Econometric Accounting of the Australian Corporate Tax Rates: A Firm Panel Example

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Abstract

The paper presents an econometric accounting of the effective corporate tax rate in Australia for the years 1993 to 1996. A model is specified and estimated using a panel of Australian firms and fixed and random effects estimators. The model specifies that the statutory rate of corporation tax (SRCT) corresponds to the (time-varying) constant term in the regression. An ability to find an estimated statutory tax rate that is close to the actual rate suggests a certain confidence in the estimated effects of the others factors affecting the effective tax rate. The results show importance for interest expenses, depreciation allowances, debt/asset structures, and the foreign ownership of firms. There is support for an Australian role as a preferential tax location.

Keywords: Effective tax rate, accounting model, panel data, random and fixed effects

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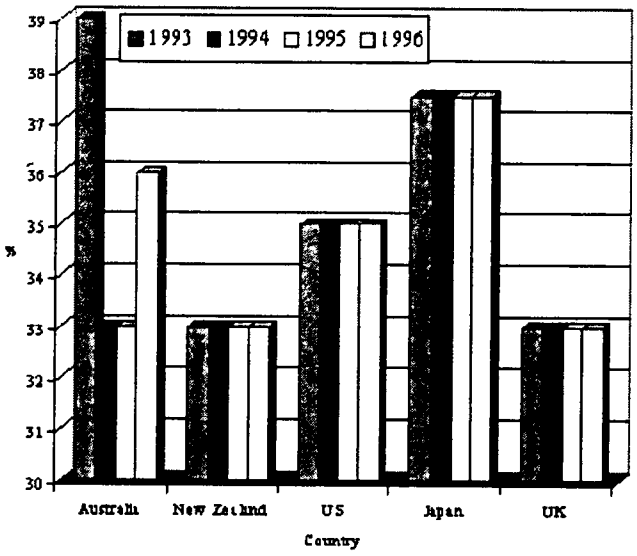
1. Introduction

This paper presents a model of the effective corporate tax rate that it estimates econometrically using panel data techniques. The contribution is that it presents an exercise that combines an accounting with an economic approach to studying the determinants of effective corporate taxation. An accounting model without estimation is unable to weight the importance of the different factors that firms actually use in structuring their taxation strategy. Estimation of an accounting-based model however, puts statistical weights on what actually was important to the firms. The exercise is useful in that it presents a way to distinguish between what corporate form the tax law allows and what corporate form manifests given the tax law. This can be used as a guide to analysis of tax features when tax law reform is being considered, or as a guide to the sensitivity of revenue yield from different tax law provisions.

Starting with an accounting identity of corporate taxes in Australia, hypotheses are formulated and robust estimation results are presented. The estimation follows previous work such as Gropp (1997) in using a consistent normalisation factor across its current period variables, and in focusing on depreciation, interest, revenue, and the debt to asset ratio. This effective tax rate (ETR) estimation finds significance for these variables as well as for firm ownership and subsidiary structure. The paper therefore illustrates how an

Figure 1
International Statutory Rates of Corporation Tax



accounting-econometric approach can work; suggests that the approach may warrant further application; and yields results of interest from a tax policy perspective.

2. Australian Corporate Tax System

Figure 1 illustrates the levels of the statutory corporate tax rate in Australia for the years under study as they compare to a set of Western countries. Australia's rate was lower than Japan's in three of the four years, and lower than that of the US half of time. Relative to the UK and New Zealand, Australian rates were equal or higher.

In terms of how the tax base is defined, Table 1 illustrates that taxable (corporate) income is gross profit, plus capital gains, minus deductions.

Allowable interest expenses are limited to those resulting from at most a three to one debt to equity ratio. Credits (and "rebates") directly reduce the tax payable, whereas deductions reduce taxable income before the tax rate is applied. Carry-loss forwards are the most important tax credit. The investment tax "credit" in Australia, unlike that which has existed in the US, is actually a deduction rather than a credit. It allows (from 1992 to 2002) for an additional 10% depreciation allowance, by the Income Tax Assessment Act 1936 (sections 82AAAA to 82AQ), applying to certain projects costing more than $50 million (Australian) during 1992 to 2002. R&D also is largely taken as a deduction, with firms having an aggregate R&D expense of greater than $20,000 (Australian) being entitled to an enhanced deduction ("concession") of 150%, reduced to 125% in 1996. There is an alternative option to take a tax credit (a tax "offset") based on R&D, this being less used. Other differences in deductions are project or industry specific, such as immediate expensing for mining; and other credits exist such as for paid foreign tax. Capital gains on a company's assets are added to taxable income. Note that differences can arise between taxable income and accounting income, in particular, because of "timing and permanent differences" (Wise, Needles, Anderson, and Caldwell 1998).

Firms in Australia report their financial information through tax entities. A tax entity by definition either carries out a distinct function for the firm or operates within a specific geographic or industrial market. Firms can have as many tax entities as they wish, and tax entities generally have various sets of inter-entity transactions with each other. Subsidiaries typically tend to be tax entities.

Table 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).

Table 2
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%

3. The Data

Accounting data from a firm's financial balance sheet is used in the study. The data is part of the IBIS Enterprise Database, a panel data set. It contains information on an annual basis for medium to large firms (no small firms) in Australia from 1979 to the present. A balanced panel consisting of 377 firms was constructed from the database for the years 1993 to 1996.[1] 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 econometric analysis. The relatively short length of the panel reduces the chance of survivorship bias affecting the results.

Excluded from the panel are financial firms, government firms, trusts, associations and cooperatives. The effective tax rate is defined as the ratio of income tax expense to profit before tax and can take on values greater than zero and less than one; other values are excluded.[2] Manufacturing firms account for 45 percent of all firms included in the panel, whilst just over 22 percent are involved in wholesale trade; 42 percent are listed; whilst 55 percent are Australian owned, thus a large percent are foreign owned.

1 A "balanced" panel is one in which all firms are observed for the same number of years. Use of such a panel aids estimation although dependent on the nature of the firms not included and the processes which determines non-inclusion, this potentially introduces a selection bias.

2 See Gropp (1997) for a study that includes such outliers.

Table 3
Summary Statistics

	Mean	Standard Deviation	Minimum	Maximum	Observations
ETR = T/π	0.339	0.122	0.001	0.974	1,508
Revenue/π	41.40	123.8	0.944	1,888	1,508
Depreciation/π	0.221	0.367	0.001	7.335	1,508
Interest/π	0.141	0.288	0.000	3.102	1,508
Debt/Assets	0.558	0.271	0.089	5.448	1,508
Subsidiaries	1.633	1.243	0.000	5.595	1,508
Foreign	0.448	0.498	0.000	1.000	1,508
SD (Revenue)	0.074	0.183	0.000	1.525	1,508
Size	11.74	1.500	7.809	17.377	1,508

Table 2 compares the median effective tax rate for firms included in the panel along with the statutory rate for each year. The median effective tax rate for IBIS firms is close to the statutory rate for 1994, 1995, and 1996, and 2.5 percentage points less than the statutory rate in 1993. Table 3 provides summary statistics on selected financial variables.

4. Accounting Specification

Consider the definition of taxable income given in Table 1. Denoting this by y_{it}, for each firm i and year t, it is equal to revenue (R_{it}) minus costs (C_{it}) minus interest expense (i_{it}) plus capital gains (g_{it}) and minus deductions (d_{it}), yielding

$$y_{it} = R_{it} - C_{it} - i_{it} + g_{it} - d_{it} \quad (1)$$

Table 1 also indicates that "taxes due" are equal to the statutory rate of corporation tax (SRCT) τ_t in period t factored by reported before-tax profits π_{it}, and subtracting credits and rebates (c^p_{it}). Denoting the tax due by T_{it}, this gives

$$T_{it} = \tau_t \pi_{it} - \sum_{p=1}^{P} c^p_{it}, \quad (2)$$

where there are $p = 1, \ldots, P$ possible tax credits and rebates ($c^p_{it} \geq 0$, $\forall p$, i and t).

Equation (2) can be normalized by dividing through by π_{it}, giving

$$\frac{T_{it}}{\pi_{it}} = \tau_t - \frac{1}{\pi_{it}} \sum_{p=1}^{P} c^p_{it}. \quad (3)$$

Equation (3) defines a so-called "effective tax rate". Such an ETR is typically thought of as the normalized tax expense (Wickerson, Reddan, and Khan 2000), where the normalisation makes the ETR an "average" tax rate. Here the data is of a financial nature that makes available before-tax profit, so this is used as the normalising variable.[3]

4.1 Testable Hypotheses

The definition of the ETR as taxes normalized by π_{it}, as in equation (3), offers an approach for studying taxes that has testable features. First, using the identity nature of the structure, the estimated constant should be equal to τ_t, the SRCT; and this is a testable hypothesis. The second set of hypotheses comes from the difference between the theoretical taxable income y_{it} and the reported before-tax profit π_{it}. The factors that comprise the theoretical taxable income (R_{it}, C_{it}, i_{it}, g_{it}, d_{it}) arise as candidates that can be focused on in the transition from taxable income to reported before-tax profits. For example, if revenues are higher in actual taxable income than in reported profit, it would be expected that inclusion of revenues in the estimation of the ETR would lower the tax rate. This is because, in effect, the additional revenues "dilute" the average amount of tax paid. Similarly, if interest expenses in actual income are greater than those expensed in reported profit, such interest

3 See Plesko (1999) for a study of marginal versus average tax rates; and see Harris and Feeny (2003) for a different normalization as based on tax data.

expenses act to raise costs, lower income and raise the ETR. This logic would also give a positive relation between deductions and the estimated ETR.

With respect to capital gains, one influence is how much is held in equity that needs to be reinvested outside of the firm, thereby generating capital gains. Such gains would be positive on average, since they would hover around a return of at least the positive risk-free interest rate. An increase in leverage through greater debt conceivably would tend to lower the equity investments, so that a higher debt to equity ratio can be viewed as leading to less capital gains. With this view, the debt/equity (*D/E*), or the debt/asset, structure, would negatively affect the theoretical taxable income and so positively affect the taxes as normalized by reported profit.[4]

The testable hypotheses thus far can be summarized as

$$\partial(T_{it}/\pi_{it})/\partial R_{it} < 0; \quad (4)$$

$$\partial(T_{it}/\pi_{it})/\partial i_{it} > 0; \quad (5)$$

$$\partial(T_{it}/\pi_{it})/\partial d_{it} > 0; \quad (6)$$

$$\partial(T_{it}/\pi_{it})/\partial(D/E)_{it} > 0. \quad (7)$$

Other factors may affect the effective amount of the credits that are actually taken or the other components of income. Here factors concerning industrial structure may affect the ETR. These factors include: whether they are foreign owned; how many subsidiaries they operate; firm size; and ownership and holding structure. For example, with regard to foreign ownership, some 45% of the firms are foreign owned (in the sample); Australia's average corporate tax rate is lower than some of its major trading partners, such as the US and Japan for more than half of the years under study. The finding of a positive effect of foreign ownership on the effective tax rate indicates possible "tax haven" use of Australian incorporation. As Hines (2004) explains, firms located in higher tax countries can use foreign ownership within a lower tax country to transfer income towards the lower tax location, while transferring deductions towards the higher tax country. This would tend to make the tax rate higher than that of a typica domestic firm, leading to a positive effect o foreign ownership. Subsidiaries on the othe hand provide the means for the transfer o income and of deductions, as well as fo differential pricing on intangible assets, and i themselves can allow a firm to lesson its ta burden, suggesting a negative effect o subsidiary numbers on the ETR.

On the basis of equations (4) to (7), and the other effects described above, the following econometric model is specified

$$T_{it}/\pi_{it} = \lambda_t + \mathbf{x}'_{it}\beta + \alpha_i + u_{it}. \quad (8$$

where λ_t is a year-specific constant; $\mathbf{x}_{it}$ is a vector of observed financial variables; β is a coefficient vector; α_i are time invarian "unobserved effects" (included to allow for any unobserved firm heterogeneity); and u_{it} is a "white noise" disturbance term. The testable hypotheses of equation (8) are that λ_t equals the SRCT in the given year; or

$$\lambda_t = \tau_t, \quad (9$$

and that the β coefficients are as predicted.

4.2 Variables Entering the Model

Variables in the $\mathbf{x}_{it}$ vector include three curren income variables: revenue; interest payments and depreciation deductions, each normalized by π_{it}. Here the interest and depreciatior variables are factored by the statutory tax rate; this is to capture additional weight given tc such deductions as the tax rate changes over the years of the sample. An additional expense-type variable that is included is normalized R&D expenses; this does not end up factoring significantly into the econometric results. The debt to asset ratio is included as in Gropp (1997). Other variables in $\mathbf{x}_{it}$ are whether the firm is foreign owned, through a (0; 1) dummy, and the number of subsidiaries, counting both domestic and foreign ones owned by a firm. The latter is defined as the log of one plus the number reported in 1995; this natural log specification yields a more preferred model in terms of fit and statistical significance. Also the initial model includes the standard deviation of revenue, to capture a role in carry-forward losses, and the size of the firm; however both of these are found to be statistically insignificant across specifications and the results are not reported below.

4 See Gropp (1997) and Gropp (2002) for related discussion of the debt/equity structure.

5. Econometric Methodology

Observed divergences in measured ETRs generally depend on observed firm characteristics. It is possible to separately control for all these observed characteristics by entering them as explanatory variables in the regression equations. There are also unobserved firm characteristics, typically known as individual or unobserved effects, that can further explain divergences in ETRs across firms. Unobserved effects tend to capture significant omitted or unmeasured variables, such as elements of firm-specific tax and management strategies.

A panel data set, in comparison to a strictly cross-section or time-series approach, facilitates conditioning on unobserved individual firm heterogeneity by allowing for the simultaneous conditioning on observed and unobserved firm characteristics (see, for example, Hsiao 1985, Hsiao 1986, Mátyás and Sevestre 1996). The panel set also facilitates the testing of the relationship between the time varying constant and the actual SRCT.[5]

5.1 Fixed versus Random Effects

Two basic approaches are common for panel estimation: *fixed* and *random effects* (FE and RE). The former treats the individual effects as fixed parameters that require estimation, the latter as independent random drawings. The Hausman (1978) test helps determine which approach may be preferable. It tests the extent of the correlation between the unobserved effects and the explanatory variables (see Mundlak 1978, Hsiao 1985, Hsiao 1986). If significant correlations exist, a FE approach is consistent while a RE approach yields biased and inconsistent parameter estimates. If such correlation does not exist, both are consistent but a RE approach is more efficient. A RE approach also allows the identification of the effects of time-invariant variables, which a FE approach precludes. If a statistically significant difference is found between these two estimators, this is evidence in favour of the FE effects approach.

Formally, the test statistic is

$$H = \left(\hat{\theta}_{FE} - \hat{\theta}_{RE}\right)' \left[Avar\left(\hat{\theta}_{FE}\right) - Avar\left(\hat{\theta}_{RE}\right)\right]^{-1} \left(\hat{\theta}_{FE} - \hat{\theta}_{RE}\right) \sim \chi^2_M,$$

where

$\hat{\theta}_{RE}$, $Avar\left(\hat{\theta}_{RE}\right)$ and $\hat{\theta}_{FE}$ $Avar\left(\hat{\theta}_{FE}\right)$

are respectively, the RE and FE parameter vector and asymptotic covariance matrices; M is the order of these matrices, this being the number of time-varying parameters that can be identified within the FE approach.

Note, that for the FE specifications, time-invariant variables need to be excluded: standard deviation of revenue; overseas income; the number of subsidiaries; foreign ownership; publicly listed/non-listed; and industry dummies.[6] Furthermore, as the constant is split into N separate components, an exhaustive set of dummy variables cannot be included. For this reason, one of the time dummies is removed (1996), and the coefficients on the remaining ones are interpreted as differences from that of the omitted one (of course, identical results would be obtained by including all dummies and excluding the constant term). Thus, from Table 2, the expectation is of a coefficient on the 1994 and 1995 dummies to equal -0.06 (i.e., 0.39 – 0.33) and on the 1996 one to equal -0.03 (0.39 – 0.36).

5.2 Hausman and Taylor RE Approach

A further econometric procedure is to try to model the correlation, following Hausman and Taylor (1981), if the Hausman test suggests that it is evident. In this way it is still possible to obtain consistent RE parameter estimates using a Generalized Method of Moments (GMM) approach. Consider the generic model of

$$y_{it} = \mathbf{w}'_{it}\boldsymbol{\beta} + \alpha_i + \lambda_t + u_{it}, \qquad (10)$$

where w_{it} contains both time varying variables, x_{it}, and time invariant ones, f_i. Hausman and Taylor (1981) suggest decomposing w_{it} into $w_{it} = (w'_{1it}, w'_{2it})'$, where w_{1it} is a subset of w_{it} that is independent of the unobserved effect. GMM estimation can then be based on the orthogonality conditions

$$E\left(\mathbf{z}'_{it}\alpha_i\right) = \mathbf{0},$$

where z_{it} is based upon w_{1it}. Using the same partitions as for w_{it}, the Hausman and Taylor

5 We are grateful to a referee's suggestion that it would be possible to allow response parameters to vary both over time and across industries, although this would entail a loss of degrees of freedom and smaller effective sample sizes. This approach is left to future research. As is a further suggestion to allow the both the mean and variance functions be a function of observed characteristics.

6 In essence their effects are absorbed into the α_i.

(1981) estimator (HT) uses $z_i = (\mathbf{f}_{it}, \bar{\mathbf{x}}_i)'$. The λ_t of equation (8) are still treated as fixed constants. In the results below we set $w_{2it} = R_{it}$.

The Hausman and Taylor (1981) RE estimation can be further checked for the validity of its instruments by performing the Sargan (1958) test.

6. Results

Two sets of results are reported in Table 4 corresponding to restricted and unrestricted models, where the restrictions are that the time dummies are equal to the relevant SRCT. Hausman tests quite clearly reject the null-hypotheses of $E(\alpha_i/x_{it}) = 0$ in both cases, thereby rendering standard RE estimates biased and inconsistent. Therefore, we present (consistent) results from both FE (first and second columns) and RE (third and fourth columns) approaches, where the later correspond to HT GMM estimates.

For the unrestricted FE model, explanatory power is reasonable, at over 30%, and all variables are significant at 5% size, except interest payments and the debt to assets ratio, which are significant at 10% size. For the null hypothesis regarding no fixed unobserved effects, that is $\alpha_i = 0$ for all i; the F-test significantly rejects the null hypothesis.

One of the testable hypotheses, from equation (9), is that the time dummies should be equal to the SRCT. Imposing this restriction gives the results of columns two and four, Table 4: that is, the dependent variable becomes ETR *minus* the SRCT. This testable hypothesis implies that the yearly constant should equal the rate in 1993 minus the rate in the particular year. The results show that the time dummies are individually strongly significant and close to their expected values (-0.04 as compared to -0.06, and -0.03 as compared to -0.03). A t-test clearly accepts the null hypothesis of significance for 1996, but this test indicates marginal significance for 1994 and 1995. Jointly, the F-statistic marginally rejects the null hypothesis with a p-value of 0.041 (compared to 0.05). While the time dummy restrictions are marginally not accepted, the estimated parameter coefficients are nonetheless notably constant across the unrestricted and restricted FE specifications.

The restricted and unrestricted consistent RE (HT) GMM estimates yield results closely similar to the FE specifications; and the results easily pass the Sargan (1958) test for over-identifying restrictions (that is, the instruments are valid). And the RE results allow for other variables to show significance, in particular the number of subsidiaries and the foreign ownership dummy variable.

The other testable hypotheses concern the comparative statics of equations (4) to (7) in Section 4. These suggest that the effect of revenue on ETRs should be negative and that of interest and deductions positive. Across all estimations, the effect of normalized revenue is indeed, significantly negative, and of a remarkably consistent magnitude. Normalised interest expenses exert a consistently positive effect, ranging from 0.0345 to 0.0485, although this effect appears to be relatively imprecisely estimated in the FE approaches. And normalised depreciation, an allowable deduction, has the predicted positive sign and is strongly significant across specifications, within a tight range of (0.042, 0.050). The debt to assets ratio shows a marginally significant and positive effect.

In the RE specifications, where it is possible to identify the effects of time-invariant variables, there is strong evidence that firms with a greater number of subsidiaries have increased scope for reducing their ETRs. The evidence also suggests that foreign owned firms have ETRs which are some two-and-a-half percentage points higher than their domestically owned counterparts. Note also that time-invariant dummy control variables for each of the 14 industry groups in the sample are also included; these are of varying significance and the results not reported (the only statistically significant industry dummies were those associated with Construction and Wholesale Trade, both of which were positive).[7]

In summary, higher firm ETRs are associated with higher normalized depreciation and interest payments, higher debt to assets ratios, and foreign ownership. Lower firm ETRs are associated with higher normalized revenue ratios and a larger number of subsidiaries. Except for the debt to asset ratio, these results are very robust across specifications.

7 Full results are available from the authors on request.

Table 4
Fixed and Random Effects Regression Results

	Fixed Effects: Unrestricted	Fixed Effects: Restricted	Random Effects, HT: Unrestricted	Random Effects, HT: Restricted
D94	-0.0363	–	-0.0359	–
	(0.007)**		(0.007)**	
D95	-0.0366	–	-0.0364	–
	(0.007)**		(0.007)**	
D96	-0.0253	–	-0.0264	–
	(0.007)**		(0.007)**	
Revenue/π	-0.0002	-0.0002	-0.0002	-0.0002
	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Depreciation/ π	0.0446	0.0420	0.0504	0.0480
	(0.015)**	(0.015)**	(0.012)**	(0.012)**
Interest/ π	0.0419	0.0345	0.0485	0.0427
	(0.023)*	(0.023)	(0.020)**	(0.020)**
Debt/Assets	0.0374	0.0333	0.0233	0.0219
	(0.021)*	(0.021)	(0.015)	(0.015)
No. of subsidiaries	–	–	-0.0107	-0.0107
			(0.004)**	(0.004)**
Foreign ×1	–	–	0.0267	0.0264
			(0.009)**	(0.009)**
Constant	–	–	0.3395	-0.0355
			(0.017)**	(0.016)**
Industry effects	no	no	yes	yes
R^2	0.339	0.320		–
Hausman	0.008	0.000		
F-test (α_i), *p*	0.000	0.000		
F-test (λ_t), *p*	0.041			
Sargan, p			0.30	0.26
NT	1,508			

Robust standard errors in parentheses. ** significant at 5% size, two-sided test. * significant at 10% size, two-sided test. Reported test statistics are *p*-values.

7. Discussion

The normalisation factor in the definition of the ETR typically is some measure of pre-tax income. Gupta and Newberry (1997) use income after interest and depreciation expenses are subtracted; Mills, Erickson, and Maydew (1998) use income before interest expenses are subtracted; and Gropp (1997) uses sales which is before any interest expenses or deductions are subtracted. Since this paper's ETR has interest payments and depreciation already taken out of the profit, its normalisation factor is most similar to that of Gupta and Newberry (1997). The importance of which divisor is used is in the comparative statics for the variables entering the econometric estimation of the ETR. The comparative statics in this paper of the interest payments and depreciation are of the same expected sign as in Gupta and Newberry (1997), of the opposite sign to that of Gropp (1997), and the same sign for the interest payments in Mills, Erickson, and Maydew (1998), but the opposite sign for the depreciation expenses as that in Mills, Erickson, and Maydew (1998). So for example the significance of depreciation with a negative coefficient sign contrasts with the

results found above of significance with a positive sign, but nonetheless are consistent with each other because of the different normalisation factor.

As in Gropp (1997), Gupta and Newberry (1997) and Mills, Erickson, and Maydew (1998), there is evidence of the debt to asset ratio affecting ETRs. While Gropp (1997) and Mills, Erickson, and Maydew (1998) find this to significantly negative in effect, the results above show a marginally significant positive effect. Also, like most previous studies, there is no effect from R&D. Firm size was found to be insignificant as, for example, in Gupta and Newberry (1997).

Also as in Mills, Erickson, and Maydew (1998) foreign ownership has a significant positive effect on ETRs. Further, there is the very robustly negative effect of the number of subsidiaries, suggesting as in Rego (2002), additional scope for lowering taxes. The significance of the use of depreciation deductions may be related to the strong, consistent, significant effect of the number of subsidiaries and foreign ownership. For example, the results may reflect a practice that was known as "double dipping" of deductions, such as using subsidiaries in order to artificially increase the number of "arms length" transactions and so take the same deduction more than once. Foreign firms facing high tax rates in their home countries may have been attracted by such practices as well as the somewhat lower tax rates. This allows for the possibility that, in effect, Australia may have partly acted as a tax haven.

Methodologically, previous work appears not to have focused on the link between the constant term and the statutory rate, as this paper makes exact through its choice of the normalisation factor in defining the ETR. For example, in Mills, Erickson, and Maydew (1998), the constant term is reported to vary between 42 and 54 for a data set for 1991 of US firms. The advantage of the time dummies reported in Table 4 is that they give a further check on the results by showing whether the constant is close to the statutory rate as it should be. This provides a check for robustness of the model's results that is as much a testable hypothesis as the comparative statics.

8. Conclusion

This paper presents and estimates an accounting-based model of Australian ETRs using panel data techniques. The results indicate which factors are used relatively more to lower ETRs during the period under consideration. Tax-lowering incentives appear to be working, in part, through the use of deductions that are coupled with an increased use of subsidiaries and foreign ownership. The model estimates the SRCT rather closely, which increases confidence in the reported results in terms of which factors influence the ETR, and with what sensitivity. In particular, we suggest that the accurate estimation of the SRCT for the period under study should make the range of the model's point estimates for the factors more precise than in estimations that lack the ability to approximate the statutory rate.

References

Deutsch, R., S. Gates, M. Gibson, P. Hanley, G. Payne, and W. Plummer (1996): *Australian Tax Handbook 1996.* Australian Tax Practice, Sydney, Australia.

Gropp, R. (1997): "The Effect of Expected Effective Corporate Tax Rates on Incremental Financing Decisions," Discussion paper, IMF.

_____(2002): "Local Taxes and Capital Structure Choice," *International Tax and Public Finance*, 9, 51–71.

Gupta, S., and K. Newberry (1997): "Determinants of the Variability in Corporate Effective Tax Rates: Evidence from Longitudinal Data," *Journal of Accounting and Public Policy*, 16, 1–34.

Harris, M., and S. Feeny (2003): "Habit Persistence in Corporate Effective Tax Rates," *Applied Economics*, 35, 951–958.

Hausman, J. (1978): "Specification Tests in Econometrics," *Econometrica*, 46, 1251–1271.

Hausman, J., and W. Taylor (1981): "Panel Data and Unobservable Individual Effects," *Econometrica*, 49, 1377–1398.

Hines, J. (2004): "Do Tax Havens Flourish?," Discussion Paper WP2004-11, University of Michigan, Office of Tax Policy, University of Michigan.

Hsiao, C. (1985): "Benefits and Limitations of Panel Data," *Econometric Reviews*, 4, 121–174.

_____(1986): *Analysis of Panel Data.* Cambridge University Press, Cambridge, England.

Mátyás, L., and P. Sevestre (1996): *The Econometrics of Panel Data.* Kluwer Academic Publishers, The Netherlands.

Mills, L., M. Erickson, and E. Maydew (1998): "Investments in Tax Planning," *Journal of the American Taxation Association*, 20(1), 1–20.

Mundlak, Y. (1978): "On the Pooling of Time Series and Cross Section Data," *Econometrica*, 46(1), 69–85.

Plesko, G. (1999): "An Evaluation of Alternative Measures of Corporate Tax Rates," Working paper, Massachusetts Institute of Technology.

Rego, S. (2002): "Tax Avoidance Activities of US Multinational Corporations," manuscript, University of Iowa.

Sargan, J. D. (1958): "The Estimation of Economic Relationships Using Instrumental Variables," *Econometrica*, 26, 393–415.

Wickerson, J., N. Reddan, and M. Khan (2000): "Using Tax Return Data To Assess The 'Tax Performance' Of Large Australian Companies: An 'Effective Tax Rate' Perspective, 1991/92 to 1997/98," Australian Tax Office (ATO), 4th International Conference On Tax Administration: Tax Administration in the third millenium.

Wise, D., B. Needles, H. Anderson, and J. Caldwell (1998): *Principles of Accounting: Australian Edition*. Jacaranda Wiley Ltd, Queensland.