ON CHOICE BETWEEN EXPENDITURE TAX AND TAXES ON CONSUMPTION AND CAPITAL GOODS

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NO. 10/88 NOVEMBER 1988

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Abstract

Using a two-period, two-commodity model, formulae for optimal rates of taxes under two revenue-neutral tax regimes - (a) Expenditure tax and (b) Taxes on capital and consumption goods - are derived. Under the two tax regimes considered, it is found that at optimum the implicit rate of tax on the capital good is higher than that on the consumption good. Also, the implicit rate of tax on the capital good under one tax regime is different from that under the other regime.

On Choice Between Expenditure Tax and Taxes on Consumption and Capital Goods

M N Murty

1. Introduction

The problem of substituting a direct tax on consumption expenditure (or an expenditure tax, as originally conceived by Kaldor, 1957 with commodity taxes (indirect taxes) is as important a problem in many developing countries today as is the problem of substituting expenditure tax with income taxes (direct taxes) in the developed world. Ever since the pioneering work of Kaldor (1957) there has been a lot of lively debate (US Treasury, 1977; Feldstein, 1978; Bradford, 1980; Fullerton, Shoven and Whalley, 1983) about the relative effects of expenditure and income taxes on various fiscal objectives like resource mobilisation, growth and equity. In contrast, little attention has been paid to the problem of substituting an expenditure tax with commodity taxes in spite of its importance in the current developing world. For instance, expressing his view on memoranda on tax reforms submitted to the Royal Commission on Taxation of Profits and Income (appointed in 1950) by Commission's Sub-Committee of Economists, Lord Butler, the then Chancellor of Exchequer said,

> "With the level of indirect taxation which we have now reached, and the extent to which the expenditure of those whose expenditure is not confined to necessaries include a large element of payment of tax, it seems to me that it would be impossible to carry through the examination of a scheme of taxation on expenditure without also examining on fairly fundamental lines the scope and purposes of indirect taxation." (Kaldor, 1957, p.7)

Lord Butler's view on the expenditure tax vis-a-vis indirect taxation in Britain during the early fifties seems to be more relevant for designing tax reforms in many developing economies (Murty, 1987). For example, in a developing country like India 80 per cent of tax revenue comes from commodity taxation while direct taxes are major sources of revenue to government in many developed countries. The problem of having a uniform tax on all consumption goods (which can be interpreted as proportional tax on consumption expenditure) in relation to differential commodity taxation is examined in detail with the help of static optimal commodity tax models.[1] It is established that for certain types of utility functions for households (especially with weak separability between leisure and consumption goods), uniform commodity taxation is optimum. However, in most of these models indirect taxes on capital goods are not considered. Households may save part of their income and spend it in acquiring capital goods in the current period which guarantee them certain amounts of consumption goods in future even if they do not earn any type of income in future, including wage income. In this case, a uniform tax on consumption goods means a uniform tax on current and future consumption expenditures while differential commodity taxation implies different rates of taxes on consumption goods and capital goods.

In this paper, we consider two alternative revenue-neutral tax regimes: (a) A direct tax on present and future consumption expenditures and (b) Taxes on consumption and capital goods using a simple two period - two commodity model. We derive formulae for optimal rates of taxes and comment on the relative rates of taxes on consumption and capital goods. The plan of the remaining paper is as follows: Section 2 presents a model of expenditure tax while Section 3 deals with the problem of taxes on capital and consumption goods. Conclusions are indicated in Section 4.

2. The Model of Expenditure Tax

Let us consider a representative individual in the economy who earns wage income and spends it in acquiring a consumption good and a capital good in the current period. The individual has no wage income in the future. The consumption good he purchases in future depends upon the amount of capital good he purchases in the current period as explained by the production functional relationship

$$X_{11} = F\,(X_{20}) \qquad (1)$$

$$F'\,(X_{20}) = \frac{\delta F}{\delta X_{20}} > 0, \quad F''\,(X_{20}) = \frac{\delta^2 F}{\delta\, X_{20}^{\;2}} < 0$$

where

X_{20} : Capital good purchased by the individual in the current period, and

X_{11} : Consumption good purchased by the individual in the future.

The individual has the following utility function

$$U\ (X_{10},\ X_{11},\ L) \tag{2}$$

where

X_{10} : Consumption good purchased by the individual in the current period.

L : Current period labour supply of the individual.

$$U_1 = \frac{\delta U}{\delta X_{11}} \geq 0,\ U_2 = \frac{\delta U}{\delta X_{20}} = \frac{\delta U}{\delta X_{11}} \ \frac{\delta X_{11}}{\delta X_{20}} \geq 0,\ U_L = \frac{\delta U}{\delta L} \geq 0$$

If P_1 and P_2 are respectively producer prices of consumption and capital goods, the consumer's budget without the tax situation is defined as

$$P_1\ X_{10} + P_2\ X_{20} = wL \tag{3}$$

where w is the wage rate.

Taking consumption good as numeraire if there is a tax on consumption expenditure at the rate `e', the individual's budget constraint becomes

$$(1+e)\ X_{10} + (1+e)\ \frac{X_{11}}{1+r} = wL \tag{4}$$

where r is the rate of time preference. The government's revenue constraint is defined as

$$e\ X_{10} + \frac{e\ X_{11}}{1+r} = R \tag{5}$$

Using (4) we can alternatively write (5) as

$$wL - X_{10} - \frac{X_{11}}{1+r} = R \tag{5'}$$

Given (1), (2) and (4), the first order conditions for the individual's utility maximisation are given as

$$U_1 = \alpha\,(1+e) \tag{6}$$

$$U_2 = \frac{\alpha\,(1+e)\,F'\,(X_{20})}{1+r}$$

$$U_L = -\alpha\,w$$

where α is the marginal utility of money income. The individual's budget constraint (4) can be alternatively written as

$$(1+e)\,X_{10} + (1+e)\,\frac{F'\,X_{20}}{(1+\eta)(1+r)} = wL \tag{7}$$

where η is the elasticity of average productivity of capital good[2] with respect to capital good itself.[2] Using (6), (7) can be written as

$$U_1\,X_{10} + \frac{U_2\,X_{20}}{1+\eta} + U_L\,L = 0 \tag{8}$$

The problem now is to find out the rate of tax on consumption expenditures X_{10} and X_{11} that maximises U subject to the constraints defined by (5') and (8). This can be accomplished by maximising the following Lagrangian with respect to X_{10}, X_{20} and L.

$$\mathcal{L} = U + \lambda\left[wL - X_{10} - \frac{X_{11}}{1+r} - R\right] + \mu\left[U_1\,X_{10} + \frac{U_2\,X_{20}}{1+\eta} + U_L\,L\right] \tag{9}$$

Assuming that η is constant, the first order conditions for the maximum of ϕ are

$$U_1 - \lambda + \mu[U_{11} X_{10} + U_1 + \frac{U_{21} X_{20}}{1 + \eta} + U_{L1} L] = 0 \tag{10}$$

$$U_2 - \frac{\lambda F'}{1+r} + \mu[U_{12} X_{10} + \frac{U_{22} X_{20}}{1+ \eta} + \frac{U_2}{1+ \eta} + U_{L2} L]=0 \tag{11}$$

$$U_L + \lambda w + \mu[U_{1L} X_{10} + \frac{U_{2L} X_{20}}{1 + \eta} + U_{LL} L + U_L] = 0 \tag{12}$$

Writing

$$H^1 = - \frac{U_{11} X_{10} + \frac{U_{21} X_{20}}{1 + \eta} + U_{L1} L}{U_1}$$

$$H^2 = - \frac{U_{12} X_{10} + \frac{U_{22} X_{20}}{1 + \eta} + U_{L2} L}{U_2}$$

$$H^L = - \frac{U_{1L} X_{10} + \frac{U_{2L} X_{20}}{1 + \eta} + U_{LL} L}{U_L}$$

and substituting (6) in (10), (11) and (12) we have

$$e = \frac{(\lambda - \alpha)(1-H^L) - (\lambda - \alpha)(1-H^1)}{\alpha (1-H^L) + (\lambda - \alpha)(1-H^1)} \tag{13}$$

or equivalently

$$e = \frac{(\lambda - \alpha)(1-H^L) - \dfrac{(\lambda - \alpha)(1-H^2 - \eta H^2)}{1+\eta}}{\alpha(1-H^L) + \dfrac{(\lambda - \alpha)(1-H^2 - \eta H^2)}{1+\eta}} \tag{14}$$

Therefore at optimum, the expenditure tax should be such that

$$1-H^1 = \frac{1-H^2 - \eta H^2}{1+\eta} \tag{15}$$

Alternatively

$$\frac{H^1 - H^2}{1-(H^1-H^2)} = \eta \tag{15'}$$

Equations (13) and (14) are implicit functions since H^1, H^2 and H^L also depend upon e. Also, the optimum rate of expenditure tax should be such that H^1 and H^2 satisfy the equation (15).

Proposition 1

A direct tax on present and future consumption expenditures implies at optimum a tax on capital good which is higher than the uniform rate of tax on present and future consumption expenditures.

Proof: At optimum, the producer price of the capital good is

$$\frac{F'}{1+r} = s \geq 1$$

with the assumption $F' \geq 1 + r$. With the tax on present and future consumption expenditures, the implicit consumer price of the capital good at optimum is

$$\hat{P} = (1 + e)\, s \tag{16}$$

Therefore the implicit tax on the capital good at optimum is

$$\hat{t}_2 = (1 + e)\ s - s = e\ s \tag{17}$$

$$\text{Given } s \geq 1 \text{ we have } \hat{t}_2 \geq e \tag{18}$$

Q E D

3. Taxes on Consumption and Capital Goods

Let there be equal revenue raising commodity taxes as compared to an expenditure tax at the rates t_1 and t_2 respectively on consumption and capital goods. Then the consumer's budget constraint becomes

$$(1+t_1)\ X_{10} + t_2\ X_{20} + \frac{(1+t_1)\ X_{11}}{1 + r} = wL \tag{19}$$

and the government's revenue constraint is

$$t_1\ X_{10} + t_2\ X_{20} + \frac{t_1\ X_{11}}{1 + r} = R \tag{20}$$

From (19) we can alternatively write (20) as

$$wL - X_{10} - \frac{X_{11}}{1+r} = R \tag{20'}$$

Utility maximising conditions for the consumer are

$$U_1 = \alpha(1 + t_1) \tag{21}$$

$$U_2 = \alpha\left(t_2 + \frac{(1 + t_1)\ F'}{1 + r}\right)$$

$$U_L = -\alpha w$$

Using (21) we can write (19)[4] as

$$U_1 X_{10} + \frac{U_2 + \alpha\eta t_2}{(1 + \eta)} X_{20} + U_L L = 0 \quad (22)$$

The optimal rates of taxes on consumption and capital goods are determined by maximising the following Lagrangian with respect to X_{10}, L and X_{20}.

$$\phi = U + \lambda[wL - X_{10} - \frac{X_{11}}{1+r} - R] + \mu[U_1 X_{10} + \frac{U_2 + \alpha\eta t_2}{1+\eta} X_{20} + U_L L] \quad (23)$$

$$U_1 - \lambda + \mu[U_{11} X_{10} + U_1 + \frac{U_{21} X_{20}}{1+\eta} + U_{L1} L] = 0 \quad (24)$$

$$U_2 - \frac{\lambda F'}{1+r} + \mu[U_{12} X_{10} + \frac{U_{22} X_{20} + U_2}{1+\eta} + U_{L2} L] = 0 \quad (25)$$

$$U_L + \lambda w + \mu[U_{1L} X_{10} + \frac{U_{2L} X_{20}}{1+\eta} + U_{LL} L + U_L] = 0 \quad (26)$$

Writing

$$H^1 = - \frac{U_{11} X_{10} + \frac{U_{21} X_{20}}{1+\eta} + U_{L1} L}{U_1}.$$

$$H^2 = - \frac{U_{12} X_{10} + \dfrac{U_{22} X_{20}}{1 + \eta} + U_{L2} F' L}{U_2}$$

$$H^L = - \frac{U_{1L} X_{10} + \dfrac{U_{2L} X_{20}}{1 + \eta} + U_{LL} L}{U_L}$$

we have

$$t_1 = \frac{(\lambda - \alpha)(1 - H^L) - (\lambda - \alpha)(1 - H^1)}{\alpha(1 - H^L) + (\lambda - \alpha)(1 - H^1)} \tag{27}$$

$$t_2 = \frac{s \{\lambda (1 - H^L) - (1 + t_1) [\alpha(1 - H^L) - \dfrac{(\lambda - \alpha)(1 - (1 + \eta) H^2)}{(1 + \eta)}]\}}{\alpha(1 - H^1) + (\lambda - \alpha)\left(\dfrac{1 - (1 + \eta) H^2}{(1 + \eta)}\right)} \tag{28}$$

Equations (27) and (28) are implicit functions in t_1 and t_2 for H^1, H^2 and H^L also depend on t_1 and t_2. Nevertheless, they describe the relationship between taxes and the demand system parameters for consumption and capital goods at optimum.

Proposition 2

Differential taxes on consumption and capital goods imply at optimum a tax on capital good higher than that on consumption good.

Proof: At optimum, the producer price of capital good is

$$\frac{F'}{1+r} = s \geq 1$$

With the taxes on consumption and capital goods, the implicit purchaser price of capital good at optimum is given by (20) as

$$\hat{P}_2 = t_2 + (1+t_1)\ s \tag{29}$$

Therefore, the implicit tax on capital good is given as

$$\hat{t}_2 = \hat{p}_2 - s = t_2 + t_1\ s \tag{30}$$

Also given $s \geq 1$, we have $t_1\ s \geq t_1$

Therefore we have

$$\hat{t}_2 = t_2 + t_1\ s \geq t_1 \tag{31}$$

Q E D.

Proposition 3

At optimum, the implicit rate of tax on the capital good with respect to differential commodity taxation can be different from the implicit rate with respect to a direct tax on present and future consumption expenditures.

Proof: From (17) and (30) we have implicit rates of taxes on capital good with respect to expenditure and commodity taxes as $e\ s$ and $t_2 + t_1\ s$.

From the equations (13), (14), (27) and (28) we can write

$$e\ s \gtreqless t_2 + t_1\ s \tag{32}$$

Q E D

Proposition 4

If supply of labour is completely inelastic, the optimal tax on capital good is zero.

Proof: If supply of labour is completely inelastic ($H^L \rightarrow \infty$) we have from (27) and (28)

$$t_1 = \frac{\lambda - \alpha}{\alpha} \tag{33}$$

$$t_2 = \frac{s(\lambda - (1+t_1)\alpha)}{\alpha} \tag{34}$$

substituting (33) in (34) we have

$$t_2 = 0$$

QED.

This result in turn implies that optimal tax on savings out of current income that are used to buy a capital good is zero. The optimal tax is a proportional tax on consumption expenditure (current and future). A similar result is obtained by Atkinson and Stiglitz (1972) using a model in which an individual lives for n periods, consume s X_i in period i and supplies labour L in period 1. They found that sufficient condition for the consumption tax to be optimal is that there be weak separability between consumption and leisure. Our result is comparable to their result because the assumption of completely inelastic supply of labour implies the separability between leisure and other consumption goods.

Proposition 5

If supply of labour is perfectly elastic we have inverse elasticity rule for optimal commodity taxation.

Proof: If cross price effects are zero, we have

$$H^1 = -\frac{U_{11}\, X_{10}}{U_1} \quad \text{and} \quad H^2 = \frac{-U_{22}\, X_{20}}{1+\eta} \Big| U_2 \tag{36}$$

From (21) we have

$$U_{11}\frac{\delta X_{10}}{\delta t_1} = \alpha, \quad U_{22}\frac{\delta X_2}{\delta t_2} = \alpha \tag{37}$$

Using (37) in (36) we have

$$H^1 = -\frac{1}{e_{11}} \quad \text{and} \quad H^2 = -\frac{1}{e_{22}} \tag{38}$$

where e_{11} and e_{22} are own price elasticities of demands for X_{10} and X_{20}.

In addition, if supply of labour is perfectly elastic ($H^L \to 0$), we can write (27) and (28) as

$$t_1 = \frac{1 \,|\, |e_{11}|}{\alpha/(\lambda-\alpha) + (1 - {}^1/|e_{11}|)} \tag{39}$$

$$t_2 = \frac{s\{(1+\eta)\lambda \,|\, (\lambda-\alpha) - (1+t_1)[(1+\eta)/(\lambda-\alpha) - (1-1 \,|\, |e_{22}|)]\}}{\alpha(1+\eta)/(\lambda-\alpha) + (1 - {}^1/|e_{22}|)} \tag{40}$$

4. Conclusions

We have derived the formulae for optimal tax rates under the two tax regimes considered. These formulae are implicit functional relationships in tax rates, and demand and production function parameters that should hold good at optimum.

We have shown that

(a) A direct tax on present and future consumption expenditures implies at optimum a tax on capital good which is higher than the uniform rate on consumption expenditures.

(b) Differential taxes on consumption and capital goods also imply at optimum a tax on capital good higher than the tax on consumption good and

(c) At optimum, the implicit rate of tax on the capital good with respect to differential commodity taxation can be different from the implicit rate with respect to a direct tax on consumpiton expenditure.

(d) If the supply of labour is completely inelastic, the optimal rate of tax on capital good is zero. We have only tax on consumption good purchased in present and future.

Notes

1. Stern (1987) for example provides a review of literature on this subject. See also Atkinson and Stiglitz (1977).

2. We have $\frac{F'}{1+\eta} = \frac{X_{11}}{X_{20}}$ and therefore $X_{11} = \frac{F'}{1+\eta} X_{20}$.

3. η is assumed to be constant for the sake of simplifying derivations.

4. We have

$$t_2 X_{20} + \frac{(1+t_1) X_{11}}{1 + r} = t_2 X_{20} + \frac{(1+t_1) F'}{(1+r)(1+\eta)} X_{20}$$

$$= [t_2 + \frac{(1+t) F'}{1+r} + \eta t_2] X_{20} / 1 + \eta$$

$$= \frac{U_2 + \alpha\eta t_2}{\alpha (1 + \eta)}$$

REFERENCES

Atkinson, A.B. and J.E. Stiglitz (1972). "The Stucture of Indirect Taxation and Economic Efficiency", Journal of Public Economics, 01, 97-119.

Atkinson, A.B. and J.E. Stiglitz (1980). Lectures on Public Economics, McGraw Hill, New York.

Bradford, D. (1980). `The Case for Personal Consumption Tax´ in J.A. Pechman, ed., What Should be Taxed: Income or Expenditure? Brookings Institutions, Washington, DC.

Feldstein, M. (1978). "The Welfare Cost of Capital Income Taxation", Journal of Political Economy, 86, 529-551.

Fullerton, D., J.B. Shoven and J. Whalley (1983). `Replacing the US Income Tax with a Progressive Consumption Tax: A Sequential General Equilibrium Approach´, Journal of Public Economics, 20, 3-23.

Kaldor, N. (1957). An Expenditure Tax, Allen and Unwin, London.

Murty, M.N. (1987). `Horizontal Equity and Choice between Income and Expenditure Taxes´, Economic and Political Weekly, 12, March 21, 1987, 501-506.

Stern, N.H. (1987). "Uniformity Versus Selectivity in Tax Structure: Lesson from Theory and Policy", Working Paper No. 9, Department of Economics Research Programme, London School of Economics, UK.

U.S. Treasury (1977). Blueprints for Basic Tax Reform, Office of Tax Analysis, US Treasury, Washington, DC.

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