The Determinants of Corporate Effective Tax Rates: Evidence from Australia*

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Abstract

The Effective Tax Rate (ETR) paid by firms can differ from the statutory rate due to the usage of tax shields and applicable credits and rebates. This paper attempts to investigate the characteristics of large Australian firms which drive ETR's away from the standard rate of corporation tax. There is evidence to suggest that interest payments, R&D expenditure, foreign ownership, stock-market listing and the number of subsidiaries, all have a significant effect on ETR's. The results also suggest that unobserved firm heterogeneity plays a significant role.

1. Introduction and Background

A firm's tax burden (the dollar amount of tax due to the tax authority), expressed as a percentage of its accounting income may not necessarily be equal to the statutory rate of corporation tax. That is, a firm's effective tax rate (ETR) may differ from the statutory rate applicable in a particular year. This divergence is a reflection of the usage of any tax shields and any applicable credits and rebates. However, it has been postulated that particular firm characteristics - predominantly size - may affect firms' ETR's, (Watts and Zimmerman 1978), (Gropp 1997) and (Holland 1998). This is an important policy issue for relevant tax authorities, namely what, if any, particular firm characteristics are likely to drive ETR's away from the standard rate of corporation tax.

To answer this question, a panel data set of large Australian firms is used. We derive a model for ETR's and implicit statutory restrictions are derived. These types of restriction are tested and found to be valid.

The plan of this paper is as follows. In Section 2 some key elements of the Australian corporate taxation system are described. In Section 3 the existing literature on modelling tax burden is briefly reviewed. The data are described in Section 4, and Section 5 provides a theoretical underpinning of the subsequent empirical analysis. The results are presented in Section 6. Finally, Section 7 concludes.

2. The Australian Corporate Tax System: An Overview

All companies are subject to one standard rate of corporation tax (currently a rate of 36%).[1] Similarly, unlike the personal taxation system, there is no tax-free threshold. Company tax returns are subject to self-assessment, meaning that only brief details of taxable income are required in the annual company tax return form.

2.1. Taxable Income

Company taxable income is calculated in much the same manner as that of personal income. That is, the provisions of the Income Tax Assessment Act 1936 (ITAA) are applied to determine whether amounts are assessable income or deductions. However, although the basic structure is the same, the provisions for companies are more varied. Table 2.1 below demonstrates the basic concepts underlying the calculation of taxable income.

[1] From 1993/94 to 1994/95 it was 33% and 39% prior to this.

Table 2.1: Taxable Income

Total profit/loss			
plus			
capital gains and other add back items			
minus			
allowable deductions			
equals			
taxable income	→	*apply tax rates*	→
			gross tax payable
			minus
			credits and rebates
			equals
			total liability
			minus
			tax already paid
			equals
			tax to pay/refund

Source: Deutsch, Gates, Gibson, Hanley, Payne, and Plummer (1996).

Rebates and credits directly reduce the tax payable, whereas deductions reduce taxable income before the tax rate is applied. The former are especially pertinent to companies which have special provisions for carrying losses forward (see below) and bad debts, for example.

2.2. Accounting and Taxable Income

Although superficially the same, a company's taxable income does not necessarily correspond to the reported accounting income as entered in company accounts. The reason for this is that the former is derived in accordance with approved accounting standards, and the latter by application of the provisions of the ITAA. Thus, there may be differences in the way certain items are treated. For example, some amounts may be excluded from a profit and loss account, but treated as income for tax purposes. The major differences are known as 'timing and permanent differences' and are discussed in the appendix to this paper.

3. Empirical Literature Review of Modelling ETR's

This section is primarily concerned with how firm-level data can be used to model the ETR's faced by firms - a topic not often addressed in the literature. The first

sub-section below considers how average ETR's may be influenced by the size of firm. The second sub-section reviews some recent research that uses a firm-level data set to measure the expected (future) ETR. This paper does not consider marginal ETR's (METR). The literature on METR's is predominantly concerned with measuring the METR faced by hypothetical firms which have a range of investment and funding characteristics (King and Fullerton 1984). As such, this type of study is not of direct relevance here.

3.1. Average Effective Tax Rates and Firm Size

The relationship between firm size (proxied by both sales and total assets) and ETR's has been considered for large British (non-financial) firms, over the years 1968-1993 (Holland 1998). Firms with negative (or zero) tax burdens, or accounting losses, were excluded, as interpretation of negative effective tax rates is "equivocal" (however, the sample may still potentially include some firms that are using tax losses from previous years in periods where they are reporting positive tax charges).

The study involved splitting the sample (arbitrarily) into deciles according to firm size and subsequent analysis is focused on the ETR's of the firms of the top decile. "Typical" values of each decile's ETR were taken to be simple and weighted (by profit) averages. Four procedures were then used to test the hypothesis of a relationship between firm size and ETR. Firstly, a non-parametric (Mann-Whitney) test was used to test whether there were differences between the distribution of the top decile's distribution of ETR's and the rest of the sample (over each year).

Secondly, a binomial test was used to ascertain whether the mean ETR for the top decile was the highest over the full sample for each year. Thirdly, each decile was ranked by virtue of their average ETR's and then mean rankings over a number of years were calculated (a size effect would then be suggested by a "high" value of the mean rank for the top decile). Finally, separate regressions for each year were run, regressing the mean ETR per decile against the decile's (log of) average size (thus using very small sample sizes of around 10).

The results provided no clear conclusions: sometimes a significant positive relationship was found, in others a negative one and in others still, none at all. Results varied with un/weighted ETR measure, size proxy used and time period considered. There was, however, clear evidence of differences across industries.

Relating this study back to the previous discussion, none of the implicit restrictions were enforced, although even so the constant was invariably highly significant and often very close to the statutory rate. Moreover, inference is based on very

small sample sizes.

3.2. Expected Effective Tax Rates and Leverage

Gropp (1997) used COMPUSTAT U.S. data (as compiled by Standard and Poor) in consideration of the effect of expected ETR's on firms' leverage. This was undertaken in two stages. The first stage involves estimating (expected) ETR's. In the second, these estimated expected ETR's are related to firms' incremental financing choice. For the purposes of this paper, the first stage is the more relevant. Here the effects of tax shields on expected future ETR's are explicitly modelled assuming rational expectations and four different time horizons to yield different proxies for the expected value of ETR's in period $t+1$:

(1) the actual tax rate in period $t+1$;

(2) a linear prediction of the actual tax rate in period $t+1$, using present ETR's, additional variables available to the firm at time t (such as debt and non-debt tax shields) and individual and time effects. Due to the lagged dependent variable, care has to be taken in estimating this model (although the precise nature of the estimation technique is not given, the time effects are treated as fixed whereas the firm ones as random);

(3) five yearly averages (arbitrarily chosen) which are linearly predicted as above, but on the assumption that both the time and firm effects are fixed and;

(4) weighted five yearly averages (the discount weights decline into the future, although it is not stated how they were derived).

In terms of the explanatory variables (in addition to lagged ETR's), proxies for METR's used in other studies were used: tax loss carryforwards (scaled by sales); current ETR's; investment tax credits and investment tax credits interacted with Altman's bankruptcy predictor (the bankruptcy indicator was also included in its own right); depreciation expenses (scaled by sales); debt to total asset ratio (as high levels of past issued debt raises interest payments, thus lowering reported profits, such that higher levels of debt imply lower METR's) and; variability of firm earnings (the greater the variability the greater the potential for reduced taxes by loss carryforwards).

The data used were from the years 1979-1991. A balanced panel of 929 firms was used (371 firms with missing years were removed from the sample), any missing values of "important" variables were replaced with firm or industry specific means. For firms that recorded losses but positive tax payments, ETR's were set equal to the statutory rate (3% of cases). A negative statutory rate was attributed to firms that reported a loss and received a refund (approximately 12% of cases). For the remainder of the sample, ETR's were obtained by dividing actual income

tax payments by profits before taxes, interest and discontinued operations. However, using such a formula can still produce some quite extreme outliers (-39,000% to 6,600% in this study). To alleviate the problem these outliers may cause in subsequent estimation, the current ETR variable was split into two variables. For proper percentages ($0 < \text{ETR} \leq 1$) it was set equal to itself and for improper values ($\text{ETR} < 0$ or $\text{ETR} > 1$) it was set equal to 0.

The main findings from the estimation procedures were that firstly, as expected current ETR's are an important predictor of future ETR's. On the other hand, the effect of tax loss carryforwards was negligible.[2] Both the investment tax credits and depreciation tax shields had a significant negative effect on future expected ETR's. Expected future ETR's were also negatively affected by the variability of earnings (current profits are more likely to be shielded using previous losses). The debt to total assets ratio also exerted a negative effect, explained by the fact that it represents the accumulation of past financing decisions and therefore reflects the higher level of interest tax shields for more highly leveraged firms. Most of the other considered variables (apart from some time dummies) were found to be insignificant. Although no diagnostics were reported, the explanatory power of the equations was quite low, with R^2's of just over 10%

This methodology can again be related back to equation (5.5) although an important difference is that now expected future ETR's is the dependent variable, and actual current ETR's is one of the explanatory variables of this expectation. However, the restrictions implied by equation (5.5) again have not been enforced, or even alluded to.

Various other studies consider ETR's and debt finance, see Titman and Wessels (1988) for a review. Shum (1996) estimates the ETR's faced by Canadian firms using financial data and a Tobit maximum likelihood censored regression (since there are no data on whether a negative tax liability is reported only a "zero" tax paid).

4. The Data

The data used in this study are taken from the IBIS database. The IBIS Enterprise Database contains information on an annual basis for medium to large firms in Australia from 1979 to the present. Accounting data are available through the inclusion of each firm's profit and loss statement and balance sheet in the database. The database also includes company type and industry type by ANZSIC code. A balanced panel consisting of 377 firms was constructed from the database for

[2]Information on tax loss carryforwards is not available in the data set used in this study.

the years 1993 to 1996. To be included in the panel, firms must have non-missing financial information for all years, on all of the variables required to calculate the dependent and independent variables used in the subsequent regression analysis. As with other studies, financial firms were excluded from the panel together with government firms, trusts, associations and cooperatives. The dependent variable - the effective tax rate, is defined as the ratio of income tax expense to taxable income and can take on values greater than zero and less than one. The effective tax rate can exceed the statutory rate due to the 'timing and permanent differences' discussed in the appendix.

Table 4.1 provides a breakdown of the panel by industry sector. It shows that 45 per cent of firms included in the panel are manufacturing firms and just over 22 per cent are involved in wholesale trade.

Table 4.1: Firms by Industry Sector

ANZSIC Industry	Number of Firms
Agriculture, Forestry and Fishing	3
Mining	25
Manufacturing	169
Electricity, Gas and Water Supply	2
Construction	5
Wholesale Trade	84
Retail Trade	23
Accommodation, Cafes and Restaurants	2
Transport and Storage	17
Communication Services	5
Property and Business Services	27
Health and Community Services	2
Cultural and Recreational Services	10
Personal and Other Services	3

Table 4.2 provides a breakdown of the firms included in the panel by company type. 42 per cent of firms are listed while 55 per cent are Australian owned.

Table 4.3 provides summary statistics on selected financial variables for the firms included in the panel, and confirms the large size of these firms. Large values for the standard deviations indicate that there is a great deal of variation in these variables.

Figure 4.1 plots the distribution of ETR's for firms in 1996. In this year the statutory rate of taxation was 36%. The distribution of tax rates shows that more

Table 4.2: Firms by Company Type

Company Type	Number of Firms
Listed	158
Non-Listed	219
Australian Owned	208
Foreign Owned	169

Table 4.3: Summary Statistics

Variable	Mean	Median	Standard Deviation	Min	Max
Total Profit Before Tax 1996 ($m)	57	11	234272	0.09	3447
Total Revenue 1996 ($m)	654	166	2032731	20	19800
Interest/Sales Ratio (%)	2.0	1.1	.0358805	0.002	44.9
Depreciation/Sales Ratio (%)	4.0	2.5	.0536303	0.02	54.8
R&D Expenditure/Sales Revenue (%)	0.4	0.0	.01339	0.00	13.3

than half of firms appear to have an effective tax rate less than the statutory rate for this year.

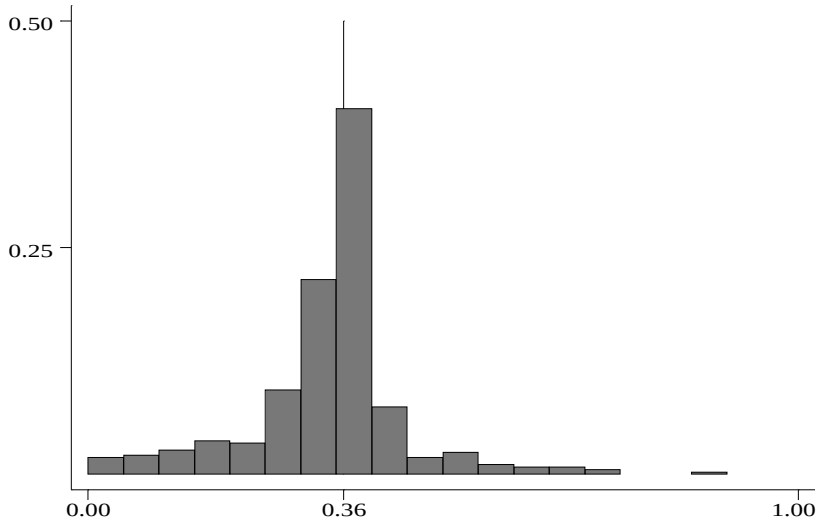
Table 4.4 compares the median effective tax rate for firms included in the panel, with the statutory rate of taxation for each year. The median effective tax rate for IBIS firms is very close to the statutory rate for 1994 to 1996 but falls approximately 2.5 percentage points short of the statutory rate in 1993.

Table 4.4: Effective v Statutory Tax Rates

Year	Median Effective Tax Rate	Statutory Rate of Taxation
1993	36.44%	39%
1994	33.28%	33%
1995	32.95%	33%
1996	35.56%	36%

In terms of analysis, the IBIS database is a *panel data* set - that is, the same firms are observed over a number of years. There are numerous advantages to using such a data set over a strictly cross-section or time-series approach (see, for example, (Hsiao 1985), (Hsiao 1986) and (Mátyás and Sevestre 1996), on the benefits of panel data in general), but arguably the major one, is the ease with which one can condition on unobserved individual/firm heterogeneity. That is, in addition to observed individual heterogeneity in the form of observed (measured) firm characteristics, there will also undoubtedly be firm specific unobserved char-

Figure 4.1: ETR's 1996



acteristics, which together, will drive observed divergences in measured ETR's. Such unobserved heterogeneity will reflect any unmeasured (possibly uncollected) data. Examples might be management and strategy variables.

5. Modelling Tax Burdens and ETR's

>From Table 2.1, gross tax payable is obtained by applying the standard statutory rate of corporation tax in period t to the firm's taxable income. Thus, assuming that firm i earns positive taxable income in period t (y_{it}^{tax}), by definition its gross tax burden (tax_{it}^{g}) will be

$$tax_{it}^{g} = \tau_t y_{it}^{tax}. \tag{5.1}$$

However, to obtain the total tax liability (tax_{it}) any applicable credits and rebates (cr_{it}^{p}) have to be subtracted

$$tax_{it} = \tau_t y_{it}^{tax} - \sum_{p=1}^{P} cr_{it}^{p}, \tag{5.2}$$

where there are $p = 1, \ldots, P$ possible tax credits and rebates ($cr_{it}^{p} \geq 0, \forall p, i,$ and t). Again by definition, taxable income is equal to gross profit (π^{g}) minus any tax

shields and exemptions

$$y_{it}^{tax} = \pi^g - \sum_{j=1}^{J} \delta_{it}^j, \tag{5.3}$$

where there are $j = 1, , J$ potential tax shields δ.[3] Using equation (5.3) in (5.2) yields

$$tax_{it} = \tau_t \pi^g - \tau_t \sum_{j=1}^{J} \delta_{it}^j - \sum_{p=1}^{P} cr_{it}^p. \tag{5.4}$$

Often equation (5.4) is expressed as an (average) ETR by dividing through by gross profit such that

$$\frac{tax_{it}}{\pi^g} = \tau_t - \frac{\tau_t}{\pi^g} \sum_{j=1}^{J} \delta_{it}^j - \frac{1}{\pi^g} \sum_{p=1}^{P} cr_{it}^p. \tag{5.5}$$

Equation (5.5) illustrates that if there are no tax shields or credits or rebates, the ETR is simply the statutory rate of corporation tax. However, such ETR's, by definition, cannot reflect the profit shifting and transfer pricing practices of firms. For estimation purposes, a random disturbance term would enter into equation (5.5). An important point is that the implicit τ_t restrictions are not enforced in the previous literature, or even mentioned.

However, there is nothing in the data to enable us to distinguish between the δ's and cr's in equation (5.5). Therefore, in order to identify the model, proxies for these variables need to be found. Thus, equations are estimated of the form

$$y_{it} = \lambda_t + x_{it}'\beta + \alpha_i + u_{it}, \tag{5.6}$$

which relates to equation (5.5) in the following manner:. y_{it} is firm i's ETR in year t; x_{it} is a vector of observed firm characteristics acting as instruments for (jointly) δ and c and; λ_t a year specific constant, which should proxy τ_t.[4] In addition to these variables, we also include α_i which allows for any unobserved firm heterogeneity to affect observed ETR's. For example, such "individual effects" may capture (unobserved) management strategy. Finally, we also include u_{it}, a "white noise" disturbance term, to account for the fact that we cannot directly measure δ and c.

An important question is what variables should we use to try and proxy δ and c? Following previous studies, the instruments chosen to enter x_{it} were: firm size

[3] Tax shields that reduce taxable income enter as positives. The converse is true of those that increase taxable income.

[4] Or, indeed could be restricted to such.

(asset based); depreciation expenditure (relative to sales revenue); interest paid (relative to sales revenue); earnings volatility (standard deviation of total revenue of firm i,over1993-96); ownership dummies (foreign versus local); a listed dummy and; ANZSIC two-digit dummies.

Size is included as an explanatory variable in the regression analysis proxied by the log of total assets. It can be postulated that larger firms may have greater scope for tax avoidance and thus pay lower effective tax rates. Interest payments, depreciation and research and development are all classed as deductions and it is expected that these variables will be negatively related to ETR's. The overseas income variable is a dummy variable which takes on the value 1 if the firm reported financial information by at least one geographic segment in the year 1996 and zero otherwise.[5] A negative sign on the coefficient of this variable could be expected as a company may have already paid tax on income abroad and this income will therefore be exempt in Australia. The number of subsidiaries variable is the log of (1+) the number of subsidiaries a firm reported in 1995. Firms with a large number of subsidiaries may have greater scope for adopting accounting practices which reduce their ETR. The revenue volatility variable is defined as the firm's standard deviation of sales revenue over the period of the panel. It may be possible for a firm to pay lower effective rates if revenue is fluctuating greatly due to carry forwards/backs. The foreign/Australian owned dummy attempts to capture any transfer payments or divergences in the taxation practices of domestic and foreign owned firms.

6. The Results

Table 6.1 contains results for our first model specification. Instruments include industry, ownership, and listed dummies, as well as an approximate measure attempting to pick up whether there was any income earned from overseas. For clarity, the industry dummies are not reported, although the majority of them were individually insignificant. However, the results suggest that foreign owned corporates faced higher ETR's as do listed ones. In fact, the results indicate that, on average, foreign firms pay 3% more tax than resident firms and non-listed firms pay 2% less tax than listed firms. The negative and significant coefficients on interest payments and R&D expenditures indicate that these variables may be used as effective tax shields. There is also evidence that firms with a greater number of subsidiaries do have greater scope for adopting accounting practices that reduce

[5] A geographical segment is a distinct component of an entity's operations in a country or group of countries. A foreign geographical segment will have substantial operations outside Australia (Perkins 1996).

their ETR's. However, the most illuminating aspect of Table 6.1 is the effect of the time dummies. As noted, in a well specified model, these should yield estimates "close" to the standard rate of corporation tax (see equation (5.5)). Clearly, this is indeed the case (estimates of 40, 36, 36 and 37% against the statutory rates of, 39, 33, 33 and 36%). Moreover, an F-test for this joint restriction does not reject the null hypothesis at the 5% significance level.

Table 6.1: OLS - Industry, Ownership, Listed and Time Dummies

	Coefficient	Standard Error
Constant	-	-
Depreciation	0.1358	0.0884
Ln(assets)	0.0025	0.0038
Sd(revenue)	-0.0119	0.0183
Interest payments	-0.1951	0.1044*
R. & D.	-0.5211	0.2266**
O/S income	0.0027	0.0109
Ln(# subsidiaries)	-0.0130	0.0039**
Foreign owned	0.0313	0.0087**
Non-listed	-0.0188	0.0091**
1993	0.40	0.0657**
1994	0.36	0.0666**
1995	0.36	0.0663**
1996	0.37	0.0661**
$\overline{R}^2$	0.08	
$F_{calc}, F^4_{1482,0.05}$	1.81	2.38

Notes: ** and * significant at 5% 2-sided and 1-sided levels, respectively. Industry dummies not reported

The above results however, do not fully utilise the panel nature of the data and any potential unobserved firm heterogeneity has been ignored. That is, there will undoubtedly be unobserved firm heterogeneity that will affect observed ETR's. This necessitates allowing the α_i's of equation (5.6) to be non-zero, which is done below.

Utilising the panel nature of the data, two basic specifications are available: *fixed* and *random effects* models. The former treats the individual effects as fixed parameters requiring estimation, the latter as (independent) random drawings from a particular distribution. Much has been said in the literature about which is the "correct" specification but results are inconclusive (Mundlak (1978), Hsiao (1985), and Hsiao (1986)). In light of this, we estimate both specifications.

Table 6.2 contains the results of a fixed effects specification. Relative to the unrestricted simple OLS results, explanatory power is now much increased (to over 30%). However, now none of the explanators (except the time dummies, as expected) are significant. This suggests that in this specification, it is the individual firm specific dummies that are primarily driving divergences in ETR's. However, the lack of significance on the other coefficients may also be due to a lack of variation in the explanatory variables over time and hence they are highly correlated with the individual firm dummies.

Table 6.2: Fixed Effects Model - Time Invariant Explanators Excluded

	Coefficient	Standard Error
Constant	-	-
Depreciation	0.1868	0.1703
Ln(assets)	0.0219	0.0184
Interest payments	-0.1981	0.1719
R. & D.	-0.9199	0.8469
1993	0.0316	0.0094**
1994	-0.0124	0.0082*
1995	-0.0149	0.0075**
$\overline{R}^2$	0.32	

Notes: see Table 6.1.

Treating the individual effects as random, yields the results presented in Table 6.3. As opposed to a fixed effects specification, the effect of time invariant dummies, such as ownership and industry, can now be identified. Again, although not reported, many of the industry dummies are individually insignificant. Once more, foreign ownership implies higher ETR's, as does being a listed corporate, and with similar magnitudes and significance levels as in the OLS specification.[6] Interest payments continue to exert a negative effect on ETR's (see previous footnote), as does the level of R&D expenditure. The effect of the number of subsidiaries is once again significantly negative and the time dummies continue to be strongly significant.

Finally, we utilise earlier results and the underlying economic model, to restrict the constants to be time varying and equal to the standard rate of corporation tax, and re-estimate the fixed and random effects models. The restricted fixed effects results can be found in Table 6.4 and the random in Table 6.5. As is

[6]Note that the two dummies (*non-listed* and *interest payments)*, are very close to statistical significance.

Table 6.3: Random Effects Model

	Coefficient	Standard Error
Constant	0.3662	0.0734**
Depreciation	0.1406	0.0948
Ln(assets)	0.0032	0.0047
Sd(revenue)	-0.0140	0.0305
Interest payments	-0.1927	0.1180
R. & D.	-0.5572	0.3029*
O/S income	0.0025	0.0188
Ln(# subsidiaries)	-0.0134	0.0051**
Foreign owned	0.0310	0.0109**
Non-listed	-0.0186	0.0117
1993	0.0262	0.0074**
1994	-0.0159	0.0073**
1995	-0.0162	0.0072**
$\overline{R}^2$	0.10#	

Notes: see Table 6.1. # not well defined.

to be expected, if the restrictions are indeed valid, the parameter estimates and standard errors remain substantially unchanged.

Table 6.4: Restricted Fixed Effects Model

	Coefficient	Standard Error
Constant	-	-
Depreciation	0.1746	0.1706
Ln(assets)	0.0212	0.0142
Interest payments	-0.2106	0.1720
R. & D.	-1.0026	0.8439
$\overline{R}^2$	0.30	

Notes: see Table 6.1.

In terms of a preferred specification, it appears important to allow for unobserved firm heterogeneity. However, the choice between the fixed and random effects specifications is not obvious. In the former, the firm dummies tend to swamp the effects of all other explanatory variables, which, as noted, might be the result of relatively little variation in the included variables over time, or simply that dummies are better proxies for δ and c than the observed firm characteristics. On the other hand, treating these individual effects as random, suggests that

Table 6.5: Retsricted Random Effects Model

	Coefficient	Standard Error
Constant	0.0066	0.0722
Depreciation	0.1357	0.0947
Ln(assets)	0.0040	0.0046
Sd(revenue)	-0.0168	0.0302
Interest payments	-0.2031	0.1180*
R. & D.	-0.5619	0.3019*
O/S income	0.0020	0.0187
Ln(# subsidiaries)	-0.0137	0.0050**
Foreign owned	0.0306	0.0108**
Non-listed	-0.0184	0.0117
$\overline{R}^2$	0.08#	

Notes: see Table 6.1. # not well defined.

R&D, the number of subsidiaries and being foreign owned, are all good proxies for δ and c. These results remain substantively unchanged across models when the implicit restrictions concerning the time effects and the statutory rates of corporation tax, are enforced.

In summary, higher ETR's are associated with foreign owned firms and listed firms. Lower ETR's are associated with firms with higher interest payments, higher R&D expenditures, and firms with a greater number of subsidiaries. These results are robust across most specifications. Fixed effect specifications indicated that unobserved firm heterogeneity is also important. To distinguish between the relative importance of unobserved firm heterogeneity in the form of firm dummies and the explanatory variables is not an easy task and is a potential area for further research.

7. Conclusions

This paper reports an attempt at explaining empirical ETR's for large Australian corporates. In deriving the model certain (statutory) restrictions became evident. However, it appears that such restrictions have not previously been alluded to in the literature, or moreover enforced. The restriction is effectively that there is a time-varying constant implicit in ETR equations, necessarily equal to the standard rate of corporation tax. Unrestricted estimation results gave estimates very close to theoretical values, suggesting that these restrictions are indeed present (this was also statistically validated).

Explaining the remainder of the total variation of ETR's varied across model specification. However, it was found that it is very important to condition on unobserved firm heterogeneity for all specifications. Estimating a *fixed effect* for each firm effectively explained the maximum possible variation in ETR's although this was at the expense of the significance of all other observed explanatory variables. This is presumably a result of the difficulty in finding appropriate instruments for deductions, credits and rebates, and that this separate firm specific constant was a better proxy for all observed and unobserved variables. However, this is not particularly useful from a policy perspective. Turning to the random effects specification, there was clear evidence that interest payments and R&D expenditure lower firms' ETR's (but not depreciation). Both listed and foreign owned firms, are likely to face higher ETR's, although there was little evidence to suggest significant divergences across industries. Finally, it appeared that corporates with more subsidiaries can more effectively utilise the tax system to reduce ETR's.

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Appendix: Timing and Permanent Differences

This paper uses 'income tax expense', as reported in a company's financial accounts, as a proxy for tax paid. Income tax expense is reported in companies' financial accounts and is based on an adjusted accounting profit. Specifically, income tax expense is defined as the statutory rate of taxation multiplied by adjusted accounting profit.

In general terms,
Taxable Profit = Assessable revenue - Allowable deductions (expenses) and
Accounting profit = Accounting revenue - Accounting expenses,
where 'assessable' and 'allowable' are defined under tax legislation.

The differences between accounting and taxable profit are complex but accountants classify the main differences as timing and permanent differences.

The financial period in which some items of revenue and expenses are included in the profit and loss statement is not the same as the period in which those items will be assessed or can be claimed as deductions for income tax purposes. These items give rise to a timing difference between pre-tax accounting profit/loss and the taxable income/loss for the period. An example of a timing difference is the use of a different rate of depreciation for accounting and taxation purposes. At some point, the total cost of an asset will be written off completely using both rates. However, the total period over which this occurs will differ as will the charge in each financial period.

Permanent differences are differences between taxable income and pre-tax accounting profit/loss which will not cancel out over time. These arise from two sources. The first is that some items may be included as a revenue or expense in the profit and loss statement, but under the current tax legislation are not included in taxable income/loss. The second source arises when some amounts are classed as allowable deductions or assessable income for tax purposes which will not be included in the profit and loss statement. An example is non-allowable depreciation on buildings. This is classed as an expense in the profit and loss statement but can not be claimed as a deduction for income tax purposes. In simple terms, accounting profit will equal taxable profit only if expenses for accounting purposes equate with allowable deductions for tax purposes, and revenues for accounting purposes equate with assessable income for tax purposes

The income tax expense recorded in a company's financial accounts is calculated with these differences in mind. So income tax expense already incorporates timing and permanent differences. If income tax expense was the numerator and taxable income was the denominator in our dependent variable, we would expect

the values to be the statutory rate of taxation. However, in the paper we are using the ratio of income tax expense to accounting profit.

As an example of the calculations involved in deriving income tax expense, consider the following simplified example (Wise, Needles, Anderson, and Caldwell 1998):

Accounting profit before tax		$100,000
Plus (minus) permanent differences:		
Dividend received (not included in taxable profit)	($4,000)	
Loss on sale of equipment (not included in taxable profit)	$10,000	$6,000
Taxable profit		$106,000
x tax rate of 36%		$38,160
Income tax expense		$38,160

In this paper we are modelling income tax expense to accounting profit (38%). This is different from the statutory rate due to the permanent differences. The difference between our dependent variable and the statutory rate is due to a dividend received and the loss on the sale of equipment.

The rationale for using income tax expense is that we want to see which broad firm characteristics are correlated with low and high effective tax rates. Ultimately, the ETR could be explained by 'auditing' the firm in question, i.e. the calculation of the effective tax rate is effectively an identity specified by the firm's accountant. However, this level of detailed knowledge is not available for all firms. The value of statistical analysis of a large sample of firms is to try and identify more general relationships.