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NETHERLANDS/PAYS-BAS
A CROSS-SECTION FRAMEWORK FOR ESTIMATING JOINTLY THE EXTENT OF SHIFTING OF SALES AND COMPANY INCOME TAXES, WITH AN APPLICATION TO KENYA*

by

ROBERT J. BRENT**

I. INTRODUCTION

Much research effort has been devoted in developed countries to attempting to estimate the extent of shifting of the company income tax. Company income taxes also play an important role in developing countries, but in addition sales taxes have been introduced. While some attempt has been made to estimate shifting of the company income tax in developing countries, the extent of shifting of sales taxes has been a neglected area of study. Since many of the conceptual and statistical problems involved with estimating shifting have been clarified by the earlier work on the company income tax, the framework provided by the studies in the developed countries can be used as a basis for models to estimate shifting of sales taxes in developing countries. But what is required is a wider framework, which allows the shifting of both types of tax which are important in a developing country to be estimated simultaneously.

The wider framework is to have the following properties:
(i) It avoids some of the statistical estimation problems involved with the models related to the developed countries;
(ii) It is sufficiently general to admit widely different hypotheses of firm behaviour which might exist in a developing country;
(iii) From the outset the analysis is to be that of "differential incidence". That is, the shifting of a tax must be considered jointly with an opposite change in another tax of equal yield. By so doing, the aggregate demand effects of a change in a tax can at least in principle be neutralised. Now, in the actual application of the framework, it may be the case — as with the subsequent Kenyan study — that the two taxes are not actually implemented in any offsetting manner. The analysis will then take the
form of "absolute incidence" (aggregate demand effects are intermixed with the tax effects). But one nonetheless is still assessing the relative impact of one tax against the other, even though the backcloth is one of inflation or deflation.

(iv) Given that sales taxes in developing countries have been only recently introduced, the basis of the analysis needs to be recast in terms of cross-section rather than time series which has been the practice with the earlier studies.

To illustrate this extended framework, the model will be applied to a developing country, Kenya, in the first year of the sales tax’s existence in that country.

II. EXISTING MODELS OF SHIFTING RELATED TO COMPANY INCOME TAXES

Firms may be statutorily responsible for paying over to the government the amount of a tax. However, if they can, by some means, adjust to the tax such that their profits are maintained, then some other group or groups must bear the income loss caused by the tax. The tax will then have been "shifted". This adjustment process is general equilibrium in nature, in that the final effect on profits may have been brought about by a direct response by the firms (e.g., by raising consumer prices) or by an indirect effect due to others (e.g., by workers demanding higher wages to compensate them for the higher cost of living). The mechanism of shifting is therefore left unspecified.

The Krzyzaniak and Musgrave [9] (hereafter referred to as K-M) method of estimating the extent of shifting of the U.S. corporation tax was to regress a company income tax variable, and other factors, on profits gross of taxes. That study has come under widespread criticism for trying to explain profits with:

(i) variables that have no obvious economic rationale, e.g., the ratio of inventory to sales in the previous period, and

(ii) variables that may conceal and be affected by the actual shifting mechanism. Davies [2, p. 275] points out: "If there is forward shifting via price increases the inclusion of current price and company tax as independent variables will lead to collinearity".

An alternative approach was devised by Gordon [3] which was based on a "cost-plus" theory of firms' pricing behaviour. He developed his own estimation technique (a reiterative procedure) and his study met all of the complaints listed above concerning the earlier U.S. study.

Of these approaches, the K-M method is more viable for the objectives of this paper. It is possible to use their method without using their specific model. It is not necessary that the two defects listed above must be inherent parts of using their method. One is free therefore to specify variables which have an economic rationale
and which are relatively insensitive to the mechanism of shifting. Moreover, the main positive advantage of the K-M method is that it is not dependent on a specific pricing hypothesis for the firm, so allows the scope for introducing any behavioural variables that may be of particular importance in a developing country.

The extended K-M method differs from the original version in three main respects. First, the profit identities are redefined to include the sales tax as well as the company income tax. Second, all the tax variables will be replaced by exogenous variables on which they depend, and by factorising all variables that depend on the level of profits, a reduced form equation is obtained for a system which is exactly identified. Two stage least squares can now be used as the estimating technique and sales tax exemptions and income tax allowances play the chief role as acting as "instruments" for the endogenous tax variables. Finally, the variables used to explain profits in the absence of taxes will be different. In this respect the profits hypothesis will be non-general and will depend on the particular country being considered.

Being forced (by the absence of sufficiently long data series for sales taxes) to rely on a cross-section analysis turns out to simplify estimation. (a) The original K-M model has been criticised for excluding a variable which explicitly picks up the effect of cyclical influences which determine movements in both profits and taxes. This should not be a problem for estimates related to a single year. And (b) time series estimates of shifting had to deal with the tax rate as a variable. This played the important role in deciding which statistical technique was used to make the estimates. K-M used the instrumental variables approach which Gordon argued was not efficient. However, Gordon's more efficient reiterative procedure is not a generally available computer routine. A cross-section analysis, by treating the tax rate as a constant, enables efficient and generally available techniques to be employed.

III. INCIDENCE THEORY AND "A PRIORI" EXPECTATIONS OF TAX SHIFTING IN A CROSS-SECTION ANALYSIS

The K-M approach to estimating tax shifting constitutes only a partial guide to identifying the extent to which various groups bear the income losses or receive the income gains from a tax — its "incidence". It looks at only one factor (capital) in one sector (the corporate sector) from one side of its involvement in the market (the income sources side). The income effects on labour (and government) in any sector, and capital in the non-corporate sector is therefore ignored, as are the effects on the various groups of changes in the prices of consumption goods — the income uses side of the market. The extent of its partiality depends on (i) the competitive nature
of industry, (ii) the time period being considered, and (iii) the particular taxes one is examining. To see this clearly, consider Harberger’s [4] competitive model of shifting of the corporation tax. Assuming constant returns to scale, capital bears the full loss of income caused by the tax. In the long-run, with complete factor mobility, the loss is shared by the non-corporate as well as the corporate sector (in proportion to relative capital intensities in the two sectors). But in the short-run, it is only capital in the corporate sector that is affected. Thus basing ones expectations on the short-run version of the Harberger model, the corporation tax should be zero shifted and there is no need to examine other factors, or other sectors, or consumption behaviour. Only in this very special case would an actual estimate of zero shifting by firms coincide with the end of the search for the tax’s incidence.

However, it is never the case with a Harberger type model applied to a selective sales tax that the effects of taxes of firms’ profits exhausts the range of effects of this tax.¹ Unlike the company income tax, the selective sales tax is based on the use of both capital and labour in the corporate sector. So no matter what particular assumptions one may wish to make concerning factor mobility, pricing or proportions, the sales tax must affect labour’s disposable income in the corporate sector.

The other general statement that can be made is that the use of a cross-section analysis related to a one year period guarantees that it is short run shifting behaviour that is going to be observed. This means that it is not necessary to investigate the income effects in the non-corporate sector, for factor mobility is ruled out.²

The next stage in the analysis depends on working with particular assumptions. With a competitive factor market, the existence of factor immobility removes the need to trace the income uses effects of the two taxes. For if factors’ net of tax prices falls by the full amount of the tax, then the gross of tax factor prices remain unchanged and firms will have no incentive to alter product prices, no matter the postulated objectives of the firm. The crucial issue for the income uses side then revolves around the existence and strength of trade unions in the wage bargaining process. For a strong union will try to resist the income loss and this could lead to product price adjustments to accommodate tax compensatory wage demands. Because in most developing countries like Kenya trade unions have very little influence on wage determination, it may be justifiable to assume as an approximation that factor markets are competitive. Therefore the use of a cross-section analysis avoids the need to examine the income uses side.³

The resulting *a priori* expectations for tax incidence and shifting are as follows. All the income effects of the two taxes are harboured in the corporate sector, and the effect on capital and labour’s income in that sector does not need to be adjusted
for differences in consumption behaviour of the two factors. From the company income tax point of view, since only capital is affected, the expectation is that its income falls by the full amount of the tax. Consequently, estimated tax shifting should be zero. On the other hand, the selective sales tax can be treated as an equal rate tax on capital and labour in the corporate sector and so its income effect is shared between the two factors. Thus, capital does not bear the full income loss of this tax and the expected estimated level of shifting is to be greater than zero.

Note that these expectations depend on the assumption of competition in the factor market. They do not include any statements about the state of competition in the product market. This is because one of the variables that will be used subsequently to explain profits in the absence of taxes is the industry concentration ratio. Given this, the relation between competition in the product market and the extent of shifting can be examined explicitly as part of the statistical testing procedure.

IV. A GENERAL FRAMEWORK FOR ESTIMATING SHIFTING

The effect of taxes on companies can be judged by comparing profits as they exist with taxes, with what they would have been in the absence of taxes. If \( \pi^o \) stands for company profits (gross of taxes) and \( \pi^d \) stands for profits in the absence of taxes, then the two profit measures would diverge by the amount of the tax shifting. Given that the taxes being considered are a sales tax, \( T^s \), and the company income tax, \( T^c \), shifting can therefore be gauged by:

\[
\pi^o = \pi^d + \alpha_s T^s + \alpha_c T^c
\]

where \( \alpha_s \) is the extent of sales tax shifting and \( \alpha_c \) is the extent of income tax shifting.

It is the parameters in this equation that one wishes ultimately to estimate. If neither of the taxes were shifted (\( \alpha_s \) and \( \alpha_c \) were both zero) gross profits would be completely unaffected by the existence of taxes. If both taxes were fully shifted (\( \alpha_s \) and \( \alpha_c \) were both unity) gross profits would rise by the full amount of the tax paid. A value for \( \alpha_s \) and \( \alpha_c \) greater than unity represents the case of over-full shifting.

In order to estimate equation (1) by ordinary regression analysis, two conditions (at least) are necessary: firstly, the variables on the right-hand side must be exogenous. Secondly, the variables on the right-hand side must not be perfectly correlated. Whether or not \( \pi^o \) will be exogenous depends on the particular theory of profits one has in mind. But, that \( T^s \) and \( T^c \) cannot be uncorrelated and exogenous is guaranteed by their definitions.

First, consider \( T^c \). Company income tax is levied at a proportional rate, \( t^c \), on the profits tax base, \( \pi^o \). That is:
\[ T^c = \frac{c}{\pi^c} \]

Since the sales tax is an allowable deduction from gross profits and there are other allowances, \( A \), the income tax base is given by:

\[ \pi^c = \pi^g - T^s - A \]

Substituting (3) into (2) produces

\[ T^c = \frac{c}{\pi^g} - \frac{c}{T^s} - \frac{c}{A} \]

Now consider \( T^s \). The sales tax is proportional to the sales tax base, \( R^s \), which is given by deducting sales tax exemptions, \( E \), from the total value of sales, \( R \). Thus,

\[ T^s = \frac{s}{R^s} \]

and

\[ R^s = R - E \]

\( R \) is itself a part of the income tax base. Note that gross profits are the difference between revenues and costs, \( C \).

\[ \pi^g = R - C \]

or

\[ R = \pi^g + C \]

This can be substituted into (6) and then into (5) to obtain:

\[ T^s = \frac{s}{\pi^g} + \frac{i}{(C - E)} \]

Equations (4) and (9) therefore show that \( T^s \) and \( T^c \) are dependent on \( \pi^g \) and intercorrelated. So on the grounds of endogeneity and severe multi-collinearity (for the Kenyan sample the intercorrelation was 0.9) ordinary least squares cannot be applied to (1).

Viable alternative estimation procedures appear from considering the reduced form of (1), i.e., \( \pi^g \) can be shown to depend only on the three exogenous variables in the system — \( \pi^o \), \( A \), \( C \), and \( E \). The reduced form is therefore:

\[ \pi^g = b_0 \pi^o + b_A A + b_E (C - E) \]

where

\[ b_0 = \frac{1}{1 - \alpha_s^f \frac{s}{\pi^o} - \alpha_c^c \frac{c}{\pi^o} + \alpha_c^s \frac{s}{\pi^o} \frac{c}{\pi^o}} \]
SHIFTING OF SALES AND COMPANY INCOME TAXES: KENYA

\[ b_A = \frac{-\alpha_c l^c}{1 - \alpha_s l^s - \alpha_c l^c + \alpha_c l^s l^c} \]

and

\[ b_E = \frac{\alpha_s l^s - \alpha_c l^s l^c}{1 - \alpha_s l^s - \alpha_c l^c + \alpha_c l^s l^c} \]

There are also three endogenous variables in this system, viz., \( \pi^G \), \( T^s \), and \( T^c \). Thus the system is exactly identified. This means that indirect least squares (ILS) could be applied to the reduced form coefficients to obtain unique values for the shifting parameters. However, while two-stage least squares (2SLS) applied to (1) does in general produce identical estimates of the shifting coefficients as can be obtained from indirect least squares, there are two good reasons for preferring the former technique to obtain the shifting estimates: (i) 2SLS simplifies the calculations in that the standard errors for the shifting parameters come directly from the second stage regression of \( \pi^G \) on the predicted values of the tax variables. (ii) 2SLS allows more experimentation, in terms of which variables to include or exclude and trying alternative specifications, without having to recompute the relationship between structural parameters and the reduced form coefficients.

A. Company Income Tax Allowances And Sales Tax Exemptions

Given the importance of \( A \) and \( E \) in the estimation procedure, it is useful to examine further these two variables, in terms of their interrelationships and how they are to be measured.

Two points of comparison between \( A \) and \( E \) need to be clarified. (i) A company income tax can be viewed as charging the tax rate on revenue \( (R) \), but allowing the tax rate on costs \( (C) \) to be deducted, i.e.,

\[ T^c = l^c \pi^c = l^c R - l^c C \]

Conversely, a sales tax operates on \( R \), but does not allow the reduction of costs. It is for this reason that \( C \) and \( E \) have opposite signs in the reduced form, seeing that \( C \) plays the part of a negative exemption. And (ii), the sales tax is itself an income tax allowance - as equation (3) confirms. However, because \( T^s \) is a function of \( \pi^G \) it can be factorised out in the reduced form and this ensures that \( A \) can be divorced from \( E \). The point to note here therefore is that when the term company income tax allowances is being used in the rest of this article it relates only to \( A \), i.e., non sales tax, income tax allowances.

Measurement problems stem from the fact that the bases of the two taxes (\( \pi^c \) and
are not usually observed. However, measures of \( C \) and \( E \) can be obtained directly by utilising the identities given earlier, and \( A \) can be derived by adding an additional relationship.

Sales tax exemptions: \( C \) is the difference between profits and sales, equation (7), and \( E \) is the difference between sales that are subject to tax and total sales – see equations (5) and (6).

Income tax allowances: For most firms, \( A \) can be derived from equation (3), i.e., by rearranging,
\[
A = \pi^G - T^S - \pi^C
\]

Where firms incur a positive amount of company income tax, equation (2) holds, i.e.:
\[
T^C = f^c \pi^C
\]

Substituting this into (12) results in:
\[
A = \pi^G - T^S - T^G / f^C
\]

Problems arise then when equation (2) breaks down, i.e., firms do not pay income tax in the current period, for \( T^C \) cannot be negative and nor, therefore, can \( \pi^C \).

There are two situations when firms do not pay any income tax, when they make losses and when investments are on such a scale that income allowances reduce the tax base to zero and below. In both cases an intertemporal aspect is introduced in that allowances become eligible in the following year. To help accommodate these cases, define
\[
A = A_1 + A_2,
\]

this states that total allowances are the sum of allowances allocated to the current period \( (A_1) \) and allowances allocated to the subsequent period \( (A_2) \). It will be assumed that only allowances in the current period \( (A_1) \) influence the extent of current tax shifting, and thus it is the values of \( A_1 \) that measure allowances for firms that do not pay any income tax. The special cases can now be dealt with.

a) When a firm makes a loss, i.e., \( \pi^G - T^S \) is negative, the income tax is set to zero and the loss is carried over as an allowance in the subsequent period. With \( T^C = O \) and \( A_2 = \pi^G - T^S \) substituted into (13), the outcome is \( A = A_2 \) which from (14) means that \( A_1 = O \).

b) When a firm earns investment allowances greater than current profits, the excess is transferred to the subsequent period. Equation (12) makes it clear that this excess of \( A \) over \( \pi^G - T^S \) must equal \(-\pi^C\). With \( A_2 = -\pi^C \) substituted into (12), one obtains \( A = \pi^G - T^S + A_2 \) and thus using (14) \( A_1 = \pi^G - T^S \).
V. APPLYING THE FRAMEWORK TO KENYA

To apply the general framework to any particular country one needs (a) to specify a profits hypothesis for \( \pi^o \), (b) to be aware of the tax rates \( t_s \) and \( t_c \), and (c) to obtain a sample of observations on \( \pi^o, \pi^0, A, C, \) and \( E \). For reference, the main classes of exemptions and allowances existing in Kenya in 1974 are listed at the end of this section.

A. The Profits Hypothesis (\( \pi^0 \))

The two requirements for any particular profits hypothesis are that the variables included have some basic economic rationale and that they be insensitive to the mechanism of shifting.

Given the success by House [5] in explaining industry price-cost margins by supply variables, the profits hypothesis for Kenya concentrated on firm and industry characteristics.

Under the "received" theory of the firm, a firm's profit is dependent on the state of competition. The greater the competition the lower the level of profits in the long run. Using the concentration ratio to measure the state of competition, the industry's profit will be determined primarily by \( X_1 \), where \( X_1 = \text{The Industry Concentration Ratio} \). However, in Kenya, certain industries are subject to a different degree of price control than industry generally. So a second industry profit determinant was tried: \( X_2 = \text{Extent of Price Control} \). Since the dependent variable is the absolute size of profits, it is very likely that the larger the firm the larger will be \( \pi^0 \). \( X_3 = \text{Firm Size} \) will therefore pick up this scale effect. A second distinguishing characteristic for the firm that was thought important, especially in a developing country, was whether it is a multinational corporation or not. Firms will be classified therefore according to: \( X_4 = \text{Nationality of Ownership} \).

A fuller account of the price control system and the detailed specifications for all the variables are given in the notes.\(^6\)

To summarise: if the four \( X \) variables are assumed to be linear determinants of profits in the absence of taxes, then:

\[
(15) \quad \pi^o = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + u
\]

where \( u \) is the random disturbance term subject to the usual assumptions. The complete shifting model in the Kenyan context will therefore replace equation (1) by:

\[
(16) \quad \pi^G = b + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + \alpha_3 T^s + \alpha_c T^f + u
\]

where:
\[ b_K = b_0 b' K \; ; \; b_1 = b_0 b' J \; ; \; b_2 = b_0 b' 2 \; ; \; b_3 = b_0 b' 3 \; \text{and} \; b_4 = b_0 b' 4. \]

The only general issue that must be discussed in this section is the ways in which the mechanism of shifting could influence the effect of the concentration ratio in determining the extent of shifting. There are three broad ways in which a tax \((T)\) may interact with the concentration ratio \((X_I)\) and they are:

(i) \(X_I\) could increase as \(T\) increases. This reflects the idea that concentration is caused by taxes, i.e., to avoid taxes, or help pay taxes, market power is sought by all firms. However, this category of interaction is unlikely to be a problem in a short-run study.

(ii) The coefficient of \(X_I\) could increase as \(T\) increases. In terms of equation (16) this would mean

\[ b_1 = F_1 T \]

where \(F_1\) is a scalar and \(T\) could be the income or sales tax. The economic meaning of this is that a firm may not be profit maximising prior to the introduction of a tax, in that they may not be using their market power to the full. The tax then causes firms to use their market power to pay for the tax. In this way the tax forces firms to become profit maximisers.

This process can be tested empirically by substituting equation (17) into equation (16):

\[ \pi^0 = b_K + F_1 T X_I + b_2 X_2 + b_3 X_3 + b_4 X_4 + a T + u \]

where the superscripts on the taxes have been dropped for convenience. Thus the cross-product term \(T X_I\) has now been introduced, and the statistical significance of its coefficient may be checked.

(iii) The coefficient of \(T\) could increase as \(X_I\) increases. In terms of equation (16) this would mean:

\[ \alpha = F_2 X_I \]

That is, shifting itself may be determined by the extent of market concentration. Substituting (19) into (16) produces:

\[ \pi^0 = b_K + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + F_2 T X_I + u \]

To test this version one again checks the coefficient of the cross-product term, but this time \(T\) is replaced by \(X_I\) in the rest of the equation.

The cross-product term \(T X_I\) introduces an additional endogenous variable into the model. However, neither (18) nor (20) incorporate an extra exogenous variable. As it stands then the system is now underidentified. A logical way to close the system is to allow the tax allowance and exemption variables to once more act as
SHIFTING OF SALES AND COMPANY INCOME TAXES: KENYA

proxies for the endogenous tax variables. Thus \((C-E)X_1\) can be the instrument for the cross product \(T'X_1\) and \(AX_1\) can be the instrument for \(T^eX_1\).

B. The Tax Rates \((t^s\) and \(t^c\))

As equations (2) and (5) show, the tax rates need to be on an ad valorem basis. Since one is regarding the tax rates as fixed to obtain the shifting estimates, it is also useful if all firms in the sample are faced by the same rates. These two features were evident in Kenya in 1973—74. In the first year of the sales tax all manufacturing firms were subject to a 10% ad valorem sales tax, and the company income tax for manufacturing was 45%. This means that \(t^s = 0.1\) and \(t^c = 0.45\).

C. Obtaining the Sample

The data collection and selection of the sample is explained fully in Brent [1]. The aim was to choose the sample so as to represent all the sales taxed industries, and within each industry, to represent firms of all size categories. The final outcome was a sample of 34 firms in 23 of the 31 industries where output was subject to sales tax.

1. The Main Classes of Exemptions and Allowances existing in Kenya in 1974

The sales tax was levied at the manufacturing stage and so all retail trade was exempt. Apart from this, the base was reduced by four main categories of exemption:
(i) most food products, e.g., maize, wheat, flour and sugar;
(ii) some agricultural inputs, e.g., fertilizers and diesel fuels;
(iii) all small firms with a turnover less than K £5,000 and,
(iv) all exports.

The total value of consumption (K £817.3m in 1974) can be taken to be the potential base of the tax in the absence of exemptions. The effective base in 1974 was K £319.9 m. Thus the value of the exemptions was K £497.4 m and this reduced the potential base by 61%.

There are two main categories of company income tax allowances. The first category is specified by statute and the second is the result of the way the data was collected for Kenya. (a) The chief allowance existing in 1974 was an investment deduction which allowed firms to deduct from profits 20% of the value of new fixed assets, including buildings, in their first year. This was in addition to the normal depreciation allowance of 4% on industrial buildings, 12.5% on machinery and equipment, and 25% on self-propelled vehicles. It has been estimated that investment deductions were more than 1% of government revenue from direct taxation in 1967 and 1968. (b) The second category of allowances is derived from the fact that profits as calculated by the taxman differ from those compiled by the
accountants of the firm — the data source for the Kenyan sample. This had the effect of producing a negative allowance figure for a number of firms. This explains why some firms in Kenya paid more than half of their reported gross profits figure in tax even though the company income tax rate was 45%.

VI. THE STATISTICAL RESULTS FOR KENYA

A. The Shifting Model As a Whole

The 2SLS regression estimates of equations (16), (18), and (20) are presented below:

<table>
<thead>
<tr>
<th>TABLE 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>2SLS Estimates of Equations (16), (18), and (20)</td>
</tr>
<tr>
<td>(&quot;t&quot; values in brackets)</td>
</tr>
</tbody>
</table>

\[
\begin{align*}
\pi^a &= -975.515 + 3263.47X_3^2 + 1.107^{p^a} + 2.295^{p^e} \\
& (-1.690) \quad (1.862) \quad (5.257) \quad (3.431) \\
\bar{R}^2 &= 0.984 \\
\text{Instruments Used: } &X_1, X_2, X_4, A, E.
\end{align*}
\]

\[
\begin{align*}
\pi^a &= -502.641 + 2589.117X_3^2 + 0.888^{p^a} + 1.223^{p^e} + 0.018^{p^e} \hat{X}_1 \\
& (-1.118) \quad (3.002) \quad (6.863) \quad (2.107) \quad (2.631) \\
\bar{R}^2 &= 0.991 \\
\text{Instruments Used: } &X_1, X_2, X_4, A, E, AX_1
\end{align*}
\]

\[
\begin{align*}
\pi^a &= -97.651 + 3599.707X_3^2 + 0.0101^{p^a} \hat{X}_1 + 0.029^{p^e} \hat{X}_1 \\
& (-0.178) \quad (2.975) \quad (4.350) \quad (4.942) \\
\bar{R}^2 &= 0.982 \\
\text{Instruments Used: } &X_1, X_2, X_4, A, E, AX_1, EX_1.
\end{align*}
\]

Table I shows that about 98% of the variation in gross profits of Kenyan firms in 1974 could be explained by supply variables and the two taxes. The "F" values for these equations are significant at well within the 1% level, so the results are unlikely to have been chance outcomes.

Given the importance of \( A \) and \( E \) in obtaining these results, it is necessary to confirm that they are in fact "good" instruments for the tax variables. To qualify as
good instruments two conditions need to be satisfied: (i) that the instruments be highly correlated with the tax variables and (ii) that the instruments be uncorrelated with the random disturbance term. Both these conditions were satisfied by $A$ and $E$ for the Kenyan data. The zero-order correlation coefficient between $A$ and $T^c$ was 0.43 and that between $E$ and $T^s$ was (--)$0.74$. And when the complete set of instruments were regressed against the residuals of (16.1), (18.1), and (20.1), in each case the "F" value was such that one could not (at the 5% level) reject the null hypotheses of there being no correlation between the set of instruments and the residuals.

B. The Profits Hypotheses ($\pi^0$)

Only firm size ($X_j$) had a significant influence on the dependent variable and then only at the 10% level. The Kenyan data produced the result that the variables used to explain $\pi^0$ had also a role to play in explaining profits in the presence of taxes. The mechanism through which this interrelation took place was via the size of the firm. Firm size was associated with the extent of price control as well as the size of allowances. For this reason then, firm size appears as an endogenous variable in the results. The three other $X$ variables therefore play an indirect role in the model by acting as instruments for firm size.

C. The Tax Variables and Tax Instruments

The tax variables via allowances and exemptions were always significant at above the 1% level. It turned out that results were better when $E$ was used rather than (C-E). This was because $E$ was less correlated than (C-E) with the variables in the system as a whole.

D. The Shifting Estimates

The estimates of tax shifting from equations (16.1), (18.1), and (20.1) are drawn together in Table 2.

<table>
<thead>
<tr>
<th>Equation</th>
<th>Sales Tax Shifting</th>
<th>Income Tax Shifting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$d_s$</td>
<td>$d_c$</td>
</tr>
<tr>
<td>(16.1)</td>
<td>1.11</td>
<td>2.30</td>
</tr>
<tr>
<td>(18.1)</td>
<td>0.89</td>
<td>1.22</td>
</tr>
<tr>
<td>(20.1)</td>
<td>0.59</td>
<td>1.71</td>
</tr>
</tbody>
</table>
The regression coefficients of $\hat{\beta}^s$ and $\hat{c}$ in (16.1) and (18.1) directly indicate the shifting estimates. For (20.1) the coefficients of $\hat{\beta}^s X_1$ and $\hat{c} X_1$ need first to be multiplied by the average value of $X_1$ found in the sample — for Kenya, 58.91.\textsuperscript{10}

Table 2 can be used to test the \textit{a priori} expectations of tax shifting. The expectation was that the income tax would be zero shifted and this is clearly rejected by the Kenyan data. But the estimates are consistent with the hypothesis that the sales tax would be shifted by a positive amount.

The problem with equations (18.1) and (20.1) is that the cross-product terms $T^s \hat{X}_1$ and $T^c \hat{X}_1$ were highly correlated, both between themselves and with the concentration ratio, $X_1$.\textsuperscript{11} For this reason, the two hypotheses concerning taxes and concentration, in terms of the mechanism of shifting, could not be fully tested using the Kenyan data.\textsuperscript{12} While severe multicollinearity makes it unwise to draw conclusions about values of individual tax coefficients, something useful can still be said about the hypotheses from the point of view of the combined effect of the two taxes:

(i) Equation (18.1) includes the single cross-product $T^c \hat{X}_1$ in the same equation as the two tax variables. Without placing any stress on the fact that this cross-product relates to the company income tax, one can say that (18.1) supplies evidence that taxes in Kenya played some role in encouraging firms to use their market power slack to recoup the sums paid to the tax authorities. For the coefficients of both $T^s$ and $T^c$ are smaller with the cross product term than without it — see equation (16.1).

(ii) Equation (20.1) includes two cross-product terms $T^s \hat{X}_1$ and $T^c \hat{X}_1$ instead of the tax variables $\hat{\beta}^s$ and $\hat{c}$. Since (20.1) is not a more significant relationship than (16.1), one cannot claim that the cross-products are primary to estimating shifting and the taxes secondary. This means that it does not necessarily lead to biased estimates of tax shifting if one neglects to introduce variables that give explicit recognition to the fact that shifting itself may be determined by the extent of market concentration.

VII. CONCLUSIONS

The cross-section framework for estimating jointly the extent of shifting of sales and company income taxes centres on the use of tax allowances and exemptions acting as instruments for the endogenous tax variables. The application of this framework to Kenya in 1974, where profits in the absence of tax were explained by supply variables, produced the result that the sales tax was fully shifted and the company income tax was over fully shifted. In a static model, the existence of over-
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of taxes. But, there was evidence to suggest that firms were stimulated into profit maximising behaviour by the taxes themselves.

NOTES

* I wish to thank Mike Wickens of Essex for assistance in dealing with numerous econometric problems, and Martin David of Wisconsin for suggesting that cross-products between taxes and concentration could be used to help unravel the effect of concentration on the mechanism of shifting. A debt is also owed to M.J. Westlake for providing helpful comments on the original working paper.

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1 The argument used here relating to the incidence of the sales tax within a Harberger-type model makes use of the ideas expressed in McClure [7].

2 It is important to recognise the different effects that follow from assuming one or both factors immobile. This article assumes both capital and labour to be immobile in the short-run. As a consequence, supply is perfectly inelastic and factors bear the full income loss of a tax. Musgrave and Musgrave [8] on the other hand, in what they call the partial equilibrium effects of a selective sales tax, treat only capital (firms) as fixed. Supply is allowed to take on positive elasticities and in these circumstances the elasticity of demand has a role to play in determining the income effects of the tax.

3 The result that one can avoid looking at the income uses side can also be achieved by assuming, as with Musgrave, that there is a random relationship between the industry in which a person earns his income and the industries on which he spends his income. But, unlike the assumption used in the text, there is no good reason why it should hold generally in developing countries.

4 The order condition for (1) to be exactly identified is that there be two variables in the system excluded from this equation. $A$ and $(C-E)$ are these two variables.

5 Although all three variables on the right hand side of (13) are endogenous, $A$ can still be regarded as exogenous if their random elements cancel out.

6 Apart from $X_1$ all the $X$ variables were specified as dummy variables. $X_1$ is the concentration ratio allowing for competition from abroad, and the index is as defined in House [5]. He has kindly provided me with the 1974 version of his index. The extent of price control, $X_2$ was gauged by whether the firm was in an industry which was subject to "selective" price control. Technically, all firms in Kenya are subject to price control, and firms must apply to the price commission if they wish to raise their prices. This system can be called "general" price control. However, there were a number of industries whose products are thought to constitute essentials for low income earners, and their prices are more closely regulated. They were: soap, beef, soft drinks, cement, and wines and spirits. Firm size, $X_3$, was according to the number of employees. Finally, $X_4$ was according to whether the firm was a "multinational corporation" or not. The definition used was a very broad one and relates to firms that were owned by, subsidiaries of, or affiliates of, firms established outside of East Africa.

The full specifications of those variables were therefore:

$X_1$: Percentage of total industry output and imports produced by the three largest firms in the industry.

$X_2$: Dummy Variable:

$X_2 = 1$ when the firm is in one of the five industries subject to selective controls.

$X_2 = 0$ for all other firms.
$X_3$: Four Dummy Variables:

(i) $X_3^1 = 1$ when the firm employs over 500 persons;
    $X_3^1 = 0$ for all other firms.

(ii) $X_3^2 = 1$ when the firm employs over 199 persons;
    $X_3^2 = 0$ for all other firms.

(iii) $X_3^3 = 1$ when the firm employs over 99 persons;
    $X_3^3 = 0$ for all other firms.

(iv) $X_3^4 = 1$ when the firm employs over 49 persons;
    $X_3^4 = 0$ for all other firms.

$X_4$: Dummy Variable

$X_4 = 1$ when the firm is a "multinational";
$X_4 = 0$ for all local firms.

7 It is useful for all firms to be faced with a common rate, but not essential. A firm in an industry with a
    sumptuary rate can be regarded as a firm with a negative exemption.

8 See I.L.O. [6, p. 438].

9 This second category of allowances would clearly not be necessary if the researcher had permission,
    unlike the author, to consult the actual company tax returns.

10 This uses the relation expressed in equation (19).

11 The zero-order correlation between the two cross-products was 0.92; between $T^iX_i$ and $X_1$ the
    correlation was 0.34 and between $T^iX_1$ and $X_i$ it was 0.40.

12 Equation (18) was not fully tested because it was not possible to include taxes with the cross-
    products and avoid multicollinearity problems. Equation (20) had the problem of trying to include $X_1$
    with the cross-products. See also note 11.

REFERENCES

    Development Studies, University of Nairobi, November, 1976.


SHIFTING OF SALES AND COMPANY INCOME TAXES: KENYA


Summary: A Cross-section Framework for Estimating Jointly the Extent of Shifting of Sales and Company Income Taxes, with an Application to Kenya. The objective is to establish a framework for estimating tax shifting that incorporates both the company income and sales taxes, which is simple, general and avoids the use of unsatisfactory estimation techniques. The extent of shifting is to be gauged by looking at profits with and without taxes. Because taxes are endogenous it is necessary to obtain satisfactory instruments for them. By outlining the factors upon which such taxes depend, it is possible to derive the reduced form for profits as a function of the exogenous variables in the system. Two of these variables, income tax allowances and sales tax exemptions, can then be used to play the role of the tax variables. The resulting shifting model is a cross-section analysis using two stage least squares for estimation. The framework was then applied to Kenya 1973-74. A simple Harberger-type model was used to generate expectations about the size of the shifting parameters and these were tested for a sample of 34 Kenyan firms. For Kenya, where profits in the absence of taxes were explained by supply variables, the result was that the sales tax was fully shifted and the company income tax was over-fully shifted. Additionally, some attempt was made to uncover the mechanism of shifting. In a static model, the existence of over-full shifting in Kenya questions whether firms try to maximise profits in the absence of taxes. But there was evidence to suggest that firms were stimulated into profit maximising behaviour by the taxes themselves.

Résumé: Une méthodologie transversale pour l’estimation jointe de l’importance du déplacement de l’impôt sur le chiffre d’affaires et sur les bénéfices des sociétés, avec une application au Kenya. L’objectif est d’établir une méthodologie pour l’estimation des déplacements d’impôts qui incorpore à la fois les impôts sur les chiffres d’affaires et sur le bénéfice des sociétés et qui est à la fois simple, générale tout en évitant l’utilisation des techniques d’estimation non satisfaisantes. L’importance de ce rapport doit être mesurée à partir des profits bruts et nets d’impôts. Les taxes étant endogènes, en explicitant les variables dont elles dépendent, il est possible de dériver la forme réduite pour les profits en fonction des variables exogènes du système. Deux de ces variables, les dégrèvements d’impôts sur le revenu et les exemptions d’impôts sur le chiffre d’affaires, peuvent donc être utilisées pour jouer le rôle de variables fiscales. Le modèle de déplacement d’impôt qui en résulte est une analyse transversale utilisant la méthode des doubles moindres carrés comme méthode d’estimation. La méthode a été appliquée au Kenya pour la période 1973-1974. Un modèle simple de type Harberger fut utilisé pour engendrer des anticipations sur les ordres de grandeur des paramètres de déplacements et ceux-ci furent testés sur un échantillon de 34 firmes kenyanes. Pour le Kenya, où les profits, en l’absence d’impôts, sont expliqués par des variables d’offre, les résultats montrent que les taxes sur les chiffres d’affaires furent entièrement déplacées et que l’impôt sur le bénéfice des sociétés fut plus que reporté. De plus, des tentatives furent faites pour découvrir le mécanisme de ce déplacement. Dans un modèle statique, l’existence de ce deuxième type de déplacement, au Kenya, pose la question de savoir si les firmes essaient de maximiser le profit en l’absence d’impôts. Certains faits suggèrent que les firmes sont stimulées à suivre un comportement de maximisation de profit par l’existence même de ces impôts.