A REASSESSMENT OF THE TAX–SHIFTING LITERATURE: A PARADIGM

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1. INTRODUCTION

The present paper has basically a twofold objective; (a) to attempt a critical reassessment of the tax incidence literature, and (b) to illustrate some of the deficiencies of the econometric approach to the shifting question by applying the famous Krzyzaniak and Murgrave [1963] model (K-M for short) to the Greek structure.

First, we are concerned with a general reevaluation of both the general equilibrium (Section 3) and the typical econometric approach (Section 4) to the problem. We find it, however, particularly convenient to conduct the analysis within the framework provided by a relatively simple two-sector model set out in Section 2. We subsequently turn to an application of the K-M model appropriately adjusted to Greek data (Section 7). Such a model has deliberately been chosen in view of the fact that it has been widely employed to countries ranging from India to the U. S. Other people claim success; we, on the other hand, will argue on the basis of our results that there is no ground for an international transfer of such a model. Before, however, dealing with this point two other topics attract our attention; first, a general description of the K-M model (Section 5); and second, the methodology and the tax definition (Section 6).

It is worth pointing out at the outset that we are not concerned with establishing incidence conclusions. To start with, we propose a review of those characteristics and shortcomings common, more or less, to all research work in that field. Additional defects featured by particular studies are therefore bypassed.

2. A GENERAL MODEL

It will prove extremely useful to develop a simple model which may serve as a reference point when analysing, comparing or criticising existing work. Its specification should preferably be general to abstract from any dogmatic discussion about the nature of the relationships involved.

A two-sector general equilibrium model qualifies for that purpose. It is described by equations (1) to (13), with subscripts denoting the sector to which variables refer, i. e., y for the corporate and x for the non-corporate, respectively :

$$X = X(L_x, K_x) \tag{1}$$

$$\frac{\partial X}{\partial L_x} = \frac{w(1+t^G)(1+1/\varepsilon_L)}{P_x(1-t^i)} \tag{2}$$

$$\frac{\partial X}{\partial K_x} = \frac{r(1+t^G)(1+1/\varepsilon_K)}{P_x(1-t^i)} \tag{3}$$

$$Y = Y(L_y, K_y) \tag{4}$$

$$\frac{\partial Y}{\partial L_y} = \frac{w(1+t^G)(1+1/\varepsilon_L)}{P_y(1-t^i)(1+1/\varepsilon_Q)} \tag{5}$$

$$\frac{\partial Y}{\partial K_y} = \frac{[r(1+t^G)](1+t^C)(1+1/\varepsilon_K)}{P_y(1-t^i)(1+1/\varepsilon_Q)} \tag{6}$$

$$(1+t^i)P_y = wL_y + rK_y + \theta(wL_y + rK_y)\ (1+t^C) \tag{7}$$

$$L = L(w/T),\quad L' \geqslant 0 \tag{8}$$

$$K = K(r/P),\quad K' \geqslant 0 \tag{9}$$

$$L_x + L_y = L \tag{10}$$

$$K_x + K_y = K \tag{11}$$

$$P = \frac{M.V}{X+Y} \tag{12}$$

$$X = h\left(\frac{P_x}{P_y}\ ,\ X+Y\right) \tag{13}$$

Notation :

X = output of the unincorporated sector,
Y = output of the corporate sector,
L = labour input, i. e., man-hours,
K = capital input, i. e., capital services,
w = money wage rate,
r = money capital-price,
P = aggregate price index (market prices),
M = money supply,
V = velocity of money circulation,
θ = percentage mark up,
t^G = personal income tax rate,
t^i = general commodity tax rate,
t^C = corporation income tax rate,
ε_Q = demand elasticity for Y,
ε_L = labour supply elasticity,
ε_k = capital supply elasticity,

No problem is posed here insofar as 13 equations determine an equal number of endogenous variables, namely, X, Y, L, L_x, L_y, K, K_x, K_y, w, r, P, P_x and P_y. On the other hand the system contains the following exogenous variables : t^G, t^i, t^C, M, V, θ, ε_Q, ε_L and ε_K.

Equations (1) and (4) describe the production functions of the two sectors, whereas (2), (3), (5) and (6) are the usual marginal productivity conditions. Input supplies, according to the present formulation, may be sensitive to factor-compensation changes though the fixed input-supplies case is not precluded. In any case, the assumptions $L' \geqslant 0$ and $K' \geqslant 0$ may imply that equilibrium in factor markets might well occur at various aggregate labour and/or capital levels. A demand equation (13) has as arguments both relative product prices and total income.

A basic assumption made here is that the corporate sector, in contrast to the non-corporate one which operates in a perfectly competitive market, possesses some degree of monopolistic power reflected in ε_Q. Furthermore, its pricing policies follow mark up practices, i. e. equation (7). As a result, capital is able to earn not only a 'competitive' rate of return, but also a monopoly profit. A corporate income tax applies to both gross 'normal' capital returns (equation (6)) and monopolistic profits (equation (7)). A consumer's price index, conveniently thought of as a weighted average of sectoral prices, is formed according to a simple quantity theory of money (equation (12)).

Two principal directions have so far been followed in the tax incidence literature. The first is a general equilibrium theoretic approach. It is an essentially deductive approach drawing conclusions from assumptions regarding market structures, production functions and so on. The second takes an econometric approach most often without placing any a priori restriction on the behavioural or technological relations involved.

3. GENERAL EQUILIBRIUM THEORIZING

Let us first focus on general equilibrium analysis. Harberger's [1962] path breaking model has in fact extensively served as the standard analytical toolIt results as a special case of our own model and can be described by the following set of equations :

(14) $$X = X(L_X, K_X)$$

(15) $$\frac{\partial X}{\partial L_X} = \frac{w}{P_X}$$

(16) $$\frac{\partial X}{\partial K_X} = \frac{r}{P_X}$$

(17) $$Y = Y(L_Y, K_Y)$$

(18) $$\frac{\partial Y}{\partial L_Y} = \frac{w}{P_Y}$$

(19) $$\frac{\partial Y}{\partial K_Y} = \frac{r}{P_Y}$$

(20) $$X = h\left(\frac{P_X}{P_Y}\right)$$

(21) $$L_X = L_Y = \bar{L}$$

(22) $$K_X = K_Y = \bar{K}$$

The model, as presented here, refers to a no-tax world. Harberger used it to investigate the impact of a corporation income tax, but obviously a variety of other taxes might also be incorporated.

With reference to our model the following set of simplifications would produce Harberger's structure : $t^G = t^i = t^C = 0$, i. e., the no-tax situation, $\varepsilon_L = \varepsilon_K = \varepsilon_Q = \infty$, i. e., perfectly competitive product and input markets. The additional assumption needed is that there is no saving, and the labour-leisure choice is not determined by utility maximizing behaviour, i.e. our equations (8) through

(11) are to be substituted by (21) and (22), where $\overline{L}$ and $\overline{K}$ denote fixed aggregate quantities of labour and capital, respectively. We also notice that output does not figure as an argument in the demand equation, given the author's assumptions that : (a) the way in which the public sector spends the tax proceeds, if initial prices continued to prevail after taxation, counterbalances the reductions in private expenditure on the two goods, and (b) redistribution of income among consumers does not alter the consumption pattern.

The money wage rate is taken as exogenous, i. e., the numeraire, in which case the system contains exactly 9 equations in 9 unknowns. Another interesting feature of this model is the absence of any monetary variable, since incidence is a matter of relative price changes. However, a simple description of macroeconomic policy in the form of introducing explicit monetary relationships could be added to solve for changes in absolute prices too. Wages would not, of course, serve as the numeraire under such circumstances.

Harberger inquired $\frac{\partial r}{\partial t^C}$, when no pre-existing tax is assumed to operate, i. e. $t^C=0$. He concentrates on the solution of the system for an infinitesimal change in r, that is the price of capital relative to the labour price since w serves as the numeraire in terms of differential changes in all other variables. His basic formula can be written, in general terms, by assuming that initially $P_x = P_y = r = 1$, as

$$(23) \qquad dr = g(E,\ S_x,\ S_y,\ a_k^x,\ a_k^y,\ \frac{K_x}{K_y},\ \frac{L_x}{L_y},\ t^C)$$

where E = price elasticity of demand for Y,

S_i = elasticity of substitution in sector i, (i = x, y)

a_k^i = capital's initial share in sector i, (i = x, y).

We are not here interested in reviewing the various modifications and extensions of the basic model. One should consult for that purpose the work of Mieszkowski [1967, 1969], McLure [1970, 1975], Ballentine and Eris [1975], and Vandendorpe and Friedlaender [1976]. We are merely concerned with some aspects of the model which may have an importance in subsequent analysis.

The first point to make is the fixity of input supply schedules. It is doubtful whether factor supplies do not respond to alterations in input rewards. We might argue that such an assumption is inadmissible in the case of Greece. Another point is that the model does not allow for the existence of intersectoral factor-reward differentials, which is a widespread phenomenon in less developed countries. Factor mobility is largely restricted by a dual-economy structure implying that an 'advanced' and a 'backward' sector are in fact linked in a rather weak manner. We have to admit, however, that this model intends to capture the impact of taxation in a highly developed economy, i. e., the United States. As such, these two points do not really represent formal defects.

Harberger has undoubtedly performed an invaluable service in the field of tax incidence. On the one hand, the partial equilibrium framework has been dismissed in favour of a manageable general equilibrium model, which takes into consideration the interdependence of the markets. On the other, relative commodity and input price changes, which are of strategic importance in evaluating incidence effects, have for the first time been treated consistently. These are examined within an explicit behavioural model, therefore, the ad hoc treatment implicit in most ecoometric research is avoided.

By substituting concrete values in the right-hand side of (23) Harberger was able to concude that the most plausible assumptions imply that capital bears more than the full burden of the tax. But specific values for the parameters involved have not been derived by an econometric estimation of his simultaneous equation system. They are rather independent findings established by other people and, certainly, for other purposes. Under such circumstances an ideal procedure would call for substitution of statistically obtained parameter estimates.

4. THE ECONOMETRIC APPROACH

Econometric research has extensively been used as an alternative to theorizing alone. It should, however, be pointed out from the very beginning that not all studies intended to focus on incidence aspects. The purpose, for instance, of including tax variables in models like those of Burrows and Hitiris [1972], Johnston and Timbrell [1973], and Gordon [1971] was other than quantification of the shifting process. Nevertheless, any explicit reference to such aspects does not make them inferior in any way, although they often do not interpret their results, e. g. Johnston and Timbrell do not discuss the shifting implications.

Let us again take as a departure point our model which can be rewritten more concisely, when making the simplifying assumption that linear relationships[2] are involved,

(24) $B\Psi_t + \Gamma Z_t = u_t, \qquad t = 1, 2, ..., T$

where the matrices B and Γ represent the parameters of the endogenous and exogenous variables, and the column vectors Ψ_t, Z_t and u_t are the values of the endogenous, exogenous and disturbance variables, respectively. Specifically, Ψ_t and Z_t are given by

$$\Psi_t = [X, Y, L, L_x, L_y, K, K_x, K_y, w, r, P, P_x, P_y]$$

and

$$Z_t = [t^G,\ t^i,\ t^C,\ M,\ V,\ \theta,\ \varepsilon_Q,\ \varepsilon_L,\ \varepsilon_K]$$

The reduced form of (24) can be expressed in matrix notation as

$$\text{(25)} \qquad \Psi_t = -B^{l-}\ \Gamma Z_t + B^{-1}u_t$$

An important distinguishing feature between the general equilibrium and the econometric approach may be noted. It relates to the tax effects each one is supposed to measure. On the one hand, general equilibrium is concerned with relative price alterations. Such a method plays down the importance of the direction of shifting traditionally divided between fcrward and backward. On the other, an empirical approach is generally preoccupied with absolute commodity and factor price changes. In that case, the impact of taxation on, preferably, the relevant tax base is quantified.

A statistical approach is thus involved in finding out the relevant impact multipliers. In general terms, the set of impact multipliers is provided by

$$\text{(26)} \qquad \frac{\partial \psi_t}{\partial Z_t} = -B^{-1}{}_{\Gamma}$$

The following subset of impact multipliers is of particular interest

$$\left(\frac{\partial w}{\partial t^C}\right),\ \left(\frac{\partial r}{\partial t^C}\right),\ \left(\frac{\partial P_x}{\partial t^C}\right),\ \left(\frac{\partial P_y}{\partial t^C}\right)$$

$$\left(\frac{\partial w}{\partial t^G}\right),\ \left(\frac{\partial r}{\partial t^G}\right),\ \left(\frac{\partial P_x}{\partial t^G}\right),\ \left(\frac{\partial P_y}{\partial t^G}\right)$$

$$\left(\frac{\partial w}{\partial t^i}\right),\ \left(\frac{\partial r}{\partial t^i}\right),\ \left(\frac{\partial P_x}{\partial t^i}\right),\ \left(\frac{\partial P_y}{\partial t^i}\right)$$

These partial derivatives with the appropriate algebraic sign preserve the classical dichotomy between forward and backward shifting. Obvicusly, $\left(\frac{\partial P_x}{\partial t^j}\right)$ and $\left(\frac{\partial P_y}{\partial t^j}\right)$ are identified with the former, while $\left(\frac{\partial w}{\partial t^j}\right)$ and $\left(\frac{\partial r}{\partial t^j}\right)$ with the latter, and $j = G, I, C$.

Gcing a step further, the set of predetermined variables suggested by the vector Z_t represents a spectrum of influences with a bearing on the relevant dependent variable, whose behaviour one is focusing on. But only a few studies have used explicit models whose structure would immediately indicate the arguments to be picked up for estimation purposes. A natural substitute, certainly an unsatisfactory one, is an ad hoc treatment of the elements involved.

Nonetheless, some effort was devoted to that direction. Two alternatives, in particular, have been exploited; a complete macrostructure was developed along these lines by Dusansky [1972], and Dusansky and Tanner [1974]. On the other hand, economic theory itself sometimes guided the researcher to construct behavioural models; Gordon's [1967] Oakland's [1972], Moffat's [1970], and Menil's [1974] work offer representative examples.

But, as a rule, the typical econometric approach ignores the interdependencies among markets and confines itself to a rather restricted domain, yet in the absence of any analytical background. Single-equation models, which are a common situation here, are obviously inadequate to capture all aspects of the shifting process. Forward and backward shifting should, at least, be always treated as two interrelated aspects and thus simultaneously tested. Despite the tremendous signifance of that matter there has yet appeared no study with an ambition to quantify all aspects of the shifting mechanism while, at the same time, being comprehensive enough to embrace all major taxes. We consider this as a fundamental shortcoming.

Most work starts from a basic behavioural assumption made either explicitly or implicitly. That is, the dependent variable, gross of tax, exceeds itself in the absence of tax by a constant fraction s of the tax variable. The latter is usually identified with the effective rate.

Such a formulation is represented by

$$\psi_{gt} - \psi'_t = s_i z_{it}$$

where ψ_g is the dependent variable gross of tax,
ψ' is ψ in the hypothetical no-tax situation, and
z_i is the effective rate of tax i.

Small ψ here should be distinguished from capital Ψ and denotes one of the elements of vector Ψ_t. Commodity prices for indirect and factor-returns for direct taxes are often replacing Ψ. In a similar fashion, small z is one of the elememts of vector Z_t.

The most crucial point here relates to the correct specification of the causes of ψ'. Such a problem is not of course encountered when explicit behavioural models are employed. The spesicification problem is however important here in the sense that an exact measurement of the shifting coefficient s_i is critically dependent on it. How this problem was overcome by the studies under review ?

A variety of influences have actually been picked up from a widely ranged spectrum of both competitive and non-competitive elements. As a criterion for including arguments in the estimating equation has sometimes served the potential improvement in the overall statistical performance. In such a contexrt, the procedure is clearly under severe criticism.

The general form of single equation models may be represented by

$$(27) \qquad \psi_{gt} = \delta_o + s_1 z_{1t} + \ldots\ldots + s_m z_{mt} + \varepsilon_t$$

where z_i, $(i = 1, 2, \ldots, m)$ include both tax and no-tax influences, and s_i are the parameters associated with them, and indetified with the shifting coefficients whenever z's denote tax variables. The subscript t denotes time since the majority of empirical studies are time-series analyses. As far as we know the only cross-section analyses are those of Kilpatrick (1965), Levesgue (1967), Brittain (1972), and Vroman (1974a). Alternative formulations for the variables in (27) have also been used. They involve either first-differences (Moffat and Agapitos (1976) or rates of changes (Bruce (1975), Auld (1974), Vroman (1974b) and others.

Application of least-squares to (27) to estimate the coefficient of the tax variable requires, among other things, that

$$(28) \qquad E_t(\varepsilon, z_{it}) = 0, \qquad i = 1, 2, \ldots, m$$

But focusing on single equations[3], while disregarding the fact that they form part of larger systems, results in violation of (28). That is, estimation of (27) by ordinary least squares will produce inconsistent estimates of the s's.

Statutory tax rates, which frequently represent tax variables, are the ratios of tax liabilities to the corresponding tax base. However, the tax base is at the same time the dependent variable, in which case a non-linear relationship is involved[4]. Supposing that in (27) $s_2 = s_3 = \ldots = s_m = 0$,

$$(29) \qquad \psi_{gt} = \frac{1}{1 - s_1 z_{1t}} (\delta_o + \varepsilon_t).$$

Three routes have traditionally been followed in the presence of non - linearities. The first requires an instrumental variable technique, in which case finding out the appropriate instrument may prove a difficult task. This is the approach followed by K-M and their followers. A couple of alternative methods involve linearization by the Taylor's series (Moffat), and a non-linear iterative procebure (Gordon (1967). These last two approaches, though more efficient, are far from universally adopted in comparable situations.

Incidence can be viewed as absolute, budget, or differential. Which then is the methodology adopted by the empirical researcher. Since all studies have uniformly ignored the expenditure side one might infer that absolute effects are captured. Such an inference may, however, prove invalid.

Looking at the relevant statistics one gets the impression that tax revenue (and tax rates) is positively correlated with public spending. As a consequence, even if expenditure is left out, its effects on the explanatory variables make any attempt to isolate tax from expenditure effects futile. What this implies is that budget incidence may come closer to being the implicit approach underlying empirical work.

We have surveyed the major features as well as criticism associated with both a general equillibrium and an econometric approach to the tax incidence problem. To recapitulate, the advantages of the former are sometimes disadvantages for the latter and vice versa. The first is of a rather long run nature, whereas the second inquires into the short-run effects of taxation. The lack, however, of a proper theoretical structure underlying the latter method severelly restricts its usefulness.

Our next task will be to apply an econometric method, the principal objective being to illustrate some of the defects of the approach in the context of a widely employed model : the K-M one. We thus hope that some of the arguments of the present section will become clearer.

5. THE K-M MODEL

The K-M study represents a pioneering and much controversial piece of research as an econometric approach to tax incidence matters. Interest is focused on the shifting degree of company taxation. The authors start from two behavioural assumptions termed Model A and Model B, respectively :

$$\text{Model A :} \quad Y_g - Y' = a\left(\frac{T}{K}\right) = aL$$

$$\text{Model B :} \quad Y_g - Y' = b\left(\frac{T}{\Pi_g}\right) = bZ$$

where Y_g = actual gross rate of return, i. e., $\frac{\Pi_g}{K}$,

Y' = hypothetical rate of return in the no-tax situation,

T = tax liabilities,

K = capital stock, and

Π_g = gross profits.

The behavioural assumption implied in Model A is that the firm adjusts itself so as to increase the gross rate of return sufficiently to recoup a given fraction a of the negative rate of return (defined as the ratio of tax liabilities to capital) suffered from the tax. Model B carries the behavioural assumptiom that firms raise their fgross profits by a constant fraction of the tax rate.

An answer should then be provided to the crucial question : what influences Y' ? The spirit of the analysis is best clarified by Spencer (1969, p. 27) who states :

«... the variables included are important only in their ability to represent a spectrum of variables which, in the present case, will remove the non-tax influences on the rate of return while isolating the influence on the tax. Variables are selected for inclusion in the equation using standard significance tests and removed on the statistical grounds of insignificance or collinearity with the other predetermined variables.»

The final regression equation tested by the authors is of the form :

$$Y_{gt} = \gamma_0 + \gamma_1 \Delta C_{t-1} + \gamma_2 V_{t-1} + \gamma_3 J_t + \gamma_4 G_t + \gamma_5 X_t + \gamma_6 X_{t-1} + u_t$$

where X_t = tax variable, be it L_t or Z_t according to which model is tested,

ΔC_{t-1} = lagged change in the ratio of consumption to GNP,

V_{t-1} = lagged ratio of inventory to sales,

J_t = ratio of accruals of all taxes other than the corporate income tax (minus government transfer payments) to GNP, and

G_t = ratio of federal purchases to GNP.

In their 'standard model' the degree of shifting is over a hundred percent; namely, 134 %. This is a striking result which they try to explain as follows [1963, p. 44] :

«For one thing, changes in tax rates may be taken as a signal among oligopolists for price increases, which may include adjustments for other than tax factors.... For another, firms may be so eager to recoup the tax fully that they overshoot the mark.»

This model was subsequently applied to various countries. Thus with minor alterations it has also been applied to India (Laumas) West-Germany (Roskamp [1965]), Canada (Spencer), and the U. K. (Davis [1972]). A justification for such an international transfer is provided by Roskamp : [1965. p. 249].

«The rationale for using the U. S. model for another country is our belief that corporations in mixed capitalist economies have basically a very similar behaviour with respect to taxes on income and property which is only slightly modified by different institutions.»

The model came, however, under severe criticism. One objection was that the profit model is incorrectly specified. Cragg, Harberger and Mieszkowski [1967], in particular, argue that the causal connection is between the level of demand and profits;[6] and that the K-M results are based on a spurious correlation between demand and tax rates. Other criticism refers to the failure to use a fully articulated model (Gordon [1967]), and limitations of the estimation technique in Model A, where the non-linearity of the tax coefficient is overcome by an instrumental variable technique.

On another level, one should view with considerable scepticism an international transfer of the basic model; its application to a developing country like, for instance, India or Greece whose economic structure is hardly comparable to that of a highly developed economy seems theoretically unjustifiable.

6. METHODOLOGY AND THE TAX CONCEPT

The regression equation under estimation here is K-M's Model B, translated into profit-share terms, i. e.,

$$F_g - F' = \mu \left(\frac{T}{\Pi_g}\right)$$

where Fg denotes the ratio of gross-profits to value-added. It should be mentioned that the authors did not work with such a formulation though in a footnote (p. 65) they state their results for a Model A equation with a dependent variable represented by the ratio of gross profits to value-added. The period examined covers the years 1958 - 1973.

Under the provisions of the personal income tax law, income is obtained by adding up income assessed under seven heads; income from buildings (mainly imputed rent), income from unincorporated enterprises, employment income, income from professional earnings, income from the letting of land, income from securities and income from agriculture.

The assumption is made here that profit income, on a personal income basis, consists of income from unincorporated enterprises (the biggest item), income from securities, and income from buildings[7]. Strictly speaking, income from unincorporated enterprises comprises labour income as well. We find, however, reasonable to suppose that the labour component bears a more or less constant relationship to total income from that source, which, in any case, is not too high.

There are no data referring to tax liabilities due by each individual source, since taxes are assessed on the basis of total income, i. e., from all seven sources. However, the yearly publications of 'Personal Income Tax and Reported Family Incomes' divide tax-payers into six socioeconomic groups according to their main income source; (a) Employees, (b) Merchants and Industrialists, (c) Rentiers, (d) Professionals, (e) Pensioners, and (f) Agriculturers. It is, therefore, convenient to assume that income reported by Merchants and Industrialists, and Rentiers is mainly profit income, provided that it originates from either unincorporated enterpirises, or securities and buildings. Moreover, their corresponding taxes are considered as part of profit taxes.

It should be pointed out, nevertheless, that those groups do not exclusively derive income from the sources already mentioned. This, we think, does not make harm to our definitions; the inclusion of non profit components[8] too might capture cross-shifting effects.

To sum up, for the purposes of the study profit income is taken to be the sum of incomes reported by: (1) Merchants and Industrialists, and Rentiers, and (2) corporations (given by the annual publications of 'Corporate Income Tax and Reported Income of Legal Entities'). The second item includes undistributed profits only, since this is the relevant tax base. Distributed profits are taxed as personal income from securities. Companies other than corporations, such as limited liability companies and partnerships are also taxed on a different basis. Theirnet profits are taxed as personal income (i. e., income from unincorporated enterprises) of the partners irrespective of whether these are distributed or retained in the firm.

In a very narrow sense the corporate sector can be so defined as to include only corporations (i. e., firms with the legal form of Societe Anonyme), since different statutory rates apply to corporate income, on the one hand, and personal income from unincorporated enterpises, securities and buildings, on the other. A proportional rate of 35 % plus a surcharge of 15 % on this in favour of O.G..A. is levied on the former, whereas a progressive scale applies to the latter. Tax-rate differentials between the 'corporate' and 'non-corporate' sector should thus determine the legal status of the firm. But rate differentials cannot easily be computed and depend on the level of personal capital-income. Moreover, non-tax considerations may be far more important here.

The solution adopted is to treat profits-taxes as broadly originating in the non-farm private sector of the economy. As a consequence, this is the sector we focus our attention; it covers the whole range of output that is subject to profits taxes. Farmers are effectively untaxed by both the personal and corporation income tax.

To conclude, our tax variable is the ratio of profits-taxes to taxable profits. Taxable profits were preferred to reported profits for a specific reason; changes in observed tax liabilities depend on both legislative changes in statutory rates and changes in the tax base. The latter equals reported profits minus exemptions and deductions. What we are primarily concerned with is 'tax-rate' shifting, i. e., shifting taking place in response to tax-rate changes. The choice of the tax variable is therefore, obvious.

7. APPLICATION OF THE K-M MODEL TO GREECE

The model under estimation is[9]

$$(3) \quad \left(\frac{\Pi_r}{GDP_s}\right)_t = a_o + a_1\Delta C_{t-1} + a_2 J_t + a_3 G_t + a_4 \left(\frac{T}{\Pi_x}\right)_t + a_5 \left(\frac{T}{\Pi_x}\right)_{t-1}$$

where Π_r = gross reported profits,
Π_x = taxable profits,
T = tax liabilities, and
GDP_i = GDP of the non-farm private sector

Table 1 summarises the results regarding various versions of the basic model. The first two equations include the tax-variable lagged one year, but it is excluded thereatter since it is non-significant at the 0.05 level. Neverthless, other variables too are non-significant but they are retained for reasons of comparisons with similar studies.

The first four versions use the variables suggested by K-M, except the inventory-to-sales ratio for which no information exists. In equation (5) an employment variable E is introduced, which is defined as $E = 1-U$, where U is the unemployment rate. Such a variable has alsc been introduced by Cragg, Harberger and Mieszkowski but for a different reason; basically, they wanted to show that the causal connection is between the level of demand and profits rather than profits and taxation. But such a characteristic does not seem to be present in the present case. E was added to check whether it improves the explanatory power of the model. It comes up, however, with an insignificant coefficient.

Then, in equations (6), (7) and (8) the variables J and G are substituted by B, i. e., the budget deficit or surplus, defined as $B = G - J - \frac{T}{GNP}$. Such a formulation is advantageous in view of the limited number of observations and, in fact, it comes up with a significant coefficient. Equation (8) might be viewed as our 'preferred' version from a purely statistical viewpoint rather than meaningfulness of results.

The tax coefficient appears with a negative sign which is difficult to interpret. The formulation of the model, of course, is such that the shifting degree cannot be ascertained by merely looking at the size of the tax coefficient, as it is the case with Model A. A shifting measure here should be provided by the ratio $(F_{gt} - F'_t) / Z_t F_{gt}$, which reduces to a_4 / F_{gt} when the lagged tax variable is eliminated from (30). We are not computing however such a measure given the difficulty of interpreting a negative number from a shifting point of view.

TABLE 1

The K-M Model Applied to Greece, [ ] are t-ratios

No. of equation	Intercept	ΔCt-l	Jt	Gt	Zt	Zt-l	Bt	Et	$\overline{R}^2$	F	d
1	0.135	—0.140 [—0.523]	—0.478 [—0.858]	0.898 [—1.758]	—0.660 [—2.340]	0.072 [0.175]			0.720	8.22	1.42
2	0.144		—0.472 [—0.879]	0.885 [1.801]	—0.629 [—2.369]	0,010 [0.026]			0.741	11.01	1.55
3	0.149	—0.128 [—0.549]	—0.450 [—1.020]	0.855 [2.508]	—0.635 [2.996]				0.787	14.89	1.44
4	0.146	[—1.133]	—0.481 [2.751]	0.892 [—3.060]	—0.628				0.799	20.98	1.60
5	—0.113		—0.442 [—1.013]	0.894 [2.702]	—0.488 [—1.718]			0.002 [0.727]	0,791	15,25	1,66
6	0.167				—0.876 [3.859]		—1.036 [—3.144]	0.001 [0.188]	0.753	16.28	1.45
7	0.237	—0.131 [0.249]			—0.991 [—2.962]		—0.909 [—5.718]		0.758	16.69	1.33
8	0.234				—0.906 [—5.870]		—1.032 [—3.262]		0.771	26.36	1.47

It has been argued by Agapitos that a negative tax-coefficient might be explained by what he calls 'unsuccessful' shifting. That is, firms may try to shift the burden by increasing prices, but this may lead to a reduction of sales, as long as the demand is not perfectly inelastic, and a corresponding reduction of profits. This interpretation, we think, does not hold here. Basically, the denominator of our dependent variable is GDP_s, so that a reduced demand would also be reflected in GDP_s. Moreover it is not clear why 'forward shifting' is the only possibility.

A more likely explanation may, in our view, be sought in the frequent changes in the exemption rates, almost always in an upward direction. This policy which, combined with other concessions, was pursued as a means of encouraging reinvestment of profits led to increasingly smaller tax-rates and correspondingly higher profits. This negative relationship seems to be much stronger than the positive, in the case of shifting, or zero, in the case of no shifting, relationship and hence the net result is again a negative figure.

As a consequence, the tax coefficient gives in no way indication about the shifting-degree of profits-taxation. It is the resultant of different components, each with differing strength. 'Correction' of the data, in order to isolate these two separate forces, cannot be undertaken because it is impossible to distinguish between deductions and exemptions (in the non-taxable income).

But a more serious objection relates to the methodology itself which attributes statistical rather than purely economic significance on the variables. From such a point of view, the criticism referred to earlier applies in full. In other words, it is difficult to interpret the tax-coefficient in terms of shifting measures, when the underlying model is not derived from an explicit structure describing the working of the economic system.

Most of the non-tax variables used in the model seem to have little a priori justification and do not resemble variables such as sales and costs which are employed by numerous econometric models to explain profit movements. Under the circumstances, an international transfer of the model is entirely unjustified, as the application of the model to Greece has shown.

Nevertheless, K-M's work should not be dismissed as worthless. In reality, these authors have offered a valuable service in the incidence literature. They were among the first to show that precise shifting measures should result through application of econometric techniques. What, instead , they overlooked was the need for a proper theoretical framework.

The reassessment of the shifting literature as well as the illustrative paradigm have taught us an important lesson. Both approaches, i. e., the general equilibrium theorizing and the econometric approach, have merits and demerits. But they are incapable, when taken in isolation from each other, to quantify the shifting process precisely. General equilibrium models end up with a set of highly general qualitative statements; and econometric techniques deserve credibility only if a proper theoretical framework underlies the empirical findings. Therefore, it is our strong feeling that a successful combination of the two methods is the best way to tackle incidence questions.

NOTES

1. Both production functions are supposed to be homogeneous of the first degree so a_i^i, which might also figure in (23), results as a residual.

2. In fact most studies postulate for simplicity linear functional relationships between the endogenous and predetermined variables.

3. The models used by Dusansky [1972], Dusansky and Tanner [1974a] and Agapitos [1976] represent notable exceptions.

4.We notice by the way that the non-linearity problem has only been faced with regard to the profits tax in the context of an either rate-of-return equation [K-M; Gordon, 1967] or a price equation [Moffat, 1970].

5. Harberger's assumption about the way the public sector spends the tax proceeds makes general equilibrium also cast in terms of a budget incidence approach.

6. Criticism along these lines was also expressed by Goode [1966] and Slitor [1966] who introduced the ratio of actual to potential GNP to account for demand changes. Such an addition decreased the estimated degree of shifting. Cragg, Harberger and Mieszkowski [1967] added an employement variable with the effect of making the tax variable insignificant.

7. Lianos and Prodromides [1974] calculate profit income (on a personal income basis) in the same way, but they exclude income from unincorporated enterprises, because of its labour component.

8. Non-profit income in the above sense varies between 10 and 20 percent.

9. Jt includes here government transfer payments. Moroeover, Z represents here the ratio (T/Π_X).

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