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THE EXPENDITURE TAX AND PROGRESSIVITY

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ABSTRACT

Examples are provided to show that a progressive income tax can be more efficient than a progressive expenditure tax in the standard life-cycle model, even if consumption and leisure are separable in the utility function.

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I. Introduction

Given a simple life-cycle model with separability of leisure and consumption in the utility function, it is a standard proposition that a proportional expenditure tax is economically efficient relative to an equal-yield proportional tax on all income (e.g., Musgrave and Musgrave (1976, pp. 468-469); Atkinson and Stiglitz (1980, p. 442)). The reason is essentially that the income tax on interest drives a wedge between the borrowing and lending rate of interest and hence distorts an individual's intertemporal consumption decision. While this efficiency argument has generally been accepted, the expenditure tax has been criticized as inequitable, partly because of fears that the expenditure tax would be implemented on a flat rate basis, perhaps using a general sales or value-added tax. However proponents of the new base counter that there is no need for the tax to be flat rate and suggest that with a system of annual returns something like the current income tax system, annual expenditure could be straightforwardly calculated and taxed on a progressive basis (e.g., Feldstein, 1976a).

However, what has not been emphasized in policy discussions is that if, as is likely, a progressive expenditure tax is implemented on an annual rather than a lifetime basis, it too can cause intertemporal distortion if expenditure in different years falls in different brackets.[1] In addition, a progressive income tax may be less distortionary than a proportional one if interest receipts can be deferred to retirement when marginal tax rates may be low under a progressive system. The purpose of this note is to show that these effects can combine in the progressive case to reverse the standard result: it is possible that a progressive income tax can be more efficient than an equally progressive expenditure tax even if leisure is separable in the utility function. Section II illustrates the basic intuition using diagrams while Section III examines formally some simple theoretical examples. Section IV presents the conclusions.

II. A Diagrammatic Example

The following diagrams make the essential point in a heuristic fashion. Consider a single individual who lives two periods, receiving exogenous income Y in period 1 with utility a function in (only) C_1 and C_2, the consumption in each period, so that leisure is clearly separable. No bequests are made or received; for the purpose here no "overlapping-generations" features are required. The pre-tax interest rate r is exogenous,[2] either by a small-country assumption or because of technology. There is perfect certainty. The (tax-exclusive) price of the consumption good is one in both periods. The income tax and expenditure tax systems considered are progressive, with increasing marginal rates as income or per period expenditure increase respectively. It is assumed the same tax rules must be in place both periods.

In Figure 1, the possibility that a progressive income tax will dominate a progressive consumption tax is shown. OY is the individual's income before tax. It is assumed that the government must take revenue of present value AY from this individual, so the tax parameters of any system will be adjusted so that the individual's consumption bundle is on AB, the "equal-yield line" (which has slope $1+r$). In terms of efficiency, the first-best optimum for the consumer is therefore the point (not shown) where an indifference curve is tangent to AB. This may be attained, for example, if a proportional expenditure tax or a proportional interest-exempt income tax is used.

Given a progressive, interest-included income tax, however, the resulting consumption bundle will be X, which is a point on the equal yield line AB where an after-tax budget constraint (represented by CD)[3] is tangent to an indifference curve. The slope of CD at X is $1+r(1-t_X)$, where t_X is the marginal rate of tax on each dollar of interest income at point X.

The after-tax budget constraint under a progressive expenditure tax is given by curve EF. This is bowed out from the origin because with a progressive tax structure, as C_i increases, the marginal expenditure tax rate on C_i and hence the relative tax-inclusive price of C_i also rises ($i=1,2$). X^C is the point where such a budget constraint is tangent to an indifference curve on the equal yield line AB. In Figure 1, the case where X is preferred to X^C (and hence where the income tax dominates the expenditure tax) is shown.

It should be emphasized that for different indifference maps and tax parameters it would be possible for the expenditure tax to dominate. Intuitively, the result shown is more likely if the consumer has a strong preference for C_1 over C_2 (i.e., a high rate of discount).[4] As the consumption of C_1 increases, with a progressive expenditure tax, the marginal rate becomes greater and hence the distortion associated with the tax also increases. This reasoning suggests that it should also be possible that the income tax can dominate if C_2 is strongly preferred to C_1. Such a case is illustrated in Figure 2, which employs the same notation as above.

While the analysis so far illustrates the basic point, it has not been established that the two taxes compared in the diagrams are of equal progressivity. This is clearly impossible with such a one-individual diagram; instead a somewhat more formal algebraic example will be used in the following section.

III. An Algebraic Example

This section employs a given, simple progressive income tax structure as an example. In the above analysis, the utility levels of the two taxes were compared while holding tax revenue constant. Here it is more convenient to compare revenues with utility levels constant. Therefore it is assumed the progressive income tax is replaced with an equally simple expenditure tax such that no individual's utility is changed (and hence the new tax is exactly as progressive as the original). It will then be shown for the example that of the two taxes, the expenditure tax will generate less revenue and hence must be of lower economic efficiency.

This example is otherwise just as in Section II except the tax systems considered are of the specific form:

$$\text{Income Tax (both periods)} = T(Y') = 0 \quad \text{if} \quad Y' \leq Y$$
$$= t(Y' - \bar{Y}) \quad \text{if} \quad Y' > \bar{Y},\ t > 0 \tag{1}$$

$$\text{Expenditure Tax (both periods)} = T(C_i) = 0 \quad \text{if} \quad C_i \leq \bar{C}$$
$$= t^C(C_i - \bar{C}) \quad \text{if} \quad C_i > \bar{C},\ t^C > 0,\ i=1,2 \tag{2}$$

where $\bar{Y}$ and $\bar{C}$ are the exemption levels of the two systems, t and t^C are the tax rates and Y' is income including interest payments. Individuals have different incomes, but identical utility functions of Cobb-Douglas form:

$$U = C_1^{\alpha} C_2^{1-\alpha} \tag{3}$$

It is assumed that all individuals pay some tax, at least for one period; the progressive structures merely ensure they pay different average rates.

First consider the case where the parameters are such that under the income tax $rS < \bar{Y}$ where S is savings and under the expenditure tax $C_1 > \bar{C}$ but $C_2 < \bar{C}$. It is shown in the Appendix that in this case, the expenditure tax can be used to replace the income tax without changing the utility of any individual provided the tax parameters are such that

$$(1+t^C)^{-\alpha} = 1 - t$$
$$t^C\,\overline{C} = t\overline{Y}/(1-t) \tag{4}$$

The Appendix also shows that the income tax raises more revenue and hence must be more efficient. The Appendix also considers the case where again $rS < \overline{Y}$ under the income tax but now C_2 is preferred to C_1 enough so that $C_1 < \overline{C}$ but $C_2 > \overline{C}$. It is shown that again there are parameters such that the taxes are utility equivalent and again the income tax yields more revenue (in present value) and hence is more efficient.

It has been shown above that the progressive income tax is more efficient than its utility-equivalent counterpart provided $rS < \overline{Y}$ and either $C_1 > \overline{C} > C_2$ or $C_2 > \overline{C} > C_1$. To get some insight into this result, values of α and $\overline{Y}/Y$ where these conditions hold have been computed under the assumption $r = .5$ and $t = 1/3$ and are graphed in Figure 3 as shaded areas A and B. Considering the remaining areas, in regions E and F, $\overline{Y}$ is not great enough to exempt all interest income (i.e., $rS > \overline{Y}$) so the income tax is distorting (and as can be shown, necessarily more distorting than the expenditure tax). In all remaining areas where $rS < \overline{Y}$, the income tax is non-distorting (as interest is untaxed). In area G, inside the inverted "V" of the dashed lines, the income tax can be replaced with a utility-equivalent expenditure tax with both C_1 and C_2 above $\overline{C}$. With both C_1 and C_2 taxed equally on the margin, there is no efficiency loss also under the expenditure tax and the two taxes are equivalent.

For all the remaining combinations of α and $\overline{Y}/Y$ (areas A, B, C, and D), the progressive income tax is more efficient simply because with $rS < \overline{Y}$ the income tax is nondistortionary while with one of C_1 and C_2 less than or equal to $\bar{C}$, the marginal expenditure tax rates on C_1 and C_2 are different[5] and the expenditure tax has a deadweight loss. However, the clean utility-equivalence of the progressive income tax and the progressive expenditure tax over a range of incomes only occurs in the cases where either $C_1 > \bar{C} > C_2$ or $C_2 > \bar{C} > C_1$, represented respectively by areas A and B on Figure 3. (Areas C and D therefore correspond to corner solutions where either C_1 or C_2 equals $\bar{C}$.) It can be seen that as expected, the progressive expenditure tax tends to be inferior when α is either low or high and hence when either C_1 or C_2 is strongly preferred.

These calculations were redone by resetting t to .25 and .5 and r to .25 and 1. It seems sufficient to report that the areas where the progressive income tax dominates remain substantial in all cases. If r is increased the lower $rS > \bar{Y}$ boundary shifts upwards tending to reduce area B, although the vertical boundaries of both areas A and B move outward. For increases in t, the $rS > \bar{Y}$ boundary shifts downwards while the remaining boundaries of A and B shrink. However, in this latter case the area outside the inverted V actually increases, indicating an increase in the probability of a corner solution as the marginal tax rates increase.

The reader may have noted that despite the fact interest income is potentially taxable under the income tax, in fact the algebraic examples where the income tax dominates all have $rS < \bar{Y}$ so interest is untaxed and the income tax is nondistortionary. However as Figures 1 and 2 would suggest, this is just a consequence of the simplicity of the example. The essential points are (1) that progressivity can actually reduce the distortions associated with the income tax by reducing the marginal tax on interest and (2) that a progressive expenditure tax can cause substantial intertemporal distortion when individuals have a strong preference for either C_1 or C_2 and that this can in some cases outweigh the intertemporal distortion of the income tax. To show that the result here does not depend on r being completely untaxed under the income tax, one can imagine that $\bar{Y}$ and $\bar{C}$ are not exemptions, but upper limits of a lower tax bracket. It should be clear that at least if the marginal rates in this lower bracket are very small, examples where the progressive income tax is more efficient will still be available. To confirm this, a numerical example of this nature is given in the Appendix.

Finally note that a one-time tax based on the first-period present value of current and future expenditure has no distortion regardless of progressivity. This emphasizes that the administrative issues of tax-averaging or the possibility of a "cumulative" consumption tax are not peripheral, but in fact central to the policy implications of the expenditure tax.

IV. Conclusions

Given separability in leisure, a proportional expenditure tax is more efficient than a proportional income tax. But when comparing annual, progressive taxes, this result does not hold, as the examples in this note confirm. The progressive income tax may be more efficient than an equally progressive expenditure tax, at least when considering individuals who tend to have large differences in their consumption rates over time and hence could fall in different expenditure tax brackets in different years. If, for example, the measured consumption of some individuals falls substantially after retirement, this effect may be important and welfare analysis which assumes that a proportional income tax is replaced by a proportional expenditure tax (such as in Boskin (1978)) may tend to overestimate the gains for the progressive case.[6]

APPENDIX

Analysis for Cases where $rS < \overline{Y}$ Under Income Tax and $C_1 > \overline{C}$, $C_2 < \overline{C}$ Under Expenditure Tax

Assume incomes are on interval $(\overline{Y},\infty)$ and $rS < \overline{Y}$, where S is savings. Then under the income tax, the constrained optimization problem is to maximize the Lagrangian:

$$\mathcal{L} = C_1^{\alpha} C_2^{1-\alpha} + \lambda(Y - t(Y-\overline{Y}) - C_1 - C_2/(1+r))$$

which maximizing and solving yields

$$C_1 = \alpha(Y(1-t) + t\overline{Y})$$

$$C_2 = (1-\alpha)(1+r)(Y(1-t) + t\overline{Y})$$

so $$U = \alpha^{\alpha}(1-\alpha)^{1-\alpha}(1+r)^{1-\alpha}(Y(1-t) + t\overline{Y}) \qquad \text{(A1)}$$

Under the expenditure tax, if the parameters are such that $C_2 < \overline{C}$, the constrained optimization problem is to maximize the Lagrangian:

$$\mathcal{L}^C = C_1^{\alpha} C_2^{1-\alpha} + \lambda(Y - C_1 - t^C(C_1-\overline{C}) - C_2/(1+r))$$

which maximizing and solving yields:

$$C_1 = \alpha(Y + t^C \overline{C})/(1+t^C)$$

$$C_2 = (1-\alpha)(1+r)(Y + t^C \overline{C})$$

$$U^C = \alpha^{\alpha}(1-\alpha)^{1-\alpha}(1+r)^{1-\alpha}(1+t^C)^{-\alpha}(Y + t^C \overline{C}) \qquad \text{(A2)}$$

Equating U and U^C for all values of Y and solving yields

$$(1+t^C)^{-\alpha} = 1 - t$$

$$t^C \bar{C} = t\bar{Y}/(1-t) \qquad \text{(A3)}$$

Income tax revenues, R and consumption tax revenues, R^C are:

$$R = t(Y-\bar{Y})$$

$$R^C = t^C(C_1-\bar{C})$$

$$= t^C(\alpha(Y+t^C \bar{C})/(1+t^C) - \bar{C}) \qquad \text{(A4)}$$

The difference in revenues is:

$$R - R^C = t(Y-\bar{Y}) - \alpha t^C(Y+t^C \bar{C})/(1+t^C) + t^C \bar{C}$$

$$= (1 - (1+t^C)^{-\alpha})Y - t^C \bar{C}(1+t^C)^{-\alpha}$$

$$- \alpha t^C(Y+t^C \bar{C})/(1+t^C) + t^C \bar{C} \text{ using (A3)}$$

$$= [1 - (1+t^C)^{-\alpha} - \alpha t^C/(1+t^C)](Y+t^C \bar{C}) \qquad \text{(A5)}$$

which is positive for all $0 < \alpha < 1$

Analysis for Case Where $rS < \bar{Y}$ Under Income Tax and $C_1 < \bar{C}$, $C_2 > \bar{C}$ Under Expenditure Tax

Under income tax, constrained optimization is same as above. Under expenditure tax, $C_2 > \bar{C}$ so the Langrangian is:

$$\mathcal{L}^C = C_1^{\alpha} C_2^{1-\alpha} + \lambda(Y - C_1 - (C_2+t^C(C_2-\bar{C}))/(1+r))$$

so

$$C_1 = \alpha(Y+t^C \bar{C}/(1+r))$$

$$C_2 = (1-\alpha)(1+r)(Y+t^C \bar{C}/(1+r))/(1+t^C) \qquad \text{(A6)}$$

which when inserted into the utility function and equating with U in (A1) yields

$$(1+t^C)^{-(1-\alpha)} = 1 - t$$

$$t^C \bar{C} = (1+r)t\bar{Y}/(1-t) \quad \text{(A7)}$$

Now the difference in revenues (in present value) is:

$$R - R^C = t(Y-\bar{Y}) - t^C(C_2-\bar{C})/(1+r)$$

$$= [1 - (1+t^C)^{-(1-\alpha)} - (1-\alpha)t^C/(1+t^C)](Y + t^C \bar{C}/(1+r)) \quad \text{(A8)}$$

which like (A5) is positive for $0 < \alpha < 1$.

Numerical Example with Two Tax Brackets

Let $\alpha = .8$, $r = .5$, incomes range from 125 to 150 with tax system

$$\text{Income Tax} = \frac{1}{30} Y \quad \text{if } Y \leq 100$$

$$= \frac{1}{3}(Y - 100) + \frac{100}{30} \quad \text{if } Y > 100 \quad \text{(A9)}$$

If replaced by an expenditure tax of the form

$$\text{Expenditure Tax} = t_1^C C_i \quad \text{if } C_i \leq \bar{C}$$

$$= t_2^C(C_i-\bar{C}) + t_1^C \bar{C} \quad \text{if } C_i > \bar{C}, \quad i=1,2$$

no individual's utility will be changed if $t_1^C = .0112359$, $t_2^C = .66002$ and $\bar{C} = 69.360521$ but tax revenue will fall. This will be demonstrated for $Y = 125$ and $Y = 150$; it clearly will be true also for the interval between. Under income tax

$$C_1 = \alpha(Y(1-t_2) + (t_2 - t_1)\overline{Y})$$

$$= .8\ (125(2/3) + .3(100)) = 90.\dot{6}$$

$$C_2 = (1-\alpha)(1 + r(1-t_1))(Y(1-t_2) + (t_2 - t_1)\overline{Y})$$

$$= .2(1 + .5(1 - (1/30)))(125(2/3) + .3(100)) = 33.6\dot{2}$$

$$U = 74.350$$

$$\text{Present Value of Revenue} = t_1\overline{Y} + t_2(Y-\overline{Y}) + t_1 \cdot r \cdot S/(1+r)$$

$$= 100/30 + 25/3 + (1/30)(.5)(125 - 90.\dot{6} - 100/30 - 25/3)/1.5$$

$$= 11.919$$

Under Expenditure Tax

$$C_1 = \alpha(Y + (t_2^C - t_1^C)\overline{C})/(1+t_2^C)$$

$$= .8(125 + (.66002 - .0112359)69.360521)/1.66002$$

$$= 81.92627$$

$$C_2 = (1-\alpha)(1+r)(Y + (t_2^C - t_1^C)\overline{C})/1 + t_1^C$$

$$= .2(1.5)(125 + (.66002 - .0112359)69.360521)/1.0112359$$

$$= 50.43334$$

$U = 74.350$, as under income tax.

$$\text{Present Value of Revenue} = t_1^C\bar{C} + t_2^C(C_1-\bar{C}) + t_1^C C_2/(1+r)$$

$$= (.0112359)69.360521 + .66002(81.92672 - 69.360521) + (.0112359)(50.43334)/(1.5)$$

$$= 9.451$$

Revenue has fallen under expenditure tax. With Y = 150, a similar set of calculations indicates:

Under the income tax: $C_1 = 104$, $C_2 = 38.5\dot{6}$ U = 85.284 and Revenue = 20.289.

Under the expenditure tax: $C_1 = 93.974771$, $C_2 = 57.850003$, U = 85.284 and Revenue = 17.675.

This again shows the expenditure tax does not change utility but lowers revenue.

Footnotes

[1]This point has been noted by Ballentine (1981, footnote 7) and is implicit in Atkinson and Stiglitz (1980, p. 72) and Auerbach, Kotlikoff and Skinner (1983).

[2]This assumption only simplifies the analysis. Whalley (1979) provides a simple example where a particular kind of interest rate endogeneity makes the proportional income tax equivalent to the proportional expenditure tax.

[3]CD is curved due to progressivity: moving from C along CD towards D, savings increase so that interest income rises and the marginal tax on interest also rises causing the budget line to flatten.

[4]The result is also more likely if the budget constraint under the expenditure tax is highly curved, that is, if the tax system is very progressive.

[5]That is to say the marginal tax rates on the last units actually purchased were different.

[6]Auerbach, Kotlikoff and Skinner do estimate a welfare gain from switching from a progressive income tax to a progressive consumption tax using a computational general equilibrium model of the United States. However, they equate the progressivity of the taxes only very roughly (by equating top marginal rates) and assume individuals differ only by age.

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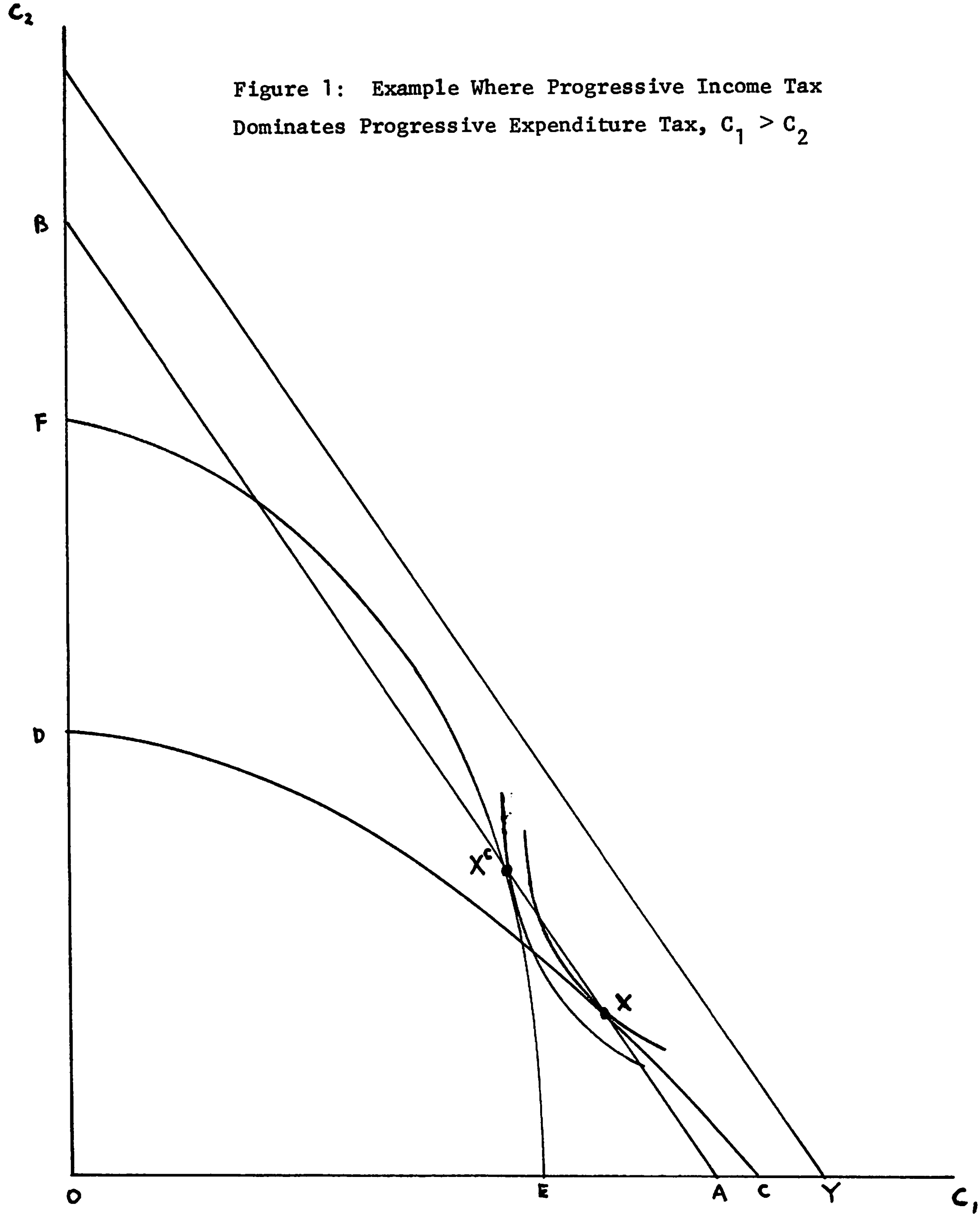
Figure 1: Example Where Progressive Income Tax Dominates Progressive Expenditure Tax, $C_1 > C_2$



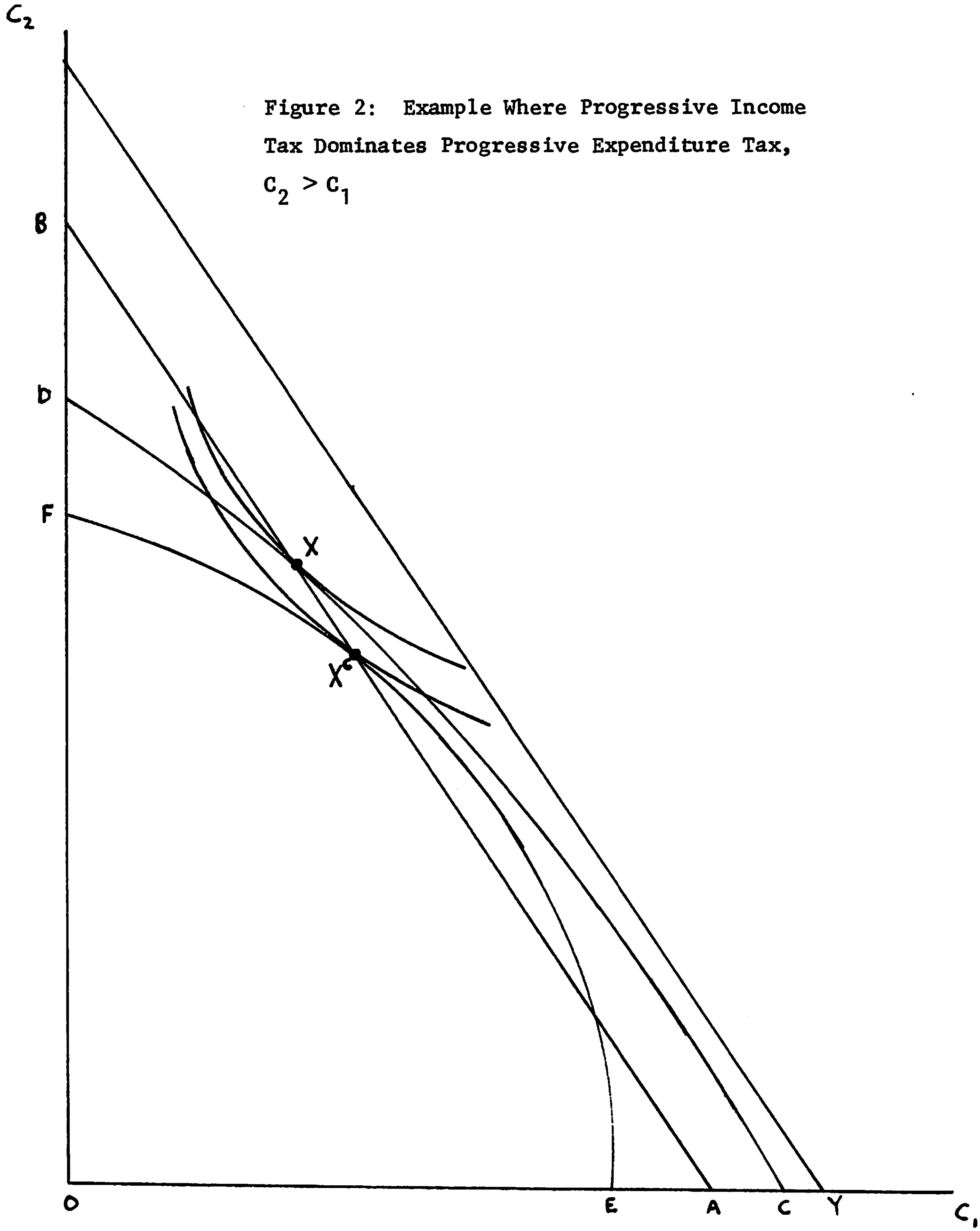
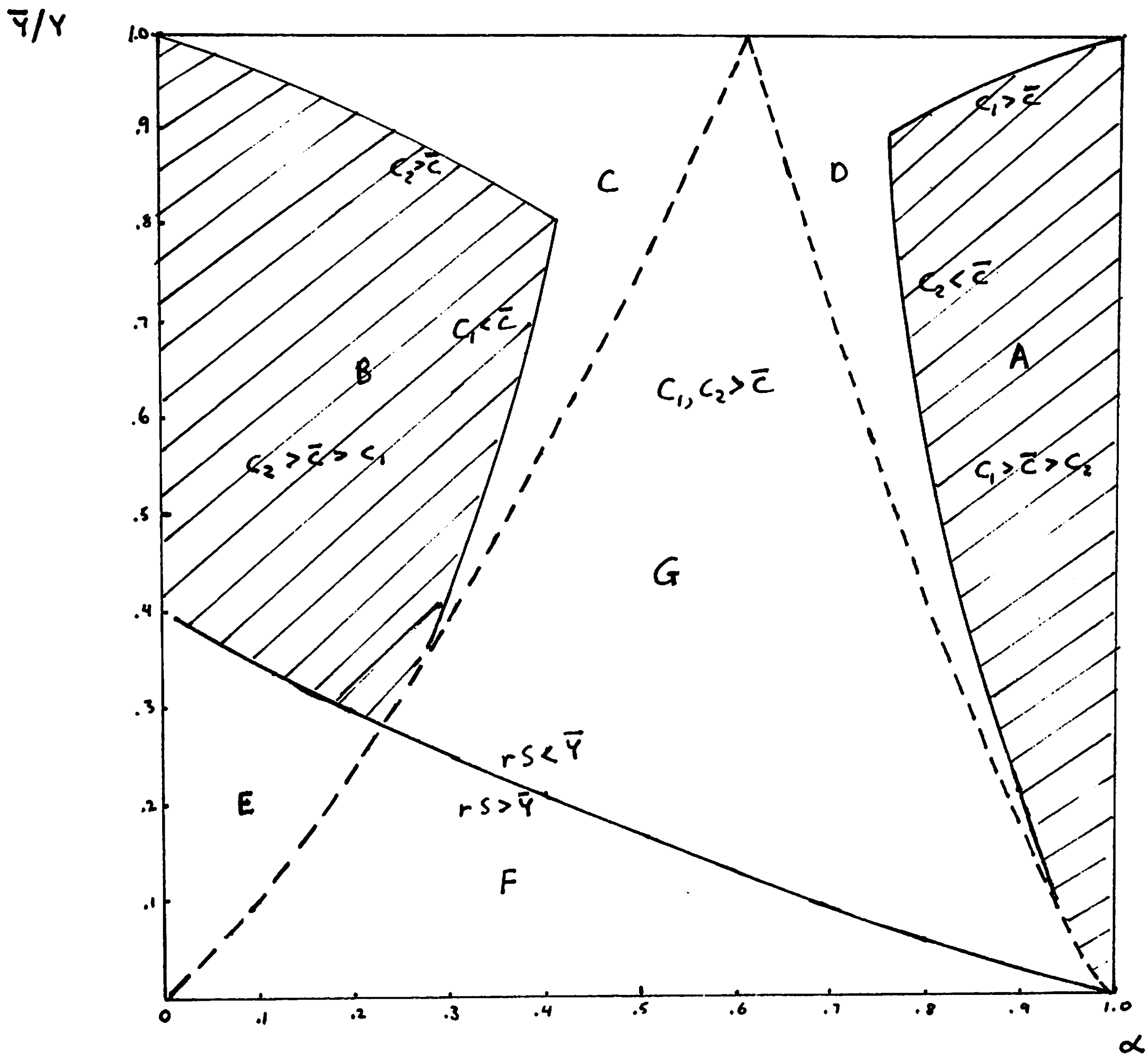


Figure 2: Example Where Progressive Income Tax Dominates Progressive Expenditure Tax, $C_2 > C_1$

Figure 3: Combinations of α and $\bar{Y}/Y$ Such that the Progressive Income Tax Dominates the Progressive Expenditure Tax, $t = 1/3$, $r = .5$



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