)$, and the output forgone is $Q'Q$, the total subsidy received would be $\frac{Q'Q.OQ'}{OQ}(ef)$. The quota entitlement with respect to these units would be $\frac{Q'Q.OQ'}{OQ}$, and the annual rent per unit of quota would be ef. Renting out of the quota entitle-

ment would thus yield producers the same revenue as they would receive under the tax-subsidy scheme. Similarly, the payments made by intra-marginal producers for quotas additional to their allotted quotas would be equal to their tax payments under the tax-subsidy scheme.

The outcome of scheme 5 could be obtained by means of a transferable buying quota scheme, analogous to the production quota scheme just described. To achieve the 'no transfer' outcome of scheme 7 is a little harder, but not so infeasible as it may seem. What would be required is the introduction of both the production and the consumption quota schemes just described, plus the fixing of the price at its initial level, *Og*. The production quota scheme would cause the supply curve, and the buying quota scheme the demand curve, to become perfectly inelastic at output *OQ'*. Price would then become indeterminate within the range *ad*, and hence could be fixed at any level within that range. Fixing it at *Og* would preserve the distributional status quo.

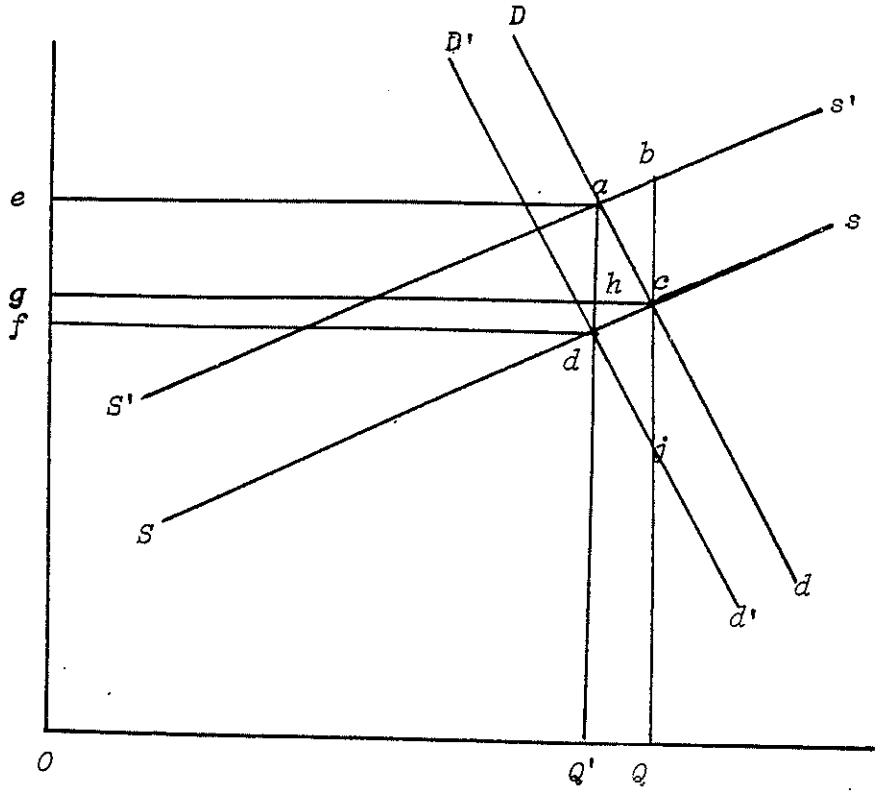

Figure 1.

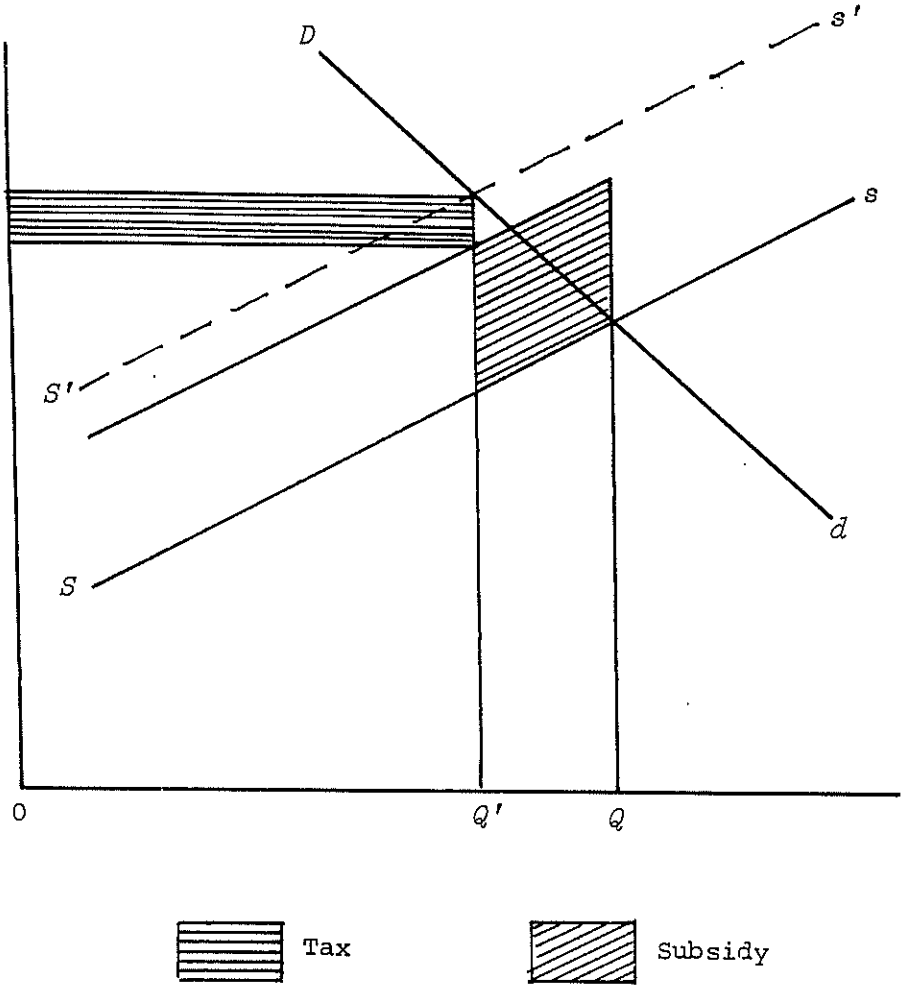

Figure 2.

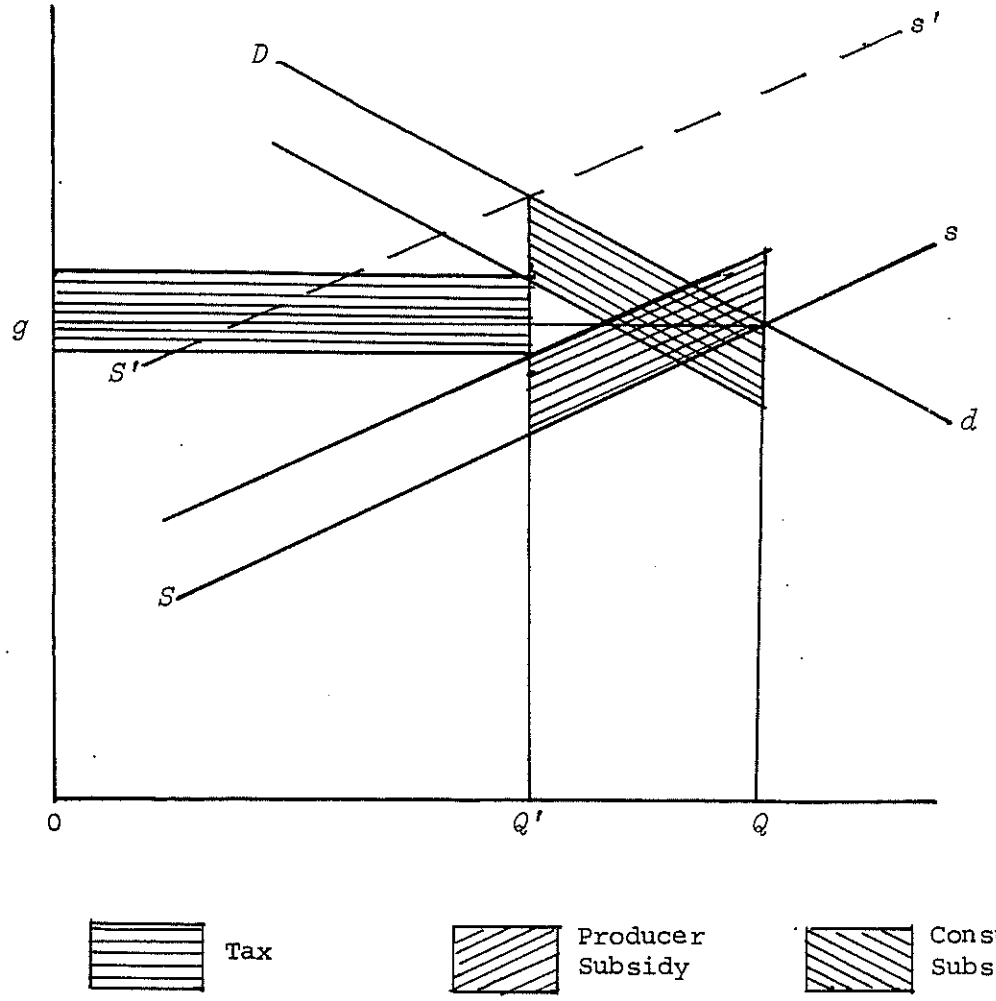

Figure 3.