Modelling Corporate Tax in the CGETAX Model

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1. Introduction

This note explains how company income tax is modelled in the CGETAX model. CGETAX is a long-run computable general equilibrium model with a special focus on tax policy. While it models each of the taxes shown in Table 1, this note is limited to explaining how company income tax is modelled.

Table 1
Taxes Modelled in CGETAX

Tax Category	Taxes Modelled	Tax Category	Taxes Modelled
Income Taxes	Company Income Tax Petroleum Resource Rent Tax Personal Income Tax: labour income Personal Income Tax: asset income Superannuation: contributions tax Superannuation income tax	Remaining Product Taxes and Subsidies:	Excise: petroleum Excise: tobacco Luxury Car Tax Gambling taxes Insurance taxes Other product taxes Petroleum subsidies Other product subsidies Import Duty
Goods and Services Tax	Rate GST status of each industry		
Stamp duty on conveyances	residential conveyancing non-residential conveyancing	Production Taxes	Payroll tax Land tax Municipal rates Other taxes on production NEI Other subsidies on production Mining Royalties
Taxes on Alcoholic Beverages	WET: wine WET: cider Excise: beer Excise: spirits		

An earlier version of CGETAX was used to model a wide variety of corporate tax policies in studies including Murphy (2016a, 2016b, 2017, 2018a, 2018b). In Murphy (2025), the recently-updated version of the model, CGETAX2025, was used to model a series of alternative corporate tax policies for the Productivity Commission.

A key consideration in modelling corporate tax is that the tax base has two main components. The first component is normal returns to capital, which are highly inefficient to tax in a small open economy, discouraging both investment and the labour supply (Gordon, 1986). The second component is location-specific economic rents, which are highly efficient to tax, and include natural resource rents and oligopoly rents. Corporate tax revenue is split about 50-50 between these two components (Murphy, 2025), which are both modelled in detail in CGETAX.

There are four other significant issues in modelling corporate tax. First, International Profit Shifting (IPS) is significant and wastes resources on tax avoidance. Second, the Australian franking credits system lacks logic if the marginal investor is foreign. Third, the Australian dual rate system with base rate entities and standard rate entities may have both benefits and costs. Fourth, the existence of corporate tax may create a bias against incorporation.

CGETAX models the first two out of those four issues. However, the forthcoming Dynamic CGETAX model will also model the remaining two issues. In addition, it will model vertical equity and the dynamic adjustment of the economy to its long run equilibrium.

The next three sections explain in turn how CGETAX2025 allows for different types of profits, international profit shifting (IPS) and alternative corporate tax regimes. Section 5 derives the model's equation for the user cost of capital that drives investment, highlighting the influence of corporate tax policy. Finally, section 6 discusses developments in modelling corporate tax policy in Australia from the Henry Review to CGETAX to the forthcoming Dynamic CGETAX model.

2. Different Types of Profits

In modelling the effects of corporate tax, we need to make the basic distinction between the two different types of profits because the economic effects of taxing them are so different. Ideally, we would tax profits that take the form of economic rents, but we would not tax normal profits from produced capital. That way, the corporate tax system would not discourage investment.

In CGETAX we go further and distinguish eight types of produced capital and three types of economic rents. This extra detail allows us to more fully capture the complexities of the corporate tax system. It also takes into account that different types of economic rents have different policy implications, as explained below.

We can see where the different types of produced capital and economic rents fit into the production function of each industry in Figures 1 to 3. We begin with Figure 2.

Capital

Figure 2 distinguishes six types of produced general business capital. In each industry, the elasticity of substitution between these types of general business capital is assumed to be low at 0.3. Our corporate tax system treats two of these types of capital differently.

In particular, mineral & petroleum exploration and research & development can be expensed immediately instead of being depreciated gradually. Further, in the case of research & development investment, this full expensing attracts loadings under the research & development tax incentive. CGETAX takes these complexities into account.

The remaining two types of produced capital are structures and ownership transfer costs. As seen in Figure 3, within each industry, the elasticity of substitution between structures and land is assumed to be 0.5, while the resulting structures-land composite has an elasticity of substitution of 0.3 with ownership transfer costs in producing structure services.

For a given tax rate, the extent to which corporate tax discourages investment depends importantly on the elasticity of substitution between labour and capital. To interpret the value of that elasticity in CGETAX, we need to take into account that general business capital and structure services enter the production technology separately in Figure 1.

Figure 1
Production in each industry

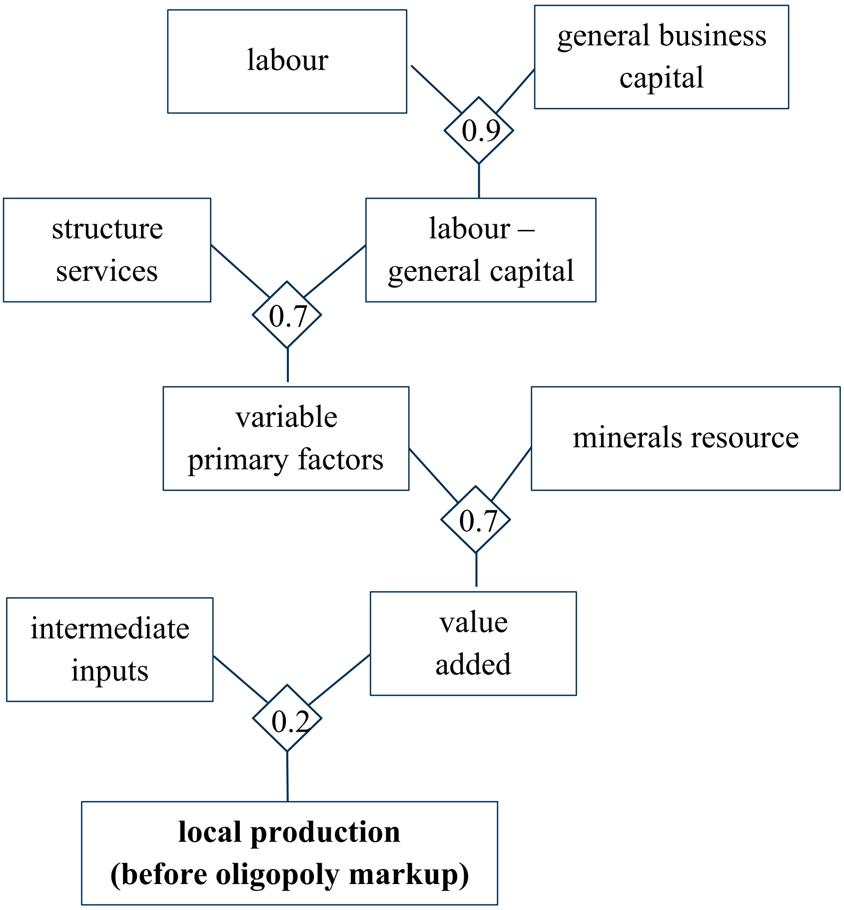


Figure 2
General business capital in each industry

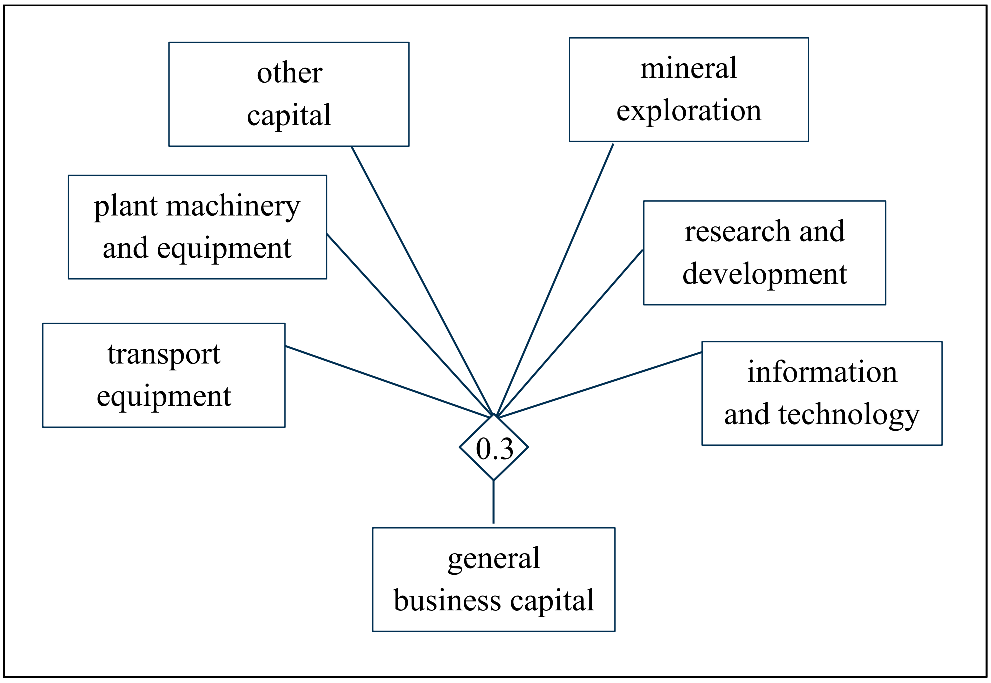
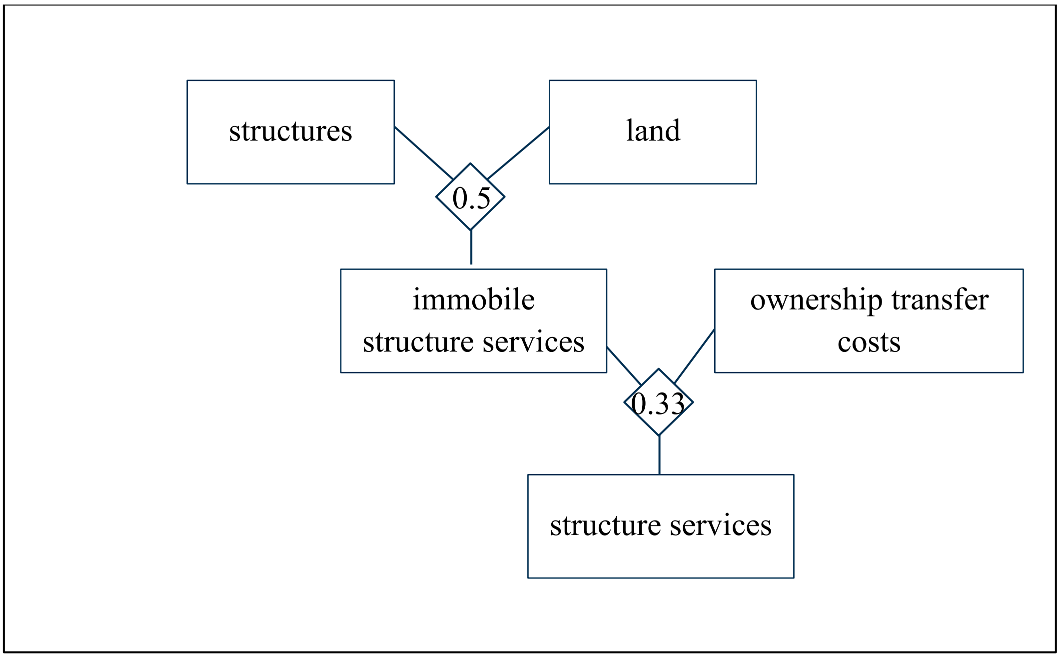


Figure 3
Structure services in each industry



On the one hand, the elasticity of substitution between general business capital and labour is assumed to be 0.9, just below the value of 1.0 under a Cobb Douglas production function. On the other hand, the elasticity of substitution between the general business capital-labour composite and structure services is a bit lower at 0.7.

Taking both of these elasticities into account, we can say that the overall elasticity of substitution between labour and capital is about 0.8, where capital includes both general business capital and structures.

Economic Rents

The remaining sources of corporate profit are three types of location-specific economic rents:

- rent on land for non-dwelling structures;
- mineral rents; and
- oligopoly rents.

The first two types of rents are modelled as fixed factor rents. That is, there is assumed to be a fixed supply of the factor of production, so rents are driven by demand. More specifically, the values of these fixed factor rents are modelled as follows.

The total supply of non-dwelling land is assumed to be fixed, but its allocation between industries is flexible. Hence, the rent on this land adjusts to balance the fixed total supply with the combined demand from all industries derived using the production technology of Figure 3.

Mineral resources are modelled as an industry-specific fixed factor of production in Figure 1. This fixed factor is present in the following five industries: coal mining (0601Z); crude oil (0701A); LNG (0701B); other gas extraction (0701C); and iron ore mining (0801Z). The rent on each industry’s mineral resource adjusts to balance the fixed factor supply with the industry’s demand derived using the production technology of Figure 1.

Oligopoly rents are different in nature from fixed factor rents. Firms with market power are able to markup prices above the marginal cost of production even though marginal cost is defined to include a normal rate of return on capital. Oligopoly rents are modelled in those industries that are: (a) identified as earning above normal rates of return on capital; and (b) have other characteristics of an oligopoly. While Figure 1 shows that oligopoly rents are added to production costs, in practice they are present in only 29 out of the 278 industries in the model. Further, 85 per cent of oligopoly rents are received by just five industries which are: bank interest margins (6201A); wholesale margins (3301M); retail margins (3901M); bank fees (6201B); and telecommunications networks (5801A).

A fourth type of economic rent, firm-specific rents, is not represented in CGETAX. Unlike corporate tax on location-specific rents, corporate tax on firm-specific rents may discourage investment. In particular, MNCs may generate economic rents from their know-how and taxing such rents may reduce a country’s access to that know-how.

It is efficient to impose a rent tax on location-specific economic rents, irrespective of whether those rents are fixed factor rents or oligopoly rents. However, some other policy choices depend on whether fixed factor or oligopoly rents are present. An oligopoly in an industry means prices are marked up above the marginal cost of production, making demand and production inefficiently low.

In the presence of an oligopoly, a production tax will be more inefficient than usual because it will exacerbate this oligopoly over-pricing. The same problem does not arise if instead rents are generated by a fixed factor of production, because in that case initial pricing may be in line with marginal cost.

Similarly, in modelling competition policy, it is important to take into account that an improvement in competition may reduce or eliminate oligopoly rents but not fixed factor rents. Improved competition can generate large welfare gains by bringing prices down to be in line with marginal costs.

Because we cannot eliminate and tax oligopoly rents at the same time, the obvious question is which is the better policy. There are much larger gains in consumer welfare from using competition policy to eliminate oligopoly rents than from using oligopoly rents as an efficient tax base. Because competition policy can take time to work, it is a reasonable strategy to tax oligopoly rents while they persist. However, the risk is that governments become reliant on this source of revenue making them reluctant to follow appropriate competition policies, to the detriment of consumers.

For all of those reasons, it is important in modelling both tax policy and competition policy to distinguish between fixed factor rents and oligopoly rents, as is the case in CGETAX.

3. International Profit Shifting

We now explain how international profit shifting is modelled in CGETAX, including how it wastes resources on tax avoidance.

Companies engage in profit shifting to reduce their costs inclusive of tax. If a proportion, θ, of profits is shifted to a tax haven, there is a tax saving equal to the amount of the tax base that is shifted, $\theta.tkcov.BASE$, times the difference between the local tax rate and the tax haven tax rate tak-tkh.

$$tax\ saving = (tak - tkh).\theta.tkcov.BASE$$

Here, *tkcov* refers to the coverage of company profits by company income tax. This coverage factor may differ from unity due to factors such as differences between the national accounts-based measure of profits used in the modelling, *BASE*, and the tax law measure of profits.

Besides this direct tax saving, profit shifting also involves a tax avoidance cost which includes tax planning advice and the risks of fines and reputational damage. Following McKeehan and

Zodrow (2017), we assume that this avoidance cost rises with the product of the proportion of profits that is shifted, θ, and the amount that is shifted, $\theta.tkcov.BASE$. This captures the idea that profit shifting becomes more risky as the proportion of profits that is shifted rises. Here the parameter, A, is inversely proportional to the costliness of profit shifting.

$$avoidance\ costs = \frac{1}{2.A}.\theta.\theta.tkcov.BASE$$

Companies are assumed to maximise their net cost saving, S, from profit shifting, defined as the tax saving less the avoidance costs that were set out above.

$$S = (tak - tkh).\theta.tkcov.BASE - \frac{1}{2.A}.\theta.\theta.tkcov.BASE$$

Choosing the proportion of profits that is shifted to maximise this saving gives the following simple solution. The proportion of profits that are shifted is proportional to the gap between the statutory tax rate and the tax rate in the tax haven.

$$\theta = A.(tak - tkh) \qquad [a]$$

The value for θ affects both the effective company tax rate for local revenue collections, *tkr*, and the effective tax rate for investment decisions, *tkc*. The effective tax rate for local revenue collections is the statutory tax rate, *tak*, adjusted for the proportion of profits that is shifted and the profits coverage of company tax.

$$tkr = tkcov.(1 - \theta).tak \qquad [b]$$

The effective tax rate for investment decisions is the statutory tax rate less the net cost saving from profit shifting, *S*, expressed as a proportion of the tax base, *BASE*, adjusted for the profits coverage of company tax. In deriving this result, the net cost saving expression is first simplified by using the solution for θ to eliminate A. The final formula for the effective tax rate for investment decisions is as follows.

$$tkc = tkcov.\left[tak - \frac{1}{2}.\theta.(tak - tkh)\right] \qquad [c]$$

The effective tax rate for investment decisions, *tkc*, is higher than the effective tax rate for local revenue collections, *tkr*. This difference reflects the tax-related costs incurred by the foreign investor over and above their payments of Australian company tax.

$$abroad = (tkc - tkr).BASE = tkh.\theta.tkcov.BASE + \frac{1}{2}.(tak - tkh).\theta.tkcov.BASE$$

These additional costs are seen to have two components. The first component is the tax paid to the tax haven and the second component is the cost of the avoidance activity. Both costs are assumed to be incurred offshore and thus represent a payment of income abroad.

While in practice some costs of avoidance activity may be incurred locally, rather than offshore either in the home country of the MNC or the tax haven, this does not change the outcome for consumer welfare. In the first case there is wastage of GDP on local tax avoidance activity while in the second case there is wastage of national income in paying for the same activity to be conducted offshore. Thus, it is harmless for tax policy purposes to simplify by assuming that all of the tax avoidance costs are incurred offshore.

The above formula for the payment of income abroad simplifies to the following.

$$abroad = \tfrac{1}{2}.(tak + tkh).\theta.tkcov.BASE \qquad \text{[d]}$$

The implications of this for the modelling are as follows. First, the degree of profit shifting is given by equation [a]. Then we use equation [b] to obtain the effective tax rate for local tax collections, equation [c] for the effective tax rate for investment decisions and equation [d] for the payment of income abroad associated with the difference between [c] and [b].

To apply this approach to modelling IPS, we first need an estimate for the parameter *A*, that captures the cost of profit shifting activities. We proceed by inverting equation [a].

$$A = \theta/(tak - tkh) = \theta/(0.3 - 0.05) = 4 \cdot \theta \qquad \text{[e]}$$

Thus, we can estimate *A* as long as we have an estimate for the initial proportion of the potential tax base lost to profit shifting, θ. Some empirical studies estimate θ directly. Other empirical studies estimate the semi-elasticity of the observed tax base with respect to the tax rate differential, which we represent as *k*. If we have an estimate for the semi-elasticity, *k*, we can recover an estimate of θ as follows.

$$\theta = [k \cdot (tak - tkh)]/[1 + k \cdot (tak - tkh)] = [0.25 \cdot \mathrm{k}]/[1 + 0.25 \cdot \mathrm{k}] \qquad \text{[f]}$$

We start with studies that estimate θ directly. McKeehan and Zodrow (2017), in their modelling of corporate tax policy for small open economies such as Australia, survey the literature on the extent of IPS. They 'adopt a fairly conservative assumption' that income shifting represents 13 per cent of the potential corporate income tax base.

Torslov, Wier and Zucman (2023) estimate how IPS affects corporate tax collections in many different countries, including Australia. For Australia, they estimate that 7 per cent of the potential corporate income tax base is lost to profit shifting. However, this estimate is relatively imprecise because more limited data was available for Australia than for some other countries.

Taking a simple average of the estimates from these two studies gives a preliminary estimate for θ of 0.1. We now test this preliminary estimate against other studies that focus on the semi-elasticity of the observed tax base with respect to the tax rate differential.

Tran and Xu (2023) use company unit record data to estimate how IPS affects corporate tax paid by MNCs in Australia, as foreign investors respond to tax rate differentials between Australia and other countries. They used 4,726 firm-year observations. Using a range of assumptions, they obtained four main estimates for the semi-elasticity *k*. Those estimates ranged from 1.0 to 2.1 and average 1.6.

Most recently, Delis et al. (2025) conducted a large-scale international study covering 189 countries and using 2,277,435 firm-year observations. They find that 'the top 20 profit-shifting

MNEs are well-known firms that shift billions of US dollars annually and mainly belong to the information technology, pharmaceutical, and petroleum industries'. They find a semi-elasticity of 'approximately 2.8'.

Taking a simple average of these alternative estimates for the semi-elasticity of 1.6 and 2.8 gives 2.2. This semi-elasticity refers only to the behaviour of MNCs. To apply it to the Australian company tax base, we need to take into account that Australian-focussed companies have little or no scope to engage in IPS.

McKeehan and Zodrow (2017) report that the average share of domestically-owned capital in total market capitalisation across 42 countries is 80 per cent. Thus, we apply an MNC weight of 20 per cent to our MNC semi-elasticity of 2.2 to obtain an aggregate semi-elasticity of 0.44. When we insert that value for k into equation [f], we obtain an estimate for θ of 0.10. This happens to match the θ estimate we obtained from studies that estimate θ directly.

Our estimate for θ of 0.10 for CGETAX2025 is down from the estimate of 0.15 for the original CGETAX model (Murphy, 2018a). That downward revision reflects the results from the more recent studies discussed above.

Finally, we insert our estimate for θ of 0.10 into equation [e] to obtain our estimate for the underlying parameter, A, of 0.4. We can now use equation [a] to simulate how changes in the local company tax rate, *tak*, lead to changes in the proportion of the potential tax base shifted offshore, θ.

4. Alternative Corporate Tax Regimes

CGETAX allows for several alternative corporate tax regimes in modelling the cost of capital and corporate tax revenue. This modelling is performed separately for each of the model's 11 types of corporate profit that were identified in section 2. We start with taxation of investment or produced capital and then consider taxation of economic rents.

Produced capital or Investment

We begin with the general or textbook formula for the real user cost of capital, *uc*.

$$uc = \frac{PI}{P} \cdot \left\{ \delta + r + \frac{tkc}{1 - tkc} \cdot rt \right\} \qquad [1]$$

The real user cost (or rental price) of a unit of capital is given by the price of a unit of new investment, *PI*, relative to the price of a unit of output, *P*, times the rate of return calculated in brackets in equation [1]. The rate of return equals the sum of the rate of economic depreciation, δ, plus the required post-tax real rate of return, r, plus the cost of corporate tax. This last term for the cost of corporate tax requires some explanation because of two complications.

The first complication is that while investors require a post-tax rate of return, the corporate tax base is the pre-tax return. Hence, to obtain the corporate tax base, we need to gross up the after-tax rate of return, *rt*, by dividing it by unity minus the effective corporate tax rate, *1-tkc*. We then apply the effective corporate tax rate, *tkc*, to obtain the corporate tax burden on the cost of capital. This appears as the last term in the brackets in equation [1].

The second complication is that, depending on the choice of corporate tax regime, the taxed rate of return, *rt*, may differ from the required rate of return, *r*. The two rates of return are only the same in the simple textbook case shown in equation [2].

$$rt = r \tag{2}$$

The textbook case only applies if there is a single capital deduction which is for depreciation based on *economic* depreciation rates and the *replacement* cost of the investment. In practice, under the standard corporate tax system, there are two capital deductions. The first deduction is for depreciation based on *tax* depreciation rates and the *historic* cost of the investment and the second deduction is for net interest expenses.

CGETAX takes into account the two deductions available under the standard corporate tax system and also allows for other complications in how corporate tax is applied in practice. It also allows for various alternative corporate tax systems that have been proposed. This leads to the relatively complicated three-part formula for *rt* shown in equation [3]. The formula is derived by using the equilibrium condition that, under perfect competition, the net present value of the return on an investment is zero. Equation [3] is derived in section 5.

$$rt = part1 + part2 + part3 \tag{3}$$

$$part1 = (1 - fe) \cdot (\delta + r) \cdot \frac{(\pi + r) - \rho \cdot (ACC + (1 - dr) \cdot ACE)}{dtax + \pi + r} \tag{3a}$$

$$part2 = -dr \cdot Rdebt \cdot (1 - CBIT - ACC) \tag{3b}$$

$$part3 = -(load - 1) \cdot fe \cdot (\delta + r) \tag{3c}$$

Notation:

fe=proportion of new investment that is fully expensed

δ=rate of economic depreciation

r=required post-tax real rate of return

π=expected inflation rate

ρ=allowance rate for ACE or ACC

ACC=proportion of investment that is under an Allowance for Corporate Capital Regime

ACE=proportion of investment that is under an Allowance for Corporate Equity Regime

CBIT=proportion of investment that is under a Comprehensive Business Income Tax Regime

dr=ratio of debt to economic value of capital

Rdebt=nominal rate of interest on debt *load*=loading factor applied to fully expensing (greater than unity with loading, otherwise equals unity)

Equation (3) provides for the following complications in the standard corporate tax system:

- The rate of depreciation allowed under tax law, *dtax*, may differ from the economic rate of depreciation, δ, as reflected in *part1* of the formula.
- Tax law allows a depreciation deduction based on the historic cost of an asset rather than its replacement cost and so the real value of the deduction erodes with price inflation at the rate π, as reflected in *part1* of the formula.
- It would be possible to compensate for this lack of inflation accounting in the tax system by setting tax depreciation rates above economic depreciation rates using the formula shown below. Under these 'fair' rates of tax depreciation, the present value of depreciation deductions are the same as they would be under the textbook case where depreciation is based on economic depreciation rates and the replacement cost of the investment.

  $$dtax = \delta \cdot \frac{r+\pi}{r} \qquad [4]$$

  In the CGETAX database it is assumed that tax depreciation rates are fair, so equation [4] is used to construct tax depreciation rates from the economic depreciation rates used in the national accounts. Willmann (1990, Table 2, column 4) shows that Australian tax depreciation rates were fair in the 1960s but not in the 1970s and 1980s. Unfortunately, this Reserve Bank study does not seem to have been updated.
- Tax law allows a deduction of the nominal interest cost of debt, as reflected in *part2* of the formula.
- Tax law may allow for full expensing of a proportion, *fe*, of new investment, as reflected in *part1* of the formula.
- In cases where full expensing is allowed, a loading at the rate *load* may also be available such that more than 100 per cent of the cost of the new investment may be immediately expensed, as reflected in *part3* of the formula.

Equation (3) also allows for alternatives to the standard corporate tax regime as follows.

- A Comprehensive Business Income Tax (CBIT) regime denies a deduction for net interest expenses. A CBIT can be modelled by setting *CBIT*=1, which eliminates the interest deduction in *part2* of the formula.
- An Allowance for Corporate Capital (ACC) regime replaces a deduction for net interest expenses with an allowance at the rate ρ applied to the capital base in the firm's tax

accounts. An ACC can be modelled by setting *ACC*=1 in *part1* and *part2* of the formula. If the allowance rate is set equal to the nominal required rate of return on capital, i.e.

$$\rho = \pi + r$$

then it can be seen that both *part1* and *part2* in equation [3] will equal zero. *Part3* will also equal zero provided either *load*=1 or *fe*=0. Hence, under those assumptions,

$$rt = 0$$

and the ACC then does not tax the required return on capital. It is then purely a tax on economic rents and so does not discourage investment.

- An Allowance for Corporate Equity (ACE) regime retains the deduction for net interest expenses from debt funding and introduces an allowance at the rate ρ for equity funding. An ACE can be modelled by setting *ACE*=1 in *part1* of the formula. If the allowance rate is again set equal to the nominal required rate of return on capital, i.e.

  $$\rho = \pi + r$$

  then, unlike under the ACC, we see that the ACE is not neutral because the taxed rate of return is now non-zero.

  $$rt = (\delta + r) \cdot \frac{dr \cdot (\pi + r)}{dtax + \pi + r} - dr \cdot Rdebt$$

  Under the 'fair' rates of tax depreciation given by equation [4], the taxed rate of return under an ACE simplifies to the following.

  $$rt = dr \cdot (r - Rdebt)$$

  This implies that the taxed rate of return will be negative if the *nominal* rate of interest on debt, *Rdebt*, exceeds the required post-tax *real* rate of return on capital, *r*. In that case an ACE will subsidise investment.

  De Mooij and Devereux (2009) explain the source of this non-neutrality of an ACE as follows. 'The corporate tax is not entirely neutral under an ACE … (because) … the ACE applies to the equity value in the tax accounts … (whereas) … the interest deductibility applies to the actual interest payments on debt.'

  The ACC avoids this inconsistency by taking the form of a single deduction that is based on the value of capital in the tax accounts. Because the tax accounts value capital using its historic cost, the ACC allowance rate must be set as a nominal rate to compensate for inflation.

- A corporate tax regime with full expensing is modelled by setting *fe*=1 in *part1* and *part3* of the formula. In the case where there are no loadings, *load*=1, then the formula for the taxed rate of return simplifies to this negative value.

$$rt = -dr \cdot Rdebt$$

This shows that full expensing subsidises debt-funded investment. This is because debt-funded investment is deductible twice, both when the investment expenditure is incurred and again when interest payments are made on the debt.

- This problem of double deductibility for debt-funded investment can be eliminated by combining full expensing with no deduction for net interest expenses. This gives a cash flow tax (CFT) with a real base, which was originally known as a Brown tax. In CGETAX, a Brown Tax can be modelled by setting *fe*=1, to achieve full expensing and then blocking a deduction for net interest expenses by setting *CBIT*=1. It gives

  $$rt = 0$$

  showing that the Brown tax does not tax the required return on capital. It is purely a tax on economic rents and so does not discourage investment.

From the above discussion, we see that the two tax regimes which avoid taxing normal returns to capital and purely tax economic rents are the ACC and the Brown Tax. Unfortunately, they both have drawbacks.

The ACC only achieves that result if we assume that the chosen allowance rate, ρ, matches the required nominal after-tax rate of return on capital. In practice, the correct rate may vary from investment to investment with factors such as risk.

The Brown tax does not have the same problem and so comes closest to a pure tax on economic rents. However, governments have been reluctant to implement it because cash flows can be negative in the early phase on an investment project giving rise to negative tax payments for a period of time. Another issue is that the Brown tax cannot be effectively applied to banking services because it excludes interest payments which are the main source of bank profits. Murphy (2017) addresses this issue by setting out various options for including the profits from financial intermediation in the tax base of a modified Brown tax.

As explained above, the ACE is a less pure tax on economic rents than either the ACC or Brown tax. However, it involves making a smaller change to the existing corporate tax system, which may explain its greater popularity. As of 2020, countries using an ACE included Belgium, Brazil, Cyprus, Italy, Malta, Poland, Portugal and Turkey.

There is considerable variation from country-to-country in how the ACE has been implemented. In some cases, the allowance rate is plausible as a required normal rate of return on equity while in other cases it is lower. In some cases, the allowance is available for all equity investment, while in other cases it is only available for new equity investment.

If an ACE were under consideration for Australia, a cautious approach would be to confine it to new equity and begin with a low allowance rate, perhaps the government bond rate. The existing concession of full deductibility of nominal rather than real interest expenses could also be reviewed to fund part of the budget cost.

We now turn to the revenue raised from corporate tax. For produced capital, the formula for corporate tax revenue, *TAXK*, is as follows.

$$TAXK = \frac{tkr}{1-tkc}.rt \cdot PI \cdot K \quad [5]$$

That is, tax revenue is equal to the effective tax rate for revenue, *tkr*, applied to the taxed part of the rate of return on the value of the capital stock. As seen above, for a pure economic rent tax, *rt*=0 and so no revenue is raised from produced capital in that case.

Economic rents

For the three types of location-specific economic rents, the corporate tax modelling issues are simpler. There is no produced capital or investment involved. This means there is no depreciation or expensing of investment so that,

$$\delta = dtax = fe = 0$$

On the other hand, the corporate tax does allow interest expenses as a deduction for economic rents.

The modelling assumes that the new allowances under an ACE or ACC are only available for produced capital and hence are not available for economic rents. Under those assumptions, the taxed rate of return for economic rents simplifies to the following.

$$rt = r - dr \cdot Rdebt \cdot (1 - CBIT - ACC) \quad [6]$$

This shows that economic rents are almost fully subject to company tax. The only revenue leakage comes from the deduction for interest payments on debt that is available except under a CBIT, ACC or Brown tax.

The associated formula for corporate tax revenue from economic rents is as follows.

$$TAXF = \frac{tkr}{1-tkc}.rt \cdot A\$ \quad [7]$$

In the above, A$ is the value of the asset that earns economic rents. That value is modelled by capitalising after-tax income streams from each of the sources of economic rents, namely business land rents, mineral rents and oligopoly rents. The modelling of the value of these economic rents was explained in section 2.

Finally, CGETAX also allows for an industry-specific tax on economic rents that is separate from the modelling of company tax. This tax, which is used in Murphy (2025), applies to oligopoly rents and mineral rents but not business land rents. Currently, the sole example of this type of tax is the petroleum resource rent tax (PRRT). Payments of PRRT are a company tax deduction and this is assumed to also be the case for other hypothetical industry-specific rent taxes that we model.

5. Derivation of Formula for Taxed Rate of Return

We now derive the formula for the taxed rate of return, equation [3], which plays a central role in our modelling. Our approach is based on de Mooij and Devereux (2009), except where otherwise noted.

As stated in section4, we derive the formula using the condition that, in long run equilibrium under perfect competition, the net present value of the after-tax return on an additional unit of investment is zero. In more detail, this means that the upfront cost of the investment, *IC*, must equal the present value of the after-tax return, *PVRET*, plus the present value of capital-related deductions, *PVDED*. We now consider the value of each of those three components for an additional unit of investment.

The first component, the upfront cost of that unit of investment, is the price of the investment, *PI*, net of any upfront tax credit. The amount of that tax credit depends on the proportion of the investment that is eligible for immediate or full expensing, *fe*. In the case of Australian research and development investment, that tax credit may be amplified by a loading factor under the research and development tax incentive offset. Thus, we generalise the way that de Mooij and Devereux (2009) model full expensing by providing for a loading factor, *load*.

$$IC = PI \cdot (1 - fe \cdot load \cdot tkc)$$

It is convenient to expand this equation for *IC* to separate out the contributions from full expensing and the loading factor.

$$IC = PI \cdot [(1 - tkc) + (1 - fe) \cdot tkc - (load - 1) \cdot fe \cdot tkc] \qquad [8]$$

Turning to the second component, the immediate after-tax return on the investment is equal to the value of the marginal product of one unit of capital, net of corporate tax.

$$RET = P \cdot f_K \cdot (1 - tkc)$$

Future profits will erode with economic depreciation of the unit of capital at the rate δ, and be discounted using the firm's real discount rate, *r*. Thus, the present value of present and future after-tax returns on the unit of capital is given by equation [9].

$$PVRET = \frac{P \cdot f_K \cdot (1 - tkc)}{\delta + r} \qquad [9]$$

We now consider the third and final component, the present value of capital-related deductions. In doing so, we allow for a wide variety of alternative corporate tax systems. The standard form of corporate tax allows deductions for depreciation and interest expenses.

In calculating the depreciation deduction, the rate of depreciation allowed under tax law, *dtax*, may differ from the economic rate of depreciation, δ. Further, to avoid a doubling up of deductions, investment that is fully-expensed upfront is not eligible for depreciation deductions. Thus, the initial value of the depreciation deduction, *DEP*, is given by the following.

$$DEP = (1 - fe) \cdot dtax \cdot PI$$

To calculate the present value of this depreciation deduction, we need to take the following into account. First, as the asset value is written down at the rate of tax depreciation, *dtax*, the value of the deduction will erode at the same rate. Second, the lack of inflation accounting in the corporate tax system means that the depreciation deduction is based on the historic cost of the investment, without allowing for inflation in the cost of new investment. Hence, the real value of the deduction will erode at the rate of inflation, π. Third, future real depreciation deductions will be discounted using the firm's real discount rate, *r*. Taking all of the above into account, the present value of the depreciation deduction is given by equation [10].

$$PVDEP = \frac{(1-fe)\cdot dtax\cdot PI}{dtax+\pi+r} \quad [10]$$

We calculate the initial interest deduction, *INT*, assuming that a proportion of the value of the investment, *dr*, is funded using debt with an interest rate of *Rdebt*.

$$INT = dr\cdot Rdebt\cdot PI$$

De Mooij and Devereux (2009) assume that the interest rate on debt, *Rdebt*, depends positively on the debt ratio, *dr*, allowing them to model an optimal financial structure between debt and equity. To simplify, we instead take the debt ratio as given.

On the reasonable assumption that the debt ratio is constant over the life of the asset and is calculated using the economic value of the asset rather than its tax value, then real debt will fall at the rate of economic depreciation. After also applying the firm's discount rate, the present value of the interest deduction is as follows.

$$PVINT = \frac{dr\cdot Rdebt\cdot PI}{\delta+r} \quad [11]$$

De Mooij and Devereux (2009) model two options for tax reform, an Allowance for Corporate Equity (ACE) and a Comprehensive Business Income Tax (CBIT). We also consider an Allowance for Corporate Capital (ACC).

The ACE modifies the standard form of corporate tax by introducing a new deduction, an allowance for corporate equity, at the rate ρ. This allowance is designed to complement the existing deduction for interest expenses so that the costs of financing investment are deductible, irrespective of whether an investment is financed by debt or equity. This is the initial ACE deduction.

$$ALLE = (1-fe)\cdot(1-dr)\cdot\rho\cdot PI$$

They assume that the ACE allowance is based on the accumulation of capital in the firm's tax accounts. Thus, it does not apply to investments that have been fully expensed and it is capitalised in the same way as the depreciation allowance, so its present value is as follows.

$$PVALLE = \frac{(1-fe)\cdot(1-dr)\cdot\rho\cdot PI}{dtax+\pi+r} \quad [12]$$

While de Mooij and Devereux (2009) mention the policy option of an Allowance for Corporate Capital (ACC), we go further by modelling it. The ACCC is a broad capital deduction for financing costs that is independent of the method of financing and replaces the existing deduction for interest expenses. Like the ACE allowance, it would be based on the accumulation of capital in the firm's tax accounts. It has the following present value.

$$PVALLK = \frac{(1-fe)\cdot\rho\cdot PI}{dtax+\pi+r} \quad [13]$$

At the other extreme is the proposal for a comprehensive business income tax (CBIT). It modifies the standard form of corporate income tax by removing the deduction for interest expenses. The aim of a CBIT is to remove the bias in favour of debt financing over equity financing that arises from having a deduction for debt costs but not for equity costs. However, a CBIT would also tax normal returns to capital more heavily than the standard form of income tax and hence would increase the extent to which corporate tax discourages investment.

We can now calculate the present value of all capital-related deductions by combining equations [10]-[13]. In doing so, we take into account that there are no deductions for net interest expenses under either the CBIT or ACC. For generality, we allow for a composite tax system where the proportion of investment that is subject to the ACE, ACC or CBIT systems is represented by variables of the same names.

$$PVDED = tkc\cdot PI\cdot\left[(1-fe)\cdot\frac{dtax+\rho\cdot(ACC+(1-dr)\cdot ACE)}{dtax+r+\pi}+\frac{dr\cdot Rdebt\cdot(1-CBIT-ACC)}{\delta+r}\right] \quad [14]$$

Now that we have all three components, in the form of equations [8], [9] and [14], we can apply the equilibrium condition that the upfront cost of the investment, *IC*, equals the present value of the after-tax return, *PVRET*, plus the present value of capital-related deductions, *PVDED*.

$$PI\cdot[(1-tkc)+(1-fe)\cdot tkc-(load-1)\cdot fe\cdot tkc] = \frac{P\cdot f_K\cdot(1-tkc)}{\delta+r}+tkc\cdot PI\cdot\left[(1-fe)\cdot\frac{dtax+\rho\cdot(ACC+(1-dr)\cdot ACE)}{dtax+r+\pi}+\frac{dr\cdot Rdebt\cdot(1-CBIT-ACC)}{\delta+r}\right]$$

Our aim is to solve this equilibrium condition for the marginal product of capital. First, we multiply through by the factor,

$$\frac{\delta+r}{P\cdot(1-tkc)}$$

and then re-arrange and simplify to obtain the following.

$$f_K = \frac{PI}{P}\cdot\left\{\delta+r+\frac{tkc}{1-tkc}\cdot\left[(1-fe)\cdot(\delta+r)\cdot\frac{(\pi+r)-\rho\cdot(ACC+(1-dr)\cdot ACE)}{dtax+r+\pi}-dr\cdot Rdebt\cdot(1-CBIT-ACC)-(load-1)\cdot fe\cdot(\delta+r)\right]\right\} \quad [15]$$

In equilibrium, the marginal product of capital will equal the user cost of capital.

$$f_K = uc$$

Taking that into account, equation [15] can be written in a more digestible form as a set of equations for the user cost of capital. Those were presented in section 4 as equations [1], [3] and [3a]-[3c].

6. Developments in Modelling Corporate Tax Policy

This final section discusses developments in modelling corporate tax policy in Australia from the Henry Review to CGETAX to the forthcoming Dynamic CGETAX model.

The author led the team at KPMG Econtech (2010) that modelled the efficiency of different Australian taxes for the Henry Tax Review. Those estimates of the efficiency of different taxes are still quoted (Parliamentary Budget Office, 2024). The main modelling assumptions made for corporate tax are shown in Table 2 in the column for KPMG Econtech. The other columns of the table show how the main assumptions have developed in subsequent studies.

General Characteristics

We begin with the general characteristics of the different models, which are reported in the top panel of Table 2. Beginning with the Henry Tax Review modelling, most models contain some industry detail. One reason this is useful is that the economic rents that are important for corporate tax policy are distributed unevenly across industries, being particularly concentrated in industries such as mining and banking.

Most modellers measure the gains and losses from changes to tax policy using consumer welfare. This is a more appropriate measure than GDP for several reasons including that it takes into account the value of leisure, the level and composition of consumption and the balance struck between present and future consumption. Dixon and Nassios (2018) use a less comprehensive measure of consumer gain, leisure-adjusted national income (Table 2), but it does avoid some of the pitfalls in using GDP.

Two of the simplifications in the original Henry Review modelling were that the economy was in a long run equilibrium and that consumers were homogeneous. Some subsequent studies have made more general assumptions.

Dixon and Nassios (2018) model the dynamic adjustment of the economy to long run equilibrium (Table 2). Incorporating dynamics can help in designing the phasing out of old policies and the phasing in of new policies. Dynamics is less likely to affect policy selection because that is likely to depend mainly on the lasting effects of policy changes.

Tran and Wende (2021) also model dynamic adjustment. In addition, they relax the assumption that consumers are homogenous by distinguishing between low, mid and high skilled households. This makes it possible to model some of the effects of tax policy changes on vertical equity (Table 2).

Capital and Rents

The approach of the different models to capital and economic rents is shown in the middle panel of Table 2. Before considering those details, we examine the relative size of these two broad types of profit. Because the economic effects of taxing capital and rents are so different, their relative size plays an important role in the modelling.

Table 2
Assumptions in Model-based studies of Corporate Tax Policy

	KPMG Econtech: 2010 Henry Review	Murphy (2016a, 2018a)	Dixon & Nassios (2018)	McKeehan & Zodrow (2017)	Tran & Wende (2021)	CGETAX 2025	dynamic CGETAX
General Characteristics:							
number of industries	109	278	76	2	1	278	8
measure of economic gains/losses	welfare	welfare	GNI	welfare	welfare	welfare	welfare
dynamics	no	no	yes	no	yes	no	yes
vertical equity	no	no	no	no	yes	no	yes
Capital and Rents:							
perfect international capital mobility	yes	yes	no	yes	yes	yes	yes
elasticity of substitution between capital and labour	0.75	0.8	0.4	1	1	0.8	0.8
fixed factor rents	yes	yes	yes	yes	yes	yes	yes
oligopoly rents	no	yes	no	no	no	yes	yes
Other Corporate Tax Issues:							
share of corporate tax base lost to profit shifting	nil	15%	nil	13%	nil	10%	10%
elasticity of intertemporal substitution	nil	0.25	n/a	nil	0.40	0.25	0.25
benefits and costs of dual rate system	no	no	no	no	no	no	yes
bias against incorporation from corporate tax	no	no	no	no	no	no	yes

As explained in section 2, CGETAX allows for three types of location-specific economic rents. The types are oligopoly rents, mineral rents and land rents. Table 3 shows that these three types of rents account accounted for 54 per cent of corporate tax revenue in the CGETAX2025 baseline scenario.

These estimates highlight the challenges in designing corporate tax policy. About one-half of revenue is collected from normal returns to capital, doing considerable economic harm. The other half is collected from economic rents, which in principle does no economic harm.

Table 3 also shows how these estimates of rents have changed since Murphy (2018a). The estimated share of company tax revenue raised from rents has increased from 41 per cent to 54 per cent. The majority of this increase, 10 out of 13 percentage points, is due to an increase in the share of mineral rents from 3 per cent to 13 per cent (Table 3).

Table 3
Baseline Corporate Tax Revenue by Type of Income ($ billion)

	simulated 2025-26 base		simulated 2016-17 base	
	$bn	%	$bn	%
normal returns to capital	59	46%	42	59%
oligopoly rents: financial services	25	20%	17	24%
oligopoly rents: other industries	13	11%	2	3%
mineral rents	17	13%	2	3%
land rents	13	10%	8	11%
total	128	100%	71	100%

Mineral rents have risen due to higher commodity prices. They have lifted the terms-of-trade index, normalised to equal 100 in 2022-23, from 70.8 in the simulated baseline for 2016-17 to 85.6 in the simulated baseline for 2025-26. See Murphy (2025) for a discussion of the terms-of-trade in the more recent baseline.

A higher terms-of-trade is an economic positive. It boosts real incomes while, under a floating exchange rate, having little effect on inflation in consumer prices.

The other notable movement in Table 3 is an increase in oligopoly rents outside of financial services from 3 per cent to 11 per cent of corporate tax revenue. However, this increase of 8 percentage points has been driven more by a change in modelling assumptions than a change in the rents themselves.

As explained in section 2, oligopoly rents are only modelled in industries that: (i) have above normal rates of return on capital; *and* (ii) have other characteristics of an oligopoly. The broad wholesale and retail trade industry has met the first test for some time and in CGETAX2025 we assume for the first time that it meets the second test as well.

This involved making a judgement because part of the industry appears to be competitive and part of it appears to be an oligopoly. In any case, had we assumed all along that wholesale and retail trade was an oligopoly, then the increase in oligopoly rents outside of financial services would have been only 2 percentage points of corporate tax revenue, from 9 per cent to 11 per cent.

In summary, estimated economic rents have increased by 13 percentage points of company tax revenue, from 41 per cent to 54 per cent. Of this increase, 2 percentage points is due to an apparent underlining increase in oligopoly rents, notably in wholesale and retail trade, while the rest is due to other factors including higher minerals prices and a change in modelling assumptions.

We now return to the treatment of capital and rents in the different models, as summarised in the middle panel of Table 2. We begin with the treatment of capital.

We see that CGETAX assumes that the marginal investor is foreign and the elasticity of substitution between capital and labour is around 0.8 (Table 2). Other models are similar. The exception is Dixon and Nassios (2018), where the supply of foreign investment and the demand for capital are less flexible. In our opinion, their capital-related assumptions are more appropriate for a short to medium term analysis than for a long-term analysis. In any case, they result in a corporate tax cut leading to a smaller increase in GDP than in the other models.

Turning to the treatment of economic rents, their existence is recognised in all of the models in Table 2. However, while other models treat all rents as fixed factor rents, CGETAX also recognises oligopoly rents (Table 2). As explained in section 2, it is important in modelling both tax policy and competition policy to distinguish between fixed factor rents and oligopoly rents.

Other Corporate Tax Issues

We now turn to four other issues, besides the treatment of capital and rents, that are significant for modelling corporate tax policy. The approach of the different models to these issues is shown in the bottom panel of Table 2.

The first of these other issues is international profit shifting. The original modelling for the Henry Tax Review did not allow for IPS. This is also true for subsequent Australian modelling, except in the case of CGETAX (Table 2). We explained our approach to profit shifting in CGETAX2025 in section 3. It has a significant effect on the modelling results for corporate tax.

The next issue is the extent to which present and future consumption are modelled as substitutable. This was not addressed in the modelling for the Henry Tax Review, with the result that the elasticity of intertemporal substitution (EIS) was effectively assumed to be zero.

The EIS is important for modelling the taxation of saving, not of investment. However, in Australia changes to the corporate tax rate can indirectly affect taxation of saving through the franking credit system.

If the marginal investor is a foreign investor, then franking credits do not affect investment because foreign investors are unable to utilise them. Indeed, the franking credit system lacks logic if the marginal investor is foreign. In particular, instead of having its intended purpose of reducing the tax on investment, franking credits act as a subsidy on saving (Boadway and Bruce, 1992). A cut in the company tax rate reduces this subsidy and thereby affects the choice between present and future consumption.

This effect of franking credits on saving behaviour is recognised in CGETAX and Tran and Wende (2021). The assumed values for the EIS are 0.25 and 0.4 respectively (Table 2).

The remaining two issues have not been addressed in any of the Australian corporate tax modelling that is represented in Table 2.

In that modelling, the average rate of corporate tax is a model input. The average tax rate will reflect the fact that Australia has a dual rate system, with base rate entities and standard rate entities. However, this dual rate system may have behavioural effects beyond its effect through the average tax rate. Some of these behavioural effects could be positive while others could be negative.

On the one hand, oligopoly rents, which are efficient to tax, may be more prevalent for larger companies than for smaller companies, so a dual rate system may help the tax system to target oligopoly rents. On the other hand, a dual rate system can have the negative effect that it may encourage some companies operating not far above the turnover ceiling to shrink their operations sufficiently to access the lower tax rate, even when this reduces efficiency.

The final issue is that the existence of corporate income tax means that profits are taxed differently depending on whether or not a business is incorporated. This can lead to a tax-driven bias against incorporation. Gravelle and Kotlikoff (1992) show how the effects of this bias against incorporation can be modelled.

Dynamic CGETAX model

The forthcoming Dynamic CGE Tax model is being designed to build on previous work as well as address outstanding issues. Thus, as shown in Table 2, compared to the existing CGETAX model it will incorporate the following enhancements. First, it will include dynamic adjustment of capital stocks. Second, it will model vertical equity in a simple way by distinguishing between low, mid and high-income households. Third, it will model the benefits and costs of a dual rate system. Fourth, it will model the bias against incorporation from the presence of a corporate tax.

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