Corporate Taxation and Dividend Behaviour
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# Corporate Taxation and Dividend Behaviour [1]

There is now a substantial body of theory and evidence to suggest that corporate investment is responsive to changes in retained earnings. If this inference is correct, tax policies that are able to influence the level and timing of corporate saving may have important effects on economic growth and stability. Until 1958, the structure of British profits taxation provided strong incentives for corporate saving by taxing dividends at a substantially higher rate than retained earnings. The purpose of this paper is to estimate the magnitude and time profile of the impact of changes in the tax incentive.

More specifically, until 1958 all corporate profits were subject to two taxes: an income tax (at a rate which varied after 1950 between 42·5 and 47·5 per cent) and a profits tax, assessed at one rate on retained earnings (varying between 2·5 and 10 per cent) and a higher rate on dividends (varying between 22·5 and 50 per cent). A useful measure of the retention incentive provided by the differential between the profits tax rates is the implied opportunity cost of retained earnings in terms of foregone net dividends. For example, in the year before the abolition of the differential, a company could choose between retaining £1 or paying £0·68 of net dividends.[2] In the next year, a pound of retained earnings had an opportunity cost of one pound of dividends, nearly 50 per cent higher.

In spite of this apparently very strong incentive, there has been substantial disagreement about the effectiveness of the tax differential. The debate was launched by the Royal Commission on the Taxation of Profits and Income [19]. The majority of the Commission concluded that the differential tax had not been very effective (para. 537) while the dissenting opinion sought to prove the opposite (paras. 101-102). Several years after the tax differential had ended, Rubner [20] examined three-year moving averages of dividend-profit ratios for the period 1949 to 1961 in an attempt to show that abolishing the differential had had no effect. But his use of moving averages provided only one observation (for 1959-1961) that was entirely in the post-abolition period. When we recognize the possibility of a lag in the dividend response, it is not surprising that Rubner's evidence is inconclusive.[3] More recently, Paish [18] has argued that the incentive had little effect while Williams [24] has reached the opposite conclusion.

One reason for so much disagreement is that none of the previous attempts to assess the tax impact used estimated models of dividend or corporate savings behaviour. It was therefore difficult to distinguish tax-induced changes in the dividend-profit ratio from the natural cyclical changes that result from the lag between dividends and income. The current paper investigates the tax effect in the framework of a dynamic model of dividend behaviour. Section 1 discusses the specification of the model. Estimation problems are considered in Section 2. The results with aggregate data for all industries are analyzed

[1] I am grateful for research assistance by Mrs. Janet Hornby and for comments on earlier versions presented at seminars at Oxford, Cambridge and Harvard Universities and the London School of Economics.

[2] This opportunity cost is calculated on the assumption that the shareholder pays income tax at the "standard rate". For surtax payers, the opportunity cost is less while for those who pay less than standard rate, the opportunity cost is more. See below, page 58.

[3] For a fuller discussion of Rubner's work and some preliminary estimates of a simple dynamic dividend model, see Feldstein [8].

in Sections 3 and 4. Separate results for several individual industries are presented in Section 5. The concluding section considers some of the broader policy implications of this work.

## 1. A MODEL OF DIVIDEND BEHAVIOUR

The dividend equations estimated in this paper are generalizations of the model originally suggested by Lintner [12]. The basic components of such a model are (1) an equation defining the firm's "optimum" amount of dividends in the current period ($D_t^*$) and (2) a dynamic adjustment equation describing how dividends change when the current optimum dividend level is not equal to the actual dividends in the preceding period. The specification of these two equations will now be discussed.

Denoting a particular level of dividends as the "optimum " is not meant to imply any particular objective function for corporate management. Although the optimum dividend equation is consistent with the assumption that management decisions reflect the interests of the typical shareholder, it is not so precisely defined that it precludes more general behavioural assumptions. More specifically, we shall assume that $D_t^*$ reflects the firm's "permanent" or "trend" level of income ($Y_{pt}$), the tax-determined opportunity cost of one pound of retained earnings in terms of the foregone net dividends ($\theta_t$),[1] and a stochastic disturbance $U_t$.

The form of the optimum dividend equation

$$D_t^* = AY_{pt}^{\alpha}\theta_t^{\beta}U_t \qquad \ldots(1)$$

implies a constant elasticity ($\alpha$) of $D_t^*$ with respect to income and a different constant elasticity ($\beta$) with respect to the opportunity cost of retained earnings. A change in $\theta$ thus changes the optimum ratio of dividends to income at any level of income but does not change the elasticity of dividends with respect to income. Moreover, if $\alpha = 1$, the ratio of optimum dividends to income ($D_t^*/Y_{pt}$) is independent of the level of income.[2]

Two problems arise in measuring a firm's "permanent income". First, how should income be defined? Second, how should *permanent* income be approximated? Three alternative income definitions are investigated in the paper: (1) net profits after tax and depreciation (i.e., net earnings available for common stockholders); (2) gross profits before tax and depreciation; and (3) maximum possible net profits.[3] To approximate permanent income, the paper supplements the current income level with information on the current rate of growth.

The opportunity cost of retained earnings in terms of dividends differed among shareholders, being lower for shareholders with high marginal rates of income tax than for those in low income tax brackets. But although the British income tax is highly progressive in its overall structure, there is a very wide range over which the marginal tax rate is constant at what is known as the "standard rate". Although some dividend recipients are surtax payers, others pay no income tax at all (e.g., non-profit institutions); as a compromise, the standard rate of income tax is used in this study. A further justification for this simplification is that the firms distributed dividends net of income tax at the

[1] The variable $\theta$ is defined by $\theta = (1-t_y)\,(1+t_d-t_y-t_u)^{-1}$ where: $t_u$ = tax rate on undistributed profits; $t_d$ = tax rate on distributed profits; $t_y$ = "standard rate" of income tax. The use of the standard rate is explained in the final paragraph on this page. The values of the three tax rates are those applicable to profits and dividends earned and paid in the observation period and not necessarily the rates actually prevailing during the quarter. Note that $\theta$ also measures the ratio of maximum net dividends to maximum net retentions.

[2] This interpretation also implies that gross company income is not a function of the tax rates. If tax shifting is important, the coefficient $\theta$ measures only the partial effect due to tax-induced changes in the relative cost of retained earnings.

[3] Maximum net profits are equal to maximum possible retained earnings, since the firm minimizes its tax by distributing nothing.

standard rate and were therefore likely to think of this as the amount foregone by shareholders if retained earnings were increased.

Equation 1 implies that only the current tax rates influence $D_t^*$. However, an anticipated increase in $\theta$ during the next year would be expected to raise $D_t^*$. Some of the estimated models include the variable $\theta_{t+1}^e/\theta_t$ in the optimum dividend equation, where $\theta_{t+1}^e$ is the value of $\theta$ that could be expected to prevail in year $t+1$ based on information available in year $t$. The variable $\theta_t/\theta_{t-1}$ was also included in some models to investigate whether the optimum dividend level responded immediately to a change in the tax variable.

Although including dynamic variables in an equation which defines an optimum is unusual, it is not inconsistent with the definition of an optimum level. In defining $D_t^*$ no reference is made to a long-run value toward which dividends would eventually converge. Rather, $D_t^*$ is defined as the dividend level toward which firms would adjust in period $t$.

The dynamic adjustment equation specifies how firms respond (in the aggregate) to a difference between $D_t^*$ and $D_{t-1}$ by changing the dividend level toward $D_t^*$. For several reasons, the entire difference is not eliminated immediately. First, individual firms are uncertain about the optimum level of dividends and may therefore not change dividends unless the difference between $D_t^*$ and $D_{t-1}$ is substantial or sustained. Second, a rise in dividends could reduce the internal availability of funds required for investment that is already committed. Similarly, a sharp fall in dividends would produce internal funds for which there might be no immediate use. Finally, because firms are notoriously reluctant to lower dividends, if $D_t^* < D_{t-1}$ they may wait until rising income increases $D_t^*$ while if $D_t^* > D_{t-1}$ they may hesitate to raise dividends because they fear that the rise in optimum dividends is only temporary. This delayed response will be approximated by the partial adjustment model:

$$\frac{D_t}{D_{t-1}} = \left[\frac{D_t^*}{D_{t-1}}\right]^{\lambda} V_t, \qquad \ldots(2)$$

where $\lambda$ is the response elasticity and $V_t$ is a stochastic disturbance. Substituting equation 1 into equation 2 and taking logarithms yields (writing lower-case letters for logarithms of the corresponding upper case variables):

$$d_t - d_{t-1} = \lambda a + \lambda \alpha y_{pt} + \lambda \beta \theta_t - \lambda d_{t-1} + w_t, \qquad \ldots(3)$$

where $w_t = \lambda u_t + v_t$. More generally, the dividend equation is given by:

$$d_t - d_{t-1} = \lambda a + \lambda \alpha_0 y_t + \lambda \alpha_1 (y_t - y_{t-1}) + \lambda \beta_0 \theta_t + \lambda \beta_1 (\theta_{t+1}^e - \theta_t) + \lambda \beta_2 (\theta_t - \theta_{t-1}) - \lambda d_{t-1} + w_t. \qquad \ldots(4)$$

## 2. ESTIMATION METHODS

Because the explanatory variables of the dividend behaviour equations include a lagged dependent variable,[1] ordinary least squares parameter estimates will be both biased and inconsistent if the disturbance term is autocorrelated (Griliches [9]; Koyck [11]; Orcutt and Cochrane [17]). Moreover, the Durbin-Watson statistic does not provide an adequate test of the serial correlation of the disturbances, being asymptotically biased toward 2 (the value which indicates no serial correlation) (Griliches [9]; Malinvaud [14]; Nerlove and Wallis [16]).

Three different consistent methods are used in this paper to estimate the dividend behaviour equations. The first of these is an instrumental variable procedure. The

[1] It is obvious that equation 3 can be rewritten with $d_t$ as the dependent variable and $(1-\lambda)$ as the coefficient of $d_{t-1}$, without changing any of the parameter estimates.

other two, quasi-generalized least squares and augmented least squares, are more novel and will be described below.[1]

The analysis of this section and the results presented in the following sections are based on the assumption that the income variables (as well as the tax variables) are exogenous. The exogeneity of income rests on two underlying assumptions: that current dividends do not directly influence current profits, and that the disturbances in the dividend and profit equations are uncorrelated. Although these are reasonable assumptions for gross profits,[2] they are less acceptable for the most economically relevant definition: profits net of depreciation, tax and preferred dividends, i.e., net profit available for common stockholders.[3] Fortunately, the evidence discussed below for all three income measures is mutually reinforcing.

## 2.1. *Instrumental Variables*

Liviatan [13] has noted that a consistent estimate of a lagged dependent variable equation with autocorrelated disturbances can be obtained by using an instrumental variable method. If the equation to be estimated is of the form

$$y_t = \beta_0 + \beta_1 x_t + \beta_2 y_{t-1} + u_t, \qquad \ldots(5)$$

Liviatan proposes the use of $x_{t-1}$ as an instrumental variable for $y_{t-1}$. If the instrumental variable calculation is described as a two-stage least squares procedure, the first stage of Liviatan's method is to estimate (by ordinary least squares) the coefficients of

$$y_{t-1} = \alpha_0 + \alpha_1 x_t + \alpha_2 x_{t-1} + \xi_t, \qquad \ldots(6)$$

and to calculate the values of $\hat{y}_{t-1} = \hat{\alpha}_0 + \hat{\alpha}_1 x_t + \hat{\alpha}_2 x_{t-1}$. In the second stage the coefficients of

$$y_t = \beta_0 + \beta_1 x_t + \beta_2 \hat{y}_{t-1} + \varepsilon_t \qquad \ldots(7)$$

are estimated by ordinary least squares. As instrumental variable estimators, these are consistent estimates of $\beta_0$, $\beta_1$ and $\beta_2$ (Sargan [21]).

Moreover, although Liviatan did not deal with the properties of the calculated residuals ($\hat{\varepsilon}_t = y_t - \hat{\beta}_0 - \hat{\beta}_1 x_t - \hat{\beta}_2 \hat{y}_{t-1}$), it is clear that any rational function of the $\hat{\varepsilon}_t$'s is a consistent estimate of the corresponding function of the $\varepsilon_t$'s. More specifically, the large sample autocorrelation coefficients of the $\hat{\varepsilon}_t$'s are consistent estimators of the autocorrelation of the $\varepsilon_t$'s.[4] In particular, if $d^*$ is the Durbin-Watson statistic calculated from these residuals, then $1 - d^*/2$ is a consistent estimate of the first-order autocorrelation of the $\varepsilon_t$'s. Although the Durbin-Watson test is not strictly applicable to the residuals of an equation estimated by instrumental variables, for large samples $1 - d^*/2$ may be treated as an ordinary correlation coefficient (Hannan [10], p. 85). This is in direct contrast with the situation when the Durbin-Watson statistic is obtained for the residuals from an ordinary least squares estimate of a lagged dependent variable equation. Of course, if the $\varepsilon_t$'s are serially dependent, as would be expected if the $u_t$'s are autocorrelated, the

[1] If the disturbances are normally distributed, maximum likelihood estimates can be obtained either by a Newton-Raphson iterative procedure (Sargan, [22]) or, more easily, by a one-dimensional search over sufficiently finely spaced values of the autocorrelation coefficient between $-1$ and $+1$. Although it is in principle desirable to obtain maximum likelihood estimates, the procedure requires substantially more computational work than the sequential procedures that have been used in this paper. In particular, investigating the possibility of a higher than first degree autocorrelation requires a vast increase in the number of grid points to be investigated or a substantial increase in the size of the Newton-Raphson problem. The advantage of maximum likelihood estimation, which in this case is primarily the full asymptotic efficiency property, was considered insufficient to outweigh these computational disadvantages.

[2] Strictly speaking, because of autocorrelated disturbances the exogeneity of current profits requires that the disturbance in the profits equation be independent of all lagged disturbances in the dividend equation.

[3] The central role of this measure of income as the basis on which to determine dividends is indicated by its name in British financial circles, " net earned for ordinary " (i.e., for ordinary shareholders rather than preferred).

[4] We assume here, as throughout, that the disturbances are of constant variance.

standard errors and variance components of equation 7 are asymptotically biased. Evidence that the $\varepsilon_t$'s are autocorrelated should serve as a warning against the use of confidence intervals or significance tests defined in the usual way.

A second serious drawback is that the instrumental variable method will generally lead to a loss of efficiency. First, serial correlation of the $\varepsilon_t$'s reduces the efficiency of the parameter estimates for any given choice of instrument. Second, when the $u_t$'s are serially independent, the use of the instrumental variable method reduces efficiency in comparison to ordinary least squares. The efficiency of instrumental variables in the absence of autocorrelated diturbances will depend on the partial correlation between $\hat{y}_{t-1}$ and $y_{t-1}$ given $x_t$. Malinvaud ([15], p. 477) reported that the Liviatan procedure increased standard errors by an average of 50 per cent in sampling experiments with twenty observations; unfortunately, no information was given about the partial correlation of the instrument. Two methods of increasing the large sample efficiency of consistent parameter estimates will now be presented.

## 2.2. *Quasi-Generalized Least Squares*

If $\hat{u}_t$ is defined by $\hat{u}_t = y_t - \hat{\beta}_0 - \hat{\beta}_1 x_t - \hat{\beta}_2 y_{t-1}$, i.e., as the residuals calculated for equation 5 using the consistent parameter estimates of equation 7, sample autocorrelation coefficients of the $\hat{u}_t$'s are consistent estimates of the population autocorrelation coefficients of the $u_t$'s. These can be used to transform the original variables in a manner analogous to generalized least squares estimation. To consider a specific example, if the $\hat{u}_t$'s indicate only a first order autocorrelation ($u_t = \rho u_{t-1} + \omega_t$), ordinary least squares could be applied to the transformed equation:

$$y_t - \hat{\rho} y_{t-1} = \beta_0 + \beta_1 (x_t - \hat{\rho} x_{t-1}) + \beta_2 (y_{t-1} - \hat{\rho} y_{t-2}) + \omega_t. \qquad \ldots(8)$$

The estimates of $\beta_1$ and $\beta_2$ would be consistent and, in large samples, could be expected to have greater efficiency than instrumental variable estimates. Because the regressors include a lagged endogenous variable, these estimates will not have full asymptotic efficiency (Amemiya and Fuller [2]). However, Monte Carlo experiments with samples of size 50 support the assumption that this method yields more efficient parameter estimates than the instrumental variable method and reduces the bias in the standard errors (Wallis [23]).

In applying this method in the current study, the order of serial correlation in the disturbances was determined by comparing equations of the forms

$$\text{(i)}\ u_t = \rho_1 u_{t-1} + \rho_4 u_{t-4} + \omega_t,$$

$$\text{(ii)}\ u_t = \sum_{j=1}^{N} \rho_j u_{t-j} + \omega_t, \text{ and}$$

$$\text{(iii)}\ u_t = \rho_N u_{t-N} + \omega_t,$$

with $N$ taking the values one through four, and selecting the form with the highest multiple correlation coefficient ($\bar{R}$).

## 2.3. *Augmented Least Squares*

Because the generalized least squares method is not fully efficient even in large samples, an alternative and computationally easier procedure was also studied. If equation 5 is rewritten in a way which explicitly recognizes the $N$th order autocorrelation structure of the disturbance,

$$y_t = \beta_0 + \beta_1 x_t + \beta_2 y_{t-1} + \sum_{j=1}^{N} \rho_j u_{t-j} + v_t, \qquad \ldots(9)$$

it is immediately clear that the asymptotic bias that occurs when ordinary least squares is applied to equation 5 is due to the mis-specification of omitting variables ($u_{t-j}$'s) that are correlated with an explanatory variable (Griliches, [9]). This suggests that consistent parameter estimates can be obtained by augmenting the original data matrix with columns containing estimates of the lagged disturbances. More specifically, augmented least squares (ALS) estimates are defined as the ordinary least squares estimates of

$$y_t = \beta_0 + \beta_1 x_t + \beta_2 y_{t-1} + \sum_{j=1}^{N} \rho_j \hat{u}_{t-j} + \eta_t, \qquad \text{...(10)}$$

where $\hat{u}_t$ is defined in the beginning of section 2.2.

Although ALS can be shown to be consistent,[1] no specific analytic result about the efficiency of ALS is available. It should be more efficient than the instrumental variable estimation procedure for three reasons. First, equation 10 is estimated by ordinary least squares rather than instrumental variables. Second, the estimation equations contain more information (the $\hat{u}_{t-j}$'s). Third, the $\eta_t$'s should have little or no serial correlation. It is also clear from the form of the proof presented in the appendix that if $v_t$ in equation 9 and $\eta_t$ in equation 10 are not autocorrelated, the standard errors of the ALS estimates are asymptotically unbiased.

In practice, the number of lagged disturbances in equation 10 ($N$) was determined by comparing equations with values of $N$ between 0 and 4, selecting the one with the highest adjusted multiple correlation coefficient ($\bar{R}$).[2]

## 3. SOME BASIC RESULTS

The dividend equations described in section 1 were estimated with quarterly data for the period from January 1953 through December 1964. The data, derived from the summary of company accounts published monthly in the *Financial Times*, relates to all industrial companies whose financial year ended in that quarter. Lagged values such as $D_{t-1}$ and $Y_{t-1}$ therefore refer to the dividends and income reported one *year* before by those companies.[3]

Table I presents coefficients of the basic dividend model (equation 3) estimated by ordinary least squares (OLS), instrumental variables (IV), quasi-generalized least squares (GLS) and augmented least squares (ALS). The equilibrium elasticities of dividends (i.e., the elasticities of the optimum dividend level, $D_t^*$) with respect to income and to the opportunity cost of retained earnings, and the time profiles of these elasticities, are also presented. The income variable is here defined as net profits after tax, depreciation and preferred dividends (i.e., net profits available for common stockholders).

Casual inspection of Table I indicates that the estimates are approximately the same with all four estimation methods. Detailed discussion of the parameter values will therefore be limited to the simplest of the consistent estimators (instrumental variables). A brief comparison with the other methods will then follow.

The impact elasticity of dividends with respect to income is 0·412 ($\lambda\alpha$). A consistent estimate of the corresponding equilibrium elasticity with respect to income, is obtained by dividing the impact elasticity by the estimated response elasticity ($\lambda$). Although the resulting point estimate of $\alpha$, 0·951, indicates that the optimum ratio of dividends to income declines slightly as income increases, the standard errors of $\lambda\alpha$ and $\lambda$ imply that the coefficients are quite compatible with a constant optimum ratio ($\alpha = 1$).

The impact elasticity of dividends with respect to a tax-induced change in the opportunity cost of retained earnings is 0·389. The relatively small standard error (0·052),

1 A duplicated proof of consistency is available from the author.

2 Two alternative forms were also considered. The first included $\hat{u}_{t-1}$ and $\hat{u}_{t-4}$; the second included only $\hat{u}_{t-4}$.

3 The 44 quarterly observations are therefore actually four temporally interrelated samples of eleven observations each. Using seasonal dummy variables had little effect on the coefficients. Similarly, preliminary estimates with four separate series also supported the assumption that pooling all 44 observations would not distort the results.

although possibly biased downward because of the serial correlation of the disturbances, leaves little doubt about the statistical significance of the tax effect. The estimated equilibrium elasticity is 0·898. These elasticities imply that the differential rates of profit tax had a substantial impact on dividend behaviour. The abolition of the differential in 1958 increased the value of $\theta$ from 0·68 to 1·00. This increase in $\theta$ of nearly 50 per cent implied that the optimum ratio of dividends to income rose by more than 40 per cent. In the first year, dividends would be expected to rise by more than 15 per cent.

The speed of adjustment parameter ($\lambda = 0{\cdot}433$) indicates that, for small relative differences between $D_t^*$ and $D_{t-1}$, approximately 43 per cent of the difference is removed

TABLE I

*The basic dividend model: alternative estimation methods*

| Estimation method | OLS | IV | GLS | ALS |
|---|---|---|---|---|
| Coefficients | | | | |
| *(Impact Elasticities)* | | | | |
| $\lambda\alpha$ ($y$) | 0·387 | 0·412 | 0·336 | 0·381 |
| | (0·042) | (0·044) | (0·045) | (0·040) |
| $\lambda\beta$ ($\theta$) | 0·369 | 0·389 | 0·340 | 0·350 |
| | (0·051) | (0·052) | (0·057) | (0·050) |
| $\lambda$ ($-d_{-1}$) | 0·407 | 0·433 | 0·363 | 0·388 |
| | (0·042) | (0·044) | (0·046) | (0·041) |
| *Equilibrium Elasticities* | | | | |
| $\alpha$ ($y$) | 0·951 | 0·951 | 0·926 | 0·982 |
| $\beta$ ($\theta$) | 0·907 | 0·898 | 0·937 | 0·902 |
| *Time Profile Elasticities* | | | | |
| *Income* | | | | |
| 1 year | 0·38 (40) | 0·40 (42) | 0·33 (35) | 0·37 (38) |
| 4 years | 0·83 (87) | 0·85 (89) | 0·76 (83) | 0·84 (85) |
| *Tax* | | | | |
| 1 year | 0·36 (40) | 0·38 (42) | 0·33 (35) | 0·34 (38) |
| 4 years | 0·79 (87) | 0·80 (89) | 0·78 (83) | 0·77 (85) |
| $\bar{R}^2$ | 0·688 | 0·694 | 0·601 | 0·717 |
| *DWS* | 1·35 | 1·31 | 1·69 | 1·94 |

Income Variable: Net Profits after Tax, Depreciation and Preference Dividends.
Estimation Method: OLS = Ordinary Least Squares;
IV = Instrumental Variables;
GLS = quasi-Generalized Least Squares;
ALS = Augmented Least Squares.

in the first year. Because the dynamic adjustment model (equation 2) assumes a constant *elasticity* response mechanism, the more usual " proportional correction " measure of the speed of adjustment depends on the relative size of the initial change in the income or tax variable. The " time profile elasticities " presented in Table I relate to 10 per cent changes in $Y$ and $\theta$ and show the corresponding proportional changes after one and four years; the numbers in parentheses express the proportional changes as percentages of the change in the " optimum " dividend level (i.e. the " equilibrium " change). Thus, a 10 per cent increase in the value of $\theta$ yields a 3·8 per cent dividend increase after one year and an 8·0 per cent increase by the end of four years; these are 42 and 89 per cent of the ultimate dividend increase of 9·0 per cent.

Each of the ordinary least squares coefficients is lower than the corresponding instrumental variables estimate. The implied downward bias in the estimate of $\lambda$ corresponds with *a priori* expectations; if the disturbance in equation 4 is positively autocorrelated, the coefficient of $d_{t-1}$ (i.e., $-\lambda$) will be biased upward and therefore the value of $\lambda$ biased downward. The value of the Durbin-Watson statistic (DWS = 1·35) indicates that the disturbances are positively autocorrelated, since correcting for the bias would lower the Durbin-Watson statistic even further. Because the estimates of $\lambda\alpha$ and $\lambda\beta$ were lower than the corresponding instrumental variable estimates in approximately the same proportion as $\lambda$, the estimated equilibrium elasticities were almost the same for both methods.

The quasi-generalized least squares and augmented least squares estimates also support the conclusion that the differential profits tax had a substantial impact on the dividend level. The point elasticities of optimum dividends with respect to $\theta$ exceed

TABLE II

*Alternative dynamic specifications*

| Specification | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|---|
| Estimation method | ALS | ALS | ALS | ALS | IV | IV | IV | IV |
| Coefficients (*Impact Elasticities*) | | | | | | | | |
| $\lambda\alpha_0$ $(y)$ | 0·381 | 0·312 | 0·300 | 0·300 | 0·412 | 0·294 | 0·284 | 0·295 |
| | (0·040) | (0·059) | (0·060) | (0·063) | (0·044) | (0·077) | (0·079) | (0·085) |
| $\lambda\alpha_1$ $(\dot{y})$ | ... | 0·099 | 0·102 | 0·100 | ... | 0·151 | 0·154 | 0·145 |
| | ... | (0·073) | (0·074) | (0·075) | ... | (0·088) | (0·089) | (0·092) |
| $\lambda\beta_0$ $(\theta)$ | 0·350 | 0·298 | 0·278 | 0·277 | 0·389 | 0·288 | 0·271 | 0·285 |
| | (0·050) | (0·059) | (0·063) | (0·069) | (0·052) | (0·074) | (0·078) | (0·086) |
| $\lambda\beta_1$ $(\dot{\theta}_+)$ | ... | ... | −0·070 | −0·068 | ... | ... | −0·064 | −0·042 |
| | ... | ... | (0·070) | (0·086) | ... | ... | (0·081) | (0·098) |
| $\lambda\beta_2$ $(\dot{\theta}_-)$ | ... | ... | ... | −0·011 | ... | ... | ... | −0·118 |
| | ... | ... | ... | (0·259) | ... | ... | ... | (0·298) |
| $\lambda$ $(-d_{-1})$ | 0·388 | 0·318 | 0·305 | 0·305 | 0·433 | 0·315 | 0·303 | 0·316 |
| | (0·041) | (0·060) | (0·062) | (0·066) | (0·044) | (0·080) | (0·082) | (0·089) |
| *Equilibrium Elasticities* | | | | | | | | |
| $\alpha_0$ $(y)$ | 0·982 | 0·981 | 0·984 | 0·984 | 0·951 | 0·933 | 0·937 | 0·934 |
| $\beta_0$ $(\theta)$ | 0·902 | 0·937 | 0·911 | 0·908 | 0·898 | 0·914 | 0·894 | 0·902 |
| *Time Profile Elasticities* | | | | | | | | |
| *Income* | | | | | | | | |
| 1 year | 0·37 (38) | 0·40 (41) | 0·39 (40) | 0·39 (40) | 0·40 (42) | 0·43 (47) | 0·43 (46) | 0·43 (46) |
| 4 years | 0·84 (85) | 0·79 (81) | 0·78 (79) | 0·78 (79) | 0·85 (89) | 0·77 (83) | 0·76 (81) | 0·79 (84) |
| *Tax* | | | | | | | | |
| 1 year | 0·34 (38) | 0·29 (31) | 0·27 (30) | 0·26 (28) | 0·38 (42) | 0·28 (31) | 0·26 (29) | 0·17 (18) |
| 4 years | 0·77 (85) | 0·73 (78) | 0·69 (76) | 0·68 (75) | 0·80 (89) | 0·70 (77) | 0·67 (76) | 0·67 (74) |
| $\bar{R}^2$ | 0·717 | 0·725 | 0·717 | 0·717 | 0·694 | 0·639 | 0·636 | 0·627 |
| *DWS* | 1·94 | 2·00 | 2·00 | 2·05 | 1·31 | 1·34 | 1·33 | 1·34 |

Income Variable: Net Profits after Tax, Depreciation and Preferred Dividends.
Estimation Method: ALS = Augmented Least Squares; IV = Instrumental Variables.

0·9; at least 35 per cent of this reaction occurs in the first year and 85 per cent within four years. The Durbin-Watson statistics indicate that the GLS transformation and the use of ALS both reduce positive serial correlation of the disturbances. Because the ALS method incorporates additional information, it has the highest adjusted multiple correlation coefficient and smallest standard errors.

The estimates shown in Table I all refer to the simplest specification of the optimum dividend equation. Table II compares four alternative dynamic specifications. Both augmented least squares and instrumental variable estimates are shown [1]; income is

[1] For each specification, the ALS estimate has a higher $\bar{R}^2$ than the corresponding IV estimate and a DWS of almost exactly two.

again defined as net profits. Before considering the differences between the eight estimates, we may note that in each case the effect of the tax variable is large, both economically and in relation to its standard error. The estimated impact elasticities range between 0·271 and 0·389; the equilibrium elasticities range between 0·894 and 0·937. It is clear that allowing for more complex dynamic dividend behaviour does not weaken the conclusion that the differential profits tax had a substantial influence on dividend behaviour.

Specifications 2 through 4 introduce the variable $\dot{y} = \log(Y_t/Y_{t-1})$. Each of the estimated coefficients of this variable is positive and larger than its standard error, implying that the firms' " permanent income " is calculated by projecting the recent rate of growth. More specifically, $\alpha_0$ is the elasticity of optimum dividends with respect to the permanent level of income and $\alpha_1/\alpha_0$ is the implied elasticity of " permanent income " with respect to the ratio of current to previous income. For example, using the ALS estimate of specification 2, if $Y_t/Y_{t-1} = 1{\cdot}1$, the firm determines its optimum dividend level with reference to a " permanent income " of $Y_t(1{\cdot}1)^{0{\cdot}099/0{\cdot}312} = 1{\cdot}03\,Y_t$.[1] All six estimates of $\alpha_1/\alpha_0$ indicate that $Y_t/Y_{t-1}$ has only a small effect on implied permanent income; $0{\cdot}32 \leqq \alpha_1/\alpha_0 \leqq 0{\cdot}55$. All of the equations also imply that the elasticity of optimum dividends with respect to income is approximately unity.

The estimates of specifications 3 and 4 indicate that neither an expected future change in the tax $[\dot{\theta}_+ = \log(\theta^e_{t+1}/\theta_t)]$ nor a previous change $[\dot{\theta}_- = \log(\theta_t/\theta_{t-1})]$ had a substantial effect on dividend behaviour. The coefficients are less than their standard errors and the adjusted multiple correlation coefficients are less than those of specification 2. The point estimates of $\lambda\beta_1$ are all of the correct sign (negative), indicating that an expected increase in the opportunity cost of retained earnings causes retained earnings to rise in the current period. Although the estimates of $\lambda\beta_2$ are of the wrong sign, the very low $t$ values (11/259 and 118/298) indicate that this variable ($\dot{\theta}$) has no real effect.

Because of the more complex dynamic structures, the adjustment elasticity parameter ($\lambda$) is no longer an adequate measure of the speed of adjustment. The time profile elasticities for specifications 2 through 4 all indicate that dividends respond more rapidly to income changes than to changes in the tax. The ALS estimates show that 40 per cent of the equilibrium response to a 10 per cent income change occurs in the first year while only 30 per cent of the equilibrium response to a 10 per cent change in $\theta$ occurs in one year. By the end of four years, however, the proportions of the equilibrium responses are nearly equal. Similar but slightly stronger differences are obtained by IV estimation.

The coefficients presented in Tables I and II were all estimated with income defined as profits net of tax, depreciation and preferred dividends. Although this is probably the most appropriate income variable to consider as a determinant of dividends,[2] it has two disadvantages. First, because the amount of tax subtracted in calculating net profits reflected the amount of dividends (until the abolition of the differential profits tax), this income variable is clearly endogenous and the estimated coefficients are therefore biased and inconsistent. Second and more important, the use of the net profits definition blurs the fact that changes in the income and profits tax rates affect dividends through changes in net profits as well as through changes in the opportunity cost of retained earnings.

Table III compares estimates for three different income definitions: net profits; gross profits before tax and depreciation; maximum net profits (i.e. maximum retained earnings). For simplicity, only specification 1 is presented; both ALS and IV estimates are given. The results support the previous conclusions that the elasticity of dividends with respect to $\theta$ is substantial and significant, and that the elasticity of optimum dividends with respect to income is approximately one. Although the impact elasticity with respect to the tax variable is substantially higher when income is measured gross than when it is measured net, the equilibrium elasticities are approximately equal.

1 The positive elasticity of dividends with respect to $(Y_t/Y_{t-1})$ is in contrast to the common assumption that firms determine " permanent income " as a weighted average of current and past income.

2 See footnote 3, page 60.

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However, when the maximum possible profit measure of income is used, a striking and suggestive result appears. Although the estimated response elasticity ($\lambda$) and income impact elasticity ($\lambda\alpha$) are almost identical with those of the net profit equation, the impact and equilibrium tax elasticities are nearly 40 per cent higher. This difference implies that, during the period under study, tax changes which increased the opportunity cost of retained earnings simultaneously decreased the maximum net profits associated with any given gross profits. The observed changes in dividends therefore reflected a balancing of these two countervailing forces. The implications of this are developed in the next section.

TABLE III

*Alternative income definitions*

| Income definition | Net profits | Gross profits | Maximum profits | Net profits | Gross profits | Maximum profits |
|---|---|---|---|---|---|---|
| Estimation Method | ALS | ALS | ALS | IV | IV | IV |
| Coefficients (*Impact Elasticities*) | | | | | | |
| $\lambda\alpha_0$ ($y$) | 0·381 | 0·645 | 0·381 | 0·412 | 0·552 | 0·405 |
| | (0·040) | (0·044) | (0·040) | (0·044) | (0·058) | (0·046) |
| $\lambda\beta$ ($\theta$) | 0·350 | 0·538 | 0·514 | 0·389 | 0·525 | 0·550 |
| | (0·050) | (0·041) | (0·059) | (0·052) | (0·060) | (0·066) |
| $\lambda$ ($-d_{-1}$) | 0·388 | 0·631 | 0·387 | 0·433 | 0·571 | 0·424 |
| | (0·041) | (0·044) | (0·041) | (0·044) | (0·057) | (0·045) |
| *Equilibrium Elasticities* | | | | | | |
| $\alpha$ ($y$) | 0·982 | 1·022 | 0·984 | 0·951 | 0·967 | 0·955 |
| $\beta$ ($\theta$) | 0·902 | 0·853 | 1·328 | 0·898 | 0·919 | 1·297 |
| *Time Profile Elasticities* | | | | | | |
| *Income* | | | | | | |
| 1 year | 0·37 (38) | 0·63 (62) | 0·37 (38) | 0·40 (42) | 0·54 (56) | 0·39 (41) |
| 4 years | 0·84 (85) | 1·00 (98) | 0·84 (85) | 0·85 (89) | 0·93 (97) | 0·86 (88) |
| *Tax* | | | | | | |
| 1 year | 0·34 | 0·53 | 0·50 | 0·38 | 0·51 | 0·54 |
| 4 years | 0·77 | 0·83 | 1·15 | 0·80 | 0·88 | 1·16 |
| $\bar{R}^2$ | 0·717 | 0·880 | 0·735 | 0·694 | 0·706 | 0·673 |
| *DWS* | 1·94 | 2·29 | 1·98 | 1·31 | 0·91 | 1·25 |

Estimation Method: ALS = Augmented Least Squares; IV = Instrumental Variables.

## 4. THE DUAL TAX IMPACT

The dual tax impact is best represented by the use of two tax variables in the optimum dividend equation. In addition to the opportunity cost of retained earnings in terms of net dividends foregone ($\theta$), we use the ratio of maximum net profits to gross profits ($\Pi$). Equation 1 is therefore replaced by

$$D_t^* = AY_{pt}^{\alpha}\theta_t^{\beta}\Pi_t^{\gamma}U_t, \qquad \ldots(12)$$

where $Y_{pt}$ refers to gross profits before tax and depreciation. The values of $\beta$ and $\gamma$ measure the dual impact of tax changes on the optimum dividend level.

Table IV presents the estimates obtained by substituting equation 12 into the dynamic adjustment model specified in equation 2. The impact and equilibrium elasticities with respect to income and to the opportunity cost aspect of tax changes are similar to the estimates for gross profits presented in Table III. The implied effect of changes in $\Pi$ is small; the point estimates of the elasticity of $D_t^*$ with respect to $\Pi_t$ range between 0·111 and 0·313. The estimated standard errors are large relative to the point estimates of $\lambda\gamma$; moreover, because the disturbances of the IV equations are positively autocorrelated, these estimated standard errors are biased downwards. But although the high standard errors should serve as a warning that the point estimates of $\lambda\gamma$ and $\lambda$ may be substantially different from their true values, they should not be interpreted as implying that $\Pi$ has no effect on $D^*$. The large standard errors are partly a reflection of the small variation in $\Pi$ during the period of observation; the minimum and maximum values were 0·4625 and 0·5500. The safest conclusion from the evidence of Tables III and IV is that partial effect

TABLE IV

*The dual tax impact*

| Specification | 1 | 2 | 1 | 2 |
|---|---|---|---|---|
| Estimation method | ALS | ALS | IV | IV |
| Coefficients | | | | |
| (*Impact Elasticities*) | | | | |
| $\lambda\alpha_0$ ($y$) | 0·627 | 0·581 | 0·594 | 0·504 |
| | (0·063) | (0·074) | (0·092) | (0·108) |
| $\lambda\alpha_1$ ($\dot{y}$) | | 0·135 | | 0·088 |
| | | (0·121) | | (0·159) |
| $\lambda\beta$ ($\theta$) | 0·551 | 0·504 | 0·601 | 0·542 |
| | (0·046) | (0·063) | (0·090) | (0·110) |
| $\lambda\gamma$ ($\pi$) | 0·079 | 0·066 | 0·140 | 0·169 |
| | (0·090) | (0·098) | (0·102) | (0·104) |
| $\lambda$ ($-d_{-1}$) | 0·612 | 0·571 | 0·616 | 0·520 |
| | (0·063) | (0·074) | (0·092) | (0·109) |
| *Equilibrium Elasticities* | | | | |
| $\alpha_0$ ($y$) | 1·026 | 1·020 | 0·962 | 0·967 |
| $\beta$ ($\theta$) | 0·895 | 0·878 | 0·975 | 1·044 |
| $\lambda$ ($\pi$) | 0·124 | 0·111 | 0·219 | 0·313 |
| *Time Profile Elasticities* | | | | |
| *Income* | | | | |
| 1 year | 0·616 (60) | 0·707 (69) | 0·582 (60) | 0·580 (60) |
| 4 years | 1·001 (98) | 0·995 (98) | 0·940 (98) | 0·923 (96) |
| *Tax* ($\theta$) | | | | |
| 1 year | 0·539 (60) | 0·492 (56) | 0·589 (60) | 0·530 (51) |
| 4 years | 0·874 (98) | 0·847 (96) | 0·952 (98) | 0·986 (94) |
| *Tax* ($\Pi$) | | | | |
| 1 year | 0·076 (60) | 0·063 (57) | 0·133 (60) | 0·162 (51) |
| 4 years | 0·122 (98) | 0·108 (96) | 0·214 (98) | 0·297 (94) |
| $\bar{R}^2$ | 0·843 | 0·817 | 0·543 | 0·570 |
| *DWS* | 2·243 | 2·293 | 1·180 | 1·358 |

Income: Gross Profits before Tax and Depreciation.
Estimation Method: ALS = Augmented Least Squares; IV = Instrumental Variables.

of tax changes which increased the ratio of maximum net profit to gross profit was to increase dividends by an indeterminate amount.

An interesting alternative interpretation of the coefficients in equation 12 is also possible. Because $\theta_t$ measures the constant rate at which retained earnings may be transformed into dividends, the product $\theta_t\Pi_t$ is the ratio of maximum possible dividends to gross profits. Since $Y_{pt}\theta_t\Pi_t$ is therefore the maximum dividend level, rewriting equation 12 as

$$D_t^* = A(Y_{pt}\theta_t\Pi_t)^{\alpha}\theta_t^{\beta-\alpha}\Pi_t^{\gamma-\alpha}U_t \qquad \ldots(13)$$

shows that $\alpha$ may be interpreted as the elasticity of optimum dividends with respect to maximum dividends, while $\beta-\alpha$ and $\gamma-\alpha$ measure the dual tax impact when the maximum dividend level is held constant. Because $\beta-\alpha$ appears to be zero or slightly negative, a tax-induced rise in $\theta$ may be thought of as increasing $D^*$ by increasing the maximum possible dividend level rather than by changing the opportunity cost of retained earnings. Although we cannot determine whether one of these two explanations is a better behavioural description than the other, the conclusion that the differential profits tax had a substantial effect on dividends and the estimates of that effect both remain unaltered.

There is an important policy implication of the introduction of the variable $\Pi$. As already noted, during the period 1953-1964 the values of $\theta$ and $\Pi$ tended to change in opposite directions. However, because $\Pi$ depends only on the rates of tax on income and undistributed profits, while $\theta$ also reflects the tax rate on distributed profits, the two variables can be moved independently while keeping the rate of personal income tax unchanged. This offers substantially greater flexibility than a corporate income tax system under which a given change in $\theta$ implies a specific change in $\Pi$ (unless the rate of personal income tax is altered). This flexibility can be used either to change the retention incentive while keeping the total tax receipts from the corporate sector approximately constant (as in Britain) or to alter the total gross tax " burden " on the corporate sector without changing the retention incentive.

It is therefore somewhat surprising that, in 1965, Britain gave up the differential profits tax system for the less flexible corporation tax. The most obvious explanation is that government officials did not recognize that the change would reduce the number of fiscal policy instruments. Because the corporation tax would appear to *firms* to have the same characteristics as the old differential rates of profits tax, the important difference between these tax systems as instruments of public policy was ignored.

## 5. INDIVIDUAL INDUSTRY COMPARISONS

The estimates discussed in sections 3 and 4 relate to the behaviour of all public industrial corporations. Table V presents disaggregated results for the manufacturing sector as a whole, for five individual manufacturing industries, and for the industrial classification, " Finance, Land and Property ". For some sets of data, information was only available for an eight year period; the number of observations (32 or 44) is shown at the top of each column. All equations were estimated by augmented least squares.

Although there is substantial variation in the individual parameter estimates, the results as a whole support the conclusions reached above. The dividend model defined by equations 12 and 2 provides a good explanation of annual dividend changes. With the exception of Cotton Textiles, the individual coefficients are quite plausible; the dividend model is probably inappropriate for Cotton Textiles because the industry was in a secular decline.

For all other industries, except Shipbuilding,[1] $\theta$ has a substantial positive effect. The equilibrium elasticities for these growing industries range between 0·889 and 2·482, implying a tax effect substantially greater than our previous estimate for industrial corporations as a whole. The effect of $\Pi$ is also generally positive and significant. However, in addition to a near-zero value for Shipbuilding, the coefficients are negative for Finance, Land and Property (but less than the standard error) and for Motors and Aircraft.

The response elasticities ($\lambda$) are generally in the interval 0·3 to 0·5; the only exceptions are a slow response for Chemical and Allied ($\hat{\lambda}$ = 0·145) and an implausible value for Cotton Textiles ($\hat{\lambda}$ = 1·274). Examination of the time profile elasticities indicates that the response to income change is generally more rapid than the response to tax changes, although by the end of four years the gap is nearly closed. The two industries in which

[1] Shipbuilding was in a period of stagnation and secular decline. This may explain why neither tax variable had any effect.

the response to income changes is slower ($\alpha_1 < 0$) are ones with highly cyclical profits; for firms in these industries, $Y_{pt}$ is more reasonably approximated by this average of current and past income than by projecting the current growth rate. For each industry, the equilibrium response to income is approximately one; $\hat{\alpha}$ ranges between 0·859 for Finance, Land and Property and 1·039 for Engineering.

TABLE V

*Tax effects in individual industries*

| Industry | All Industries (44) | All Manufacturing (32) | Chemical & Allied (44) | Engineering (44) | Motors & Aircraft (32) | Ship-building (44) | Cotton Textiles (44) | Finance, Land & Property (32) |
|---|---|---|---|---|---|---|---|---|
| Coefficients (*Impact Elasticities*) | | | | | | | | |
| $\lambda\alpha_0$ ($y$) | 0·581 | 0·447 | 0·148 | 0·446 | 0·510 | 0·272 | 1·194 | 0·361 |
| | (0·074) | (0·079) | (0·045) | (0·087) | (0·083) | (0·070) | (0·081) | (0·074) |
| $\lambda\alpha_1$ ($\dot{y}$) | 0·135 | 0·165 | 0·467 | −0·035 | −0·076 | 0·295 | 0·217 | 0·079 |
| | (0·121) | (0·120) | (0·090) | (0·121) | (0·116) | (0·104) | (0·194) | (0·119) |
| $\lambda\beta$ ($\theta$) | 0·504 | 0·473 | 0·339 | 0·579 | 0·478 | −0·006 | 6·832 | 0·909 |
| | (0·063) | (0·080) | (0·087) | (0·092) | (0·100) | (0·113) | (0·765) | (0·110) |
| $\lambda$ ($\pi$) | 0·066 | 0·178 | 0·361 | 0·469 | −0·196 | −0·030 | 2·232 | −0·093 |
| | (0·098) | (0·113) | (0·081) | (0·244) | (0·181) | (0·010) | (0·225) | (0·115) |
| $\lambda$ ($-d_{-1}$) | 0·571 | 0·433 | 0·145 | 0·412 | 0·535 | 0·296 | 1·274 | 0·417 |
| | (0·074) | (0·083) | (0·048) | (0·101) | (0·078) | (0·076) | (0·133) | (0·077) |
| *Equilibrium Elasticities* | | | | | | | | |
| $\alpha_0$ | 1·020 | 1·035 | 1·019 | 1·039 | 0·952 | 0·916 | ... | 0·859 |
| $\beta$ | 0·878 | 1·099 | 2·482 | 1·432 | 0·889 | −0·021 | ... | 2·306 |
| $\gamma$ | 0·111 | 0·399 | 2·662 | 1·146 | −0·343 | −0·095 | ... | −0·211 |
| *Time Profile Elasticities* | | | | | | | | |
| *Income* | | | | | | | | |
| 1 year | 0·707 (69) | 0·601 (58) | 0·604 (59) | 0·433 (40) | 0·422 (44) | 0·556 (61) | ... | 0·428 (50) |
| 4 years | 0·995 (98) | 0·954 (92) | 0·758 (74) | 0·913 (87) | 0·898 (94) | 0·789 (86) | ... | 0·772 (90) |
| *Taxes* ($\theta$) | | | | | | | | |
| 1 year | 0·492 (56) | 0·462 (42) | 0·328 (13) | 0·567 (42) | 0·466 (52) | −0·006 (30) | ... | 0·905 (39) |
| 4 years | 0·847 (96) | 0·980 (89) | 1·092 (44) | 1·251 (88) | 0·846 (95) | −0·016 (76) | ... | 2·015 (87) |
| *Taxes* ($\Pi$) | | | | | | | | |
| 1 year | 0·063 | 0·171 | 0·350 | 0·457 | −0·185 | −0·028 | ... | −0·089 |
| 4 years | 0·108 | 0·357 | 1·167 | 1·003 | −0·327 | −0·072 | ... | −0·187 |
| $\bar{R}^2$ | 0·817 | 0·911 | 0·683 | 0·753 | 0·783 | 0·659 | 0·898 | 0·847 |
| *DWS* | 2·293 | 2·499 | 1·960 | 1·940 | 1·638 | 2·053 | 1·964 | 1·712 |

Income: Gross Profits before Tax and Depreciation.
Estimation: Augmented Least Squares.

## 6. CONCLUSIONS

The evidence examined in this paper shows that the policy of differential profits taxation had a substantial effect on corporate saving.[1] Tax rate changes influenced both the opportunity cost of retained earnings in terms of foregone dividends and the ratio of maximum net profits to gross profits. Dividends responded to these changes with a

[1] The strength of this evidence depends on the appropriateness of the dividend model that has been used. It would be useful to investigate whether the conclusions of this paper would be affected by allowing dividend behaviour to be influenced by the factors that determine the firms' total demand for funds: investment opportunities, the rate of interest, depreciation provisions of the tax system, corporate liquidity, etc. A multiple equation model, such as that used by Dhrymes and Kurz ([5]), would be required for this.

distributed lag; approximately 40 to 60 per cent of the ultimate effect occurred in the first year. The elasticity with respect to tax-induced changes in the opportunity cost of retained earnings appears to be substantially higher than the elasticity with respect to the ratio of maximum possible net profits to gross profits.

Although these results support the original suggestion that tax policies designed to influence the level and timing of corporate saving may have important effects on economic stability and growth, the link between corporate saving and these policy aims must still be investigated. Changes in corporate saving may be stabilizing in two ways. First, tax-induced changes in saving could (in principle) lead to higher investment during periods of low aggregate demand and lower investment during periods of high aggregate demand. But the well-established evidence that investment occurs only after a substantial lag (Eisner and Strotz [7]; Almon [1]; Eisner [6]), reduces the potential importance of such countercyclical policy, even if it is accepted that investment would be cyclically sensitive to tax-induced changes in retained earnings. Second, if corporate saving does not affect short-run corporate investment but dividends do influence consumption, tax policies to decrease dividends during periods of high aggregate demand would be stabilizing. Although this may be a potentially useful way of reducing aggregate demand by " forced saving " in high income groups instead of by lower investment or decreased general consumption, the estimated lag structure indicates that such a policy could only be effective if the government's recognition and implementation lags were sufficiently short.

When we turn to the influence of tax policies on growth, the effectiveness of the differential profits tax in influencing corporate saving raises two further questions. First, does an increase in the internal availability of corporate funds lead to increased corporate investment? Second, does an increase in corporate saving induce a corresponding decrease in personal saving? If the answer to the first question is yes and the answer to the second is no, tax policies to encourage corporate saving will increase aggregate investment. If the answer to both questions is yes, such tax policies will only shift investment from the non-corporate to the corporate sector. Finally, there is no effect on investment if the answer to the first question is no and the answer to the second question is yes.

Previous attempts to estimate the effect of retained earnings on corporate investment have been handicapped by the high degree of multicollinearity between retained earnings, profits and sales. The tax-induced changes in the " equilibrium " ratios of retained earnings to profits and sales that have occurred in Britain since 1950 may provide a useful set of data with which to estimate the effects of retained earnings. This is currently being explored.

Although the relation between corporate and personal saving has been the subject of theoretical speculation, it has never been empirically estimated. Because both forms of saving are cyclically volatile, multicollinearity problems again arise. The rise in dividends after 1958 and the relative fall that can be expected to follow the 1965 corporation tax may provide a sufficient departure from the secular and cyclical patterns to permit studying the effect of corporate retentions on personal saving.

A preliminary examination of the data for the period after 1958 shows a sharp rise in personal saving and a change in corporate financing from internal to external sources. But only a careful study will reveal whether the tax change had any qualitative effect on the total supply of saving and the level and pattern of investment.

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