Marginal Effective Tax Rates And Tax Incentive Structure Evaluation: The Case Of Greece

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ABSTRACT

In addition to the neoclassical theory of investment choice, another way of evaluating a tax incentive structure is through the use of marginal effective tax rates. An attempt is made at present to provide estimates of these rates for Greece, and the research concentrates mainly to the calculation of marginal 'effective corporate tax rates' (i.e. only corporate taxes are considered) while the construction of indices extends to the two categories of capital goods, equipment, and buildings. The theoretical background for constructing these indices is given, with special emphasis attributed to neutrality in the designing of efficient taxation systems. The research showed that the Greek tax incentive system is depressing marginal investments, while it is additionally found that there was a more favorable tax treatment of manufacturing investment in equipment than that of buildings. No attempt on recent formulations of the Greek incentive system was made to provide measures (as for example a net investment credit) that could produce some degree of tax neutrality.

Keywords: tax incentives; investment; marginal tax rates

INTRODUCTION

The performance of a tax incentive structure has been studied in the past through the use of the neoclassical theory of optimum capital accumulation. Key feature in this theory has been the user cost determinant (c) where tax parameters (like depreciation allowances, tax credits, investment grants, investment allowances and the like) are entered in its calculations and then variations in c could further indicate the effect of tax provisions, originally on c , and then on desired capital stock and thus on the amount of net investment. The study though of an incentive structure on marginal investments can be made possible with the use of a specific tax index which has been used extensively over the past years in various studies¹ and which is also used here. This is the 'marginal effective tax rate'. This rate is in fact a summary of the fiscal regime which combines all the relevant components of the tax system into a single parameter. The intention of the present article is to provide estimates of the above tax rate and then use these estimates to examine the Greek corporate tax structure (Section 5 below). The construction of marginal effective tax rates related to planned investment need a theory to justify their derivation. In this theoretical context (Section 3) special importance is attributed to neutrality (Section 4) in the designing of efficient taxation systems. Problems though involved in defining and constructing the above rate have to be given first (Section 2). These problems should be known in the first place so that results indicated by these rates could accordingly be interpreted.

PROBLEMS AND LIMITATIONS IN CONSTRUCTING THE INDEX

Although the study can be much more detailed in the calculation of the relevant tax rate, at present only specific taxes will be considered in order to provide an evaluation of the tax system. It should be noted that in addition to corporate taxes on marginal investment (as the present study will deal with) one could also include the effect of property and personal taxes in the calculation of the effective tax rates; the various combinations derived from the consideration of different forms of industries, different asset categories and various sources of finance can

also provide an extensive and detailed range of relevant rates. It is obvious that such a detailed exposition requires also very detailed data. The present study evaluates marginal 'effective corporate tax rates' (i.e. only corporate taxes are considered) and the calculation of marginal tax rates extends to the two categories of capital goods, equipment and buildings.

Taxation systems impose a variety of taxes that affect most activities of economic life either at the corporate or household level. Taxation for example can affect the work effort of individuals, labour supply, consumer demand, household savings, enterprise and risk taking, corporate investment. Taxes can be also applied at the various levels of government (federal, state, local) in a way though that their combined effect can scarcely planned to correspond to the maximization of social welfare. There are many complexities involved in the tax system-interaction of corporate and personal taxes, methods of taxation of corporate financing, differential tax treatment of various assets, to mention only few that an overall evaluation considering all the above specifications would seem impossible. The construction then of specific tax indices would seem the only way of dealing with the matter.

This construction of marginal effective tax rates is furthermore dependent on certain assumptions that are made in their calculation. Since their construction relies much on the neoclassical theory of capital accumulation it carries with it the deficiencies of some of its assumptions (as for example perfect information and competition, no risk, perfect capital markets). Attempts by various authors to correct its underlying assumptions would result in a variety of marginal effective tax rate calculations. Although important economic indicators such as inflation rates, statutory tax rates, tax allowances and credits, can be incorporated in marginal effective tax rate calculations, the algebraic expression of the above rate cannot be designed so as to account for all complexities of the way in which actual taxes are affected by innumerable provisions (as for example graduated rate schedules, depletion allowances, etc.).

The choice of the rates of inflation and the rates of interest (for discounting), that have to be made in marginal effective tax rate calculations, raise additional issues. These are discussed by Bradford and Fullerton (1981). The role of interest in the formulation of a marginal effective tax rate concerns the discounting of depreciation deductions which appear in the numerator of the algebraic expression of the relevant rate (see below). Since the depreciation deductions are a non-linear function of the rate of discount, the tax rate depends non-linearly on the rate of return for discounting (r') and it is quite sensitive (depending on schedule of deductions) to changes in that rate. Only in a neutral (linear) tax system where for example depreciation allowances are equal to economic depreciation, the sensitivity of marginal effective tax rates to predetermined interest rate values becomes irrelevant. In that case the tax is a constant fraction of the pretax return, that is the tax is independent of the value of r' at which it is evaluatedⁱⁱ. Furthermore, inflation is affecting the nominal interest rate and then an assumption is essential as to how nominal interest rates are changing with changes in inflation rates. Two possible assumptions can be employed: that either inflation adds point-for-point to the nominal interest rate (strict Fisher's Law), or that inflation adds more than point-for-point (modified Fisher's Law)ⁱⁱⁱ. Disagreement on that matter reflects on the calculation of marginal tax rates. The assumption though of a given after tax rate of return in marginal tax rate calculations would obviously imply a modified Fisher's Law. Since nominal interest is subject to tax, for a constant after tax rate of return, inflation must add more than point-for-point to the nominal interest rate.

MEANING AND MEASUREMENT OF MARGINAL EFFECTIVE TAX RATES

In the absence of taxes the rate of return to a saver who finances a project is exactly equal to the rate of return of the project itself. If taxation is involved, the prospective investor needs to know the present value of expected taxes relative to the expected income from a marginal investment. This may provide a first indication of what the marginal effective tax rate tries to measure. This meaning is similar to the notion of the ratio of actual taxes to capital income (average tax rate) only that it refers to a marginal investment. To derive an expression of the marginal effective tax rate, one needs to consider the various returns involved in a marginal investment project. The return to an investor will obviously be different in the presence of taxes than the return to the saver who finances the project. Taxation acts as a 'wedge' between the return on investment and the return on savings. The tax wedge is defined as the difference between the two returns. If we call the pretax rate of return of a marginal investment as r and the after tax rate of return to the saver as r' , the tax wedge will be

$$w = r - r' \quad (1)$$

The concept of a marginal effective tax rate refers to some measure of the above difference usually expressed relative to the pretax rate of return (tax-inclusive rate), i.e.

$$t_m = \frac{r - r'}{r} \quad (2)$$

The size of the tax wedge depends obviously on the system of corporate taxation as well as on the various forms of incentive provisions offered (credits, accelerated depreciation, investment allowances, etc.) that are all used to define the returns on capital income. Since the location of an industry will further define the amount of allowances that can be claimed, or different assets purchased will entitle the firm different amounts of tax reductions, it is evident that different marginal effective tax rates can be calculated for each specific case.

The neoclassical theory of investment choice has provided the cost of capital formulas for the analysis of planned investment and the incentive effects of tax policy changes. This theory then can be used for the measurement of marginal effective tax rates. In the absence of taxes, the marginal product of capital (c) in equilibrium, taken net of replacement costs (δ), will provide the rate of return from a marginal investment (r). When taxes are considered, the marginal product of capital, will take the neoclassical user cost expression, and then the pretax rate of return will be given by the formula

$$r = (r' + \delta) \left(\frac{1 - tz}{1 - t} \right) - \delta \quad (3)$$

where z denotes the present value of depreciation allowances, r' is the real after tax rate of discount, and t is the corporate tax rate. The value of the discount rate r' is exogenous to the firm (i.e. determined by factors external to the firm) and depends on the real rate of interest, or the rate of interest to the saver, which is further dependent on the nominal interest rate and the rate of inflation. For an assumed rate of after tax return, r in (3) above can be defined, and (2) is used for the calculation of the marginal tax rates.

NEUTRALITY AND THE MARGINAL EFFECTIVE TAX RATES

As indicated the marginal effective tax rates are insensitive to the assumed after tax rate of return only in the case of a neutral tax system. One form of neutrality is provided by the equality of depreciation allowances (d_i) and economic depreciation at replacement cost (δ) where interest deductibility is also applied. In that case z becomes equal to $\delta / r' + \delta$, and if this value is inserted into equation (3) the pretax rate of return takes the form

$$r = \frac{r'}{1 - t} \quad (4)$$

and then the marginal effective tax rate (t_m) from (2) will be equated to the statutory tax rate (t). In case of immediate expensing as another form of neutrality z will be equal to the cost of the asset, or $z = 1$ for a unit investment. If z is substituted into (3) the pretax rate of return will be equated to the after tax rate of return and the marginal effective tax rate will then be zero^{iv}. These two cases of neutrality indicate a common tax rate to all marginal investments, which is either the statutory tax rate in case of economic depreciation with interest deductibility, or a zero rate in case of expensing. Since, as indicated elsewhere (Anastassiou, 2006b), the Greek tax system had in a period of years values of z below unity, which have resulted in non-uniform positive marginal tax rates, it can be said that the tax system is depressing investment and one may seek the possibility for the designing of a tax system that can provide neutrality.

What one needs for the establishment of a neutral tax system is obviously a common marginal tax rate, i.e. a tax rate that treats marginal investment in a uniform way across assets. As can be seen, from the previous

exposition, the two cases of neutrality provide a pretax return that does not involve the parameter δ , i.e. the pretax return is independent of the durability of the asset. This is in fact the only condition for neutrality since it provides marginal tax rates that are equated among various investment projects. In that case also there is no misallocation of capital and thus any deadweight loss to the economy since there is no preferential treatment for certain capital goods. Given the above condition and expression (3) above, it is an easy matter to design a tax system that can assure neutrality. Suppose a given fraction α of the asset value is allowed for immediate expensing while the remaining fraction $(1-\alpha)$ is allowed true economic depreciation. In this case the value of z will become

$$z = \alpha + (1-\alpha) \frac{\delta}{r' + \delta} \quad (5)$$

and when this is substituted into (3) it provides a pretax rate of return equal to

$$r = \frac{r'}{1-t} (1-t\alpha) . \quad (6)$$

This rate is independent of durability and provides a uniform tax rate for marginal investments which lies between zero and the statutory tax rate t , depending on the values of α . This form of neutrality has been suggested by Harberger (1980) as a combination of the two specific forms of neutrality (total immediate expensing and true economic depreciation).

A special credit, equivalent to the above neutral incentive, can be designed. Brown (1981) has suggested a common rate of credit that is proportional not to the purchase price of the asset (gross investment credit), but to the purchase price minus the present value of depreciation (net investment credit). From (5) the tax savings due to depreciation in case of partial expensing are

$$tz = t\alpha + (1-\alpha)t \frac{\delta}{r' + \delta} \quad (7)$$

and the benefit (b) in excess of economic depreciation $z = (\delta / r' + \delta)$ is

$$b = t\alpha(1 - \frac{\delta}{r' + \delta}) . \quad (8)$$

The provision of a credit that supplies the above benefit that has been derived from a neutral incentive system will be neutral. Any credit then that is proportional to the cost of the asset ($q = 1$ at present, assuming a unit investment) minus the present value of depreciation, will assure neutrality. For the Greek case a net investment credit as described above can guarantee then a tax system that is not depressing investment, as has been the case we saw before. Even for the case that z can be greater than unity (due for example to a combination of accelerated depreciation and investment allowance measures), resulting in a non-investment depressing system (marginal tax rates negative), neutrality will disappear and capital misallocation will prevail. The importance of neutrality is obvious in designing efficient tax structures.

GREEK MARGINAL EFFECTIVE TAX RATES AND TOTAL AVERAGED RATES

In Table (1) below values of the Greek marginal effective tax rate during the seventies and early eighties^v for both equipment and buildings in manufacturing, as well as a total averaged rate for manufacturing, have been computed. The value of the assumed after tax rate of return has been set equal to 10 per cent. It is indicated that due to the arbitrariness of this figure there is no such rate as 'the' effective tax rate and different values of r' will provide different effective tax rates; the value of r' above has been chosen to correspond as closely as possible to reality, given also the observed nominal rates of the period.

It can be recalled that before 1973 the country had experienced liberalized tax legislation and new investment was totally exempted from taxable income. Marginal effective tax rates then were zero and taxation was not an impediment to new capital expenditures. Mainly the curb to liberalized tax laws came after 1973 and the marginal effective tax rates turned positive. As we have seen elsewhere (Anastassiou, 2006a) the application of investment allowances that were legislated for some of the years after 1973 could have caused, in combination with accelerated depreciation, a value of z larger than unity. But it was shown that these investment allowances were inoperative at the margin and then the final result, as can be seen from Table (1), Columns 1 and 3, was a positive marginal effective tax rate.

Table (1) further reveals that marginal tax rates for equipment are lower than those for buildings and this indicates a more favourable tax treatment of manufacturing equipment. Social (or pretax) returns from investment in different assets are not equated at the margin due to the existing differences in tax rates imposed by the tax structure. Investment then may be placed in lower taxed assets with a lower return, while projects with higher return may not be undertaken due to excess taxation. This welfare cost is the result of a non-neutral taxation which imposes non-uniform marginal effective tax rates to potential investors.

An inspection of Columns 1 and 3 of Table (1) indicates that tax rates for both equipment and buildings increase after 1973. This is the result of less favourable incentive laws applied during the latter years and the possible realization by the Greek authorities of the existence of an incentive system that had produced more government revenue losses than the benefits received from an increase in marginal investment expenditures. The switch in policy was mainly to incentive measures providing more direct grants, while accelerated depreciation benefits and investment allowances had to be reduced; the provision of grants was not made also in parallel to investment allowances, that is an investor had to choose either of the two but not both, and furthermore the annual allowances would only be applied to that part of the investment which was not subsidised. While there were some important changes to incentive provisions during recent years, no serious elaboration of measures have worked out to produce same degree of tax neutrality; the changes were part of the need to harmonize the system to EU's standards. The imposition of a neutral investment credit as discussed before would have reduced the tax rate variations.

Table 1 - Marginal Effective Tax Rates (T_m) By Asset Type, And Total Averaged Rates ($\bar{t}_m$), %

Year	Equipment		Buildings		Total Capital Stock (Billion Drs)	$\bar{t}_m$
	t_m	Capital Stock (Billion Drs At Constant Prices)	t_m	Capital Stock (Billion Drs At Constant Prices)		
	(1)	(2)	(3)	(4)	(5)	(6)
1973	11.6	39.6	20.4	18.5	58.1	14.61
1974	18.9	43.6	27.7	21.1	64.7	21.97
1975	18.9	46.8	27.7	23.3	70.1	22.03
1976	18.9	49.3	27.7	25.4	74.7	22.09
1977	18.9	51.3	27.7	26.5	77.8	22.10
1978	20.0		28.4			
1979	24.5		31.4			
1980	29.4		34.6			
1981	34.0		39.5			
1982	31.6		38.0			

The last Column of Table (1) presents an averaged marginal tax rate. It is intended to provide an overall measure of the tax burden to marginal investment. Its measurement limitations and its explanatory power will be discussed shortly. First the derivation method is presented. Since reference is made to marginal tax rates of specific assets, to derive an averaged rate one needs to know the contribution of each asset to total marginal investment. It is assumed then that marginal investments in each asset are proportional to net capital stock, since this capital stock will indicate the long run asset requirements and thus the corresponding investments to be made. Other possible

weights, as for example gross investment flows, may also be used, although in the latter case these may not be so representative of marginal investments being influenced by different asset depreciation rates. The weights then for the derivation of an overall averaged marginal tax rate can be taken from the time series of net capital stock for each asset that have already been calculated (p.226, Anastassiou, 1990) for the period 1958-77. If one calls these weights α_i (Columns 2 and 4 of Table 1), where the subscript corresponds to each asset, the total averaged rate for each year is given by the formula (King and Fullerton, 1984):

$$\bar{t}_m = \frac{\sum_{i=1}^2 (r_i - r'_i) \alpha_i}{\sum r_i \alpha_i} \quad (9)$$

This rate is calculated at present for only two asset categories and thus taxes on the income from investment in other assets are ignored. While it is further meant to represent a rate for the whole economy, personal and property taxes are also not included. The derivation at present is even more limited since equipment and buildings correspond only to the manufacturing sector. It is necessary then to indicate the considerable caution that should be used in interpreting this rate. It is mainly constructed as a counterpart to an average tax rate, giving at present the tax burden to be created from marginal investments. It does not indicate any actual tax burden (as the average tax rate does), but it can be used, even under the above limitations, to study changes overtime in the tax treatment of marginal investment. In contrast to the marginal tax rates for equipment and buildings that are specific, this rate can be taken to measure more broadly the overall incentive structure. A number of such rates (restricted though to some few years given the availability of capital stock series up to 1977) are presented in Column 6 of Table (1). The rates during the whole period have been kept considerably lower than the statutory tax rate. Their positive value indicates a tax system in which marginal investment is taxed. The importance of these rates may better be appreciated in international investment comparisons where a judgement as to the cost of marginal investment in different countries can be made. King and Fullerton (1984) for example have found that in 1980 the marginal effective total averaged tax rate was 3.7 per cent for U.K., 35.6 per cent for Sweden, 37.2 per cent for U.S.A., and 48.1 per cent for W. Germany^{vi}. Although these last rates represent a very detailed representation of each country's tax schedule and taken as an average of a very large number of marginal tax rates corresponding to very detailed asset, industry, source of finance and owner combinations, an approximate judgement as to where the Greek marginal investment incentive structure stands, can be made. Marginal investment is taxed less in Greece than in Sweden, U.S.A and W. Germany, and only the U.K. has lighter tax burden on marginal investment. Observing the trend of the rates during the period of the sample one does not find any striking changes over the years. This is the effect of a more or less unchanged tax incentive structure for the short period 1974-77 of the sample, although considerably more innovative, as it has been seen, than earlier years. The major changes in tax legislation have taken place mainly in later years (i.e. 1982 onwards).

CONCLUSION

The depressing effect of taxation on Greek marginal investments has been proved. It was indicated though that a solution to this problem can be given by the provision of some specific tax measures, as that of a net investment credit. It was also indicated that there was a more favorable tax treatment of manufacturing investment in equipment than that of buildings. This could lead to a misallocation of capital in favor of equipment and which could further create a deadweight loss to the economy by placing investments in lower taxed assets which may have a lower return than other assets. The whole incentive system needs reformulation and it was indicated that certain steps towards this reformulation have already been taken. These steps refer to the reduction of generously provided measures and the favoring of the provision of others (e.g. direct grants) that could eliminate revenue losses and increase benefits. No serious elaborations of measures though have worked out to produce some degree of tax neutrality. The last changes that were made were part of the need to harmonize the system to EU's standards.

AUTHOR BIOGRAPHY

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REFERENCES

1. Anastassiou, T.A. (1990), Tax Incentives in a Neoclassical Investment Behaviour Model: Evidence from Greek Manufacturing, *Public Finance/Finances Publiques*, Vol. 45, No 2, pp.201 – 227.
2. Anastassiou, T. A. (2006a), Are Tax Incentive Provisions Always Operative? Evidence from the Greek Manufacturing Industry, *Journal of Applied Business Research*, Vol. 22, No 1, pp. 69-80.
3. Anastassiou, T. A. (2006b), Tax Incentive Provisions and the User Cost of Capital: The Case of Greece, *Journal of Applied Business Research*, Vol. 22, No 2, pp. 61-71.
4. Bradford, D. F., and Fullerton, D. (1981), Pitfalls in the Construction and Use of Effective Tax Rates, in Charles Hulten, (ed.), *Depreciation, Inflation, and the Taxation of Income from Capital*, The Urban Institute Press, Washington D.C.
5. Brown, E. C. (1981), The ‘Net’ Versus the ‘Gross’ Investment Tax Credit, in Charles Hulten, (ed.), *Depreciation, Inflation and the Taxation of Income from Capital*, The Urban Institute Press, Washington, D.C.
6. Feldstein, M., Dicks-Miriaux, L. and Poterba, J. (1983), The Effective Tax Rate and the Pretax Rate of Return, *Journal of Public Economics*, Vol. 21, pp. 129 -158.
7. Feldstein, M. S. and Summers, L. H. (1977), Is the Rate of Profit Falling?, *Brookings Papers on Economic Activity*, 1:1977, pp. 211 – 227.
8. Fullerton, D., (1984), Which Effective Tax Rate?, *National Tax Journal*, Vol. 37, pp. 23 – 41.
9. Fullerton, D., Shoven J. B. and Whalley, J. (1983), Replacing the U.S. Income Tax with a Progressive Consumption Tax: A Sequenced General Equilibrium Approach, *Journal of Public Economics*, Vol. 20, pp. 3 – 23.
10. Gravelle, J. G. (1982), Effects of the 1981 Depreciation Revisions on the Taxation of Income from Business Capital, *National Tax Journal*, Vol. 35, pp. 1 – 20.
11. Hurlberger, A. (1980), Tax Neutrality in Investment Incentives, in Aaron, N. J. and Boskin, M. J. (eds.), *The Economics of Taxation*, Brookings Institution, Washington, D. C.
12. King, M. and Fullerton, D. (eds.) (1984), *The Taxation of Income from Capital. A Comparative Study of the U.S., U.K., Sweden, and West Germany*, The University of Chicago Press, Chicago.

ENDNOTES

1. See for example King and Fullerton (1984), Gravelle (1982), Feldstein and Summers (1977), Feldstein, Dicks-Mireaux and Poterba (1983), Fullerton, Shoven and Whalley (1983).
2. In the above case of neutrality it can be equal to the statutory tax rate, or it can be zero in case of immediate expensing. These points are clarified later.
3. This Law refers to the consideration of taxes in affecting borrowing and lending opportunities, in contrast to the strict Fisher's Law where taxes are not considered (see Bradford and Fullerton, 1981).
4. Values of z smaller than unity but greater than zero (i.e. depreciation deductions less than expensing), will provide positive marginal tax rates that can be either above or below the statutory tax rate t , as can be seen from (3). For z greater than unity (tax allowances exceeding the acquisition cost), marginal tax rates will be negative, and in case of z equal to zero (no depreciation), tax rates will be above t .
5. We report on this period since there was quite enough available data on various incentive provisions for that period that could demonstrate their effect in the formulation of c and thus on r or ultimately on t_m . Recent incentive measures are mainly capital related provisions and of the grant supporting style.

6. The overall rate for each country was an average of the effective marginal tax rates for eighty one combinations of hypothetical projects, weighted by the proportion of capital in each combination. These hypothetical projects were defined in terms of a particular combination of characteristics (concerning asset types, industrial sectors, sources of finance and ownership categories) that affect the tax levied on the returns from the project. The reported overall rates were found under the assumption of a fixed pretax rate of return.
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