Tax, foreign investment and productivity

Technical appendices to support Inland Revenue's draft long-term insights briefing (LTIB)

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OVERVIEW

1. Inland Revenue's draft long-term insights briefing (LTIB) on tax, foreign investment and productivity is available on its tax policy website.[1] These technical appendices provide some additional support for the analysis in the LTIB. It provides further analytical detail on the formal models being used. It also provides further discussion on implications of the formal modelling.

2. The technical appendices are as follows:

   - **Appendix 1** provides two formal economic models of how taxes can affect costs of capital and EMTRs. The first of these is the main OECD model that is being used throughout the draft LTIB. A crucial assumption in this first model is that non-residents are marginal shareholders. This model may, or may not, be relevant for SMEs where non-residents own negligible amounts of the business. We also explore two variants of a second model where resident individuals are marginal investors in the business.
   - **Appendix 2** provides a more detailed analysis of how New Zealand's tax settings can impact on costs of capital and EMTRs. It considers how differences in the tax treatment of different asset types and firms financed in different ways can create tax biases that may reduce economic efficiency and productivity. While EMTRs in New Zealand may often be high, at times they can be negative. The appendix explores the way inflation can increase tax imposts on assets that have high EMTRs in the first place and increase tax subsidies to assets with negative EMTRs. It considers how non-resident withholding tax on interest and approved issuer levy can affect costs of capital and EMTRs for foreign-controlled and other companies. It discusses how changes in assumptions about the marginal investor might affect the analysis.
   - **Appendix 3** discusses risk and its likely impact on costs of capital and EMTRs.
   - **Appendix 4** provides a simple cash flow example to show how some debt-financed investments can end up with negative EMTRs. Rather than investment being taxed, they can end up being subsidised. It also explores how inflation can magnify this effect.
   - **Appendix 5** examines how some tax changes, including changes to the company tax rate, depreciation rates and R&D tax credit, are likely to have affected costs of capital and EMTRs. There are other measures though, such as thin capitalisation rules and transfer pricing measures, which we have not been able to analyse.

[1] Inland Revenue. (2022). *Draft long-term insights briefing*. https://taxpolicy.ird.govt.nz/publications/2022/2022-other-draft-ltib

APPENDIX 1

Cost of capital and EMTR estimates: two formal models

1.1 The OECD website provides estimates across OECD countries and some other countries for the cost of capital, the effective marginal tax rate (EMTR) and the effective average tax rate (EATR) for a set of assets.[2] Our main focus is on the cost of capital (or the threshold real rate of return at which investment becomes profitable) and on the closely associated EMTR. Tax provisions will affect the cost of capital and incentives to invest. Changes in the cost of capital will lead to changes in New Zealand's capital stock.

1.2 This appendix presents two variants of a formal model of how tax rules affect costs of capital and EMTRs.

1.3 The first of these is just a simple version of the OECD model. It allows us to analyse costs of capital when investment is being undertaken through companies in which non-residents are the marginal equity investors (the case that underlies the numerical estimates posted on the OECD website). It provides cost of capital results that are identical to the OECD's analysis in this case. Our model is less general than the OECD's. For example, the model cannot be as easily adapted to considering different possible marginal investors. At the same time, it is considerably simpler than the OECD model and allows varying levels of debt and their impact on costs of capital to be analysed directly.[3] This variant is our main focus, and we refer to it as the 'OECD company tax model'. It is the model the OECD has used to benchmark different countries.

1.4 We also consider an alternative domestic small and medium enterprise (SME) variant. In this variant, foreigners are still the marginal suppliers of debt finance, but there is no foreign equity finance. All equity finance is supplied by resident individuals. There are two sub-variants. In the first, the individuals either invest through unincorporated enterprises or through companies that pay the maximum possible level of imputed dividends each year but no unimputed dividends. In either case, taxable income is assumed to be taxed at personal tax rates each year. The opportunity cost of equity-financed investment is the interest income that could be earned by the owners of these SMEs on interest-bearing securities. This is only a 'first cut' way of analysing investment incentives for SMEs organised as companies. Under New Zealand's full imputation system, corporate profits are eventually taxed at shareholders' tax rates when they are paid as dividends. However, there can be important deferral benefits when the company tax rate is less than the marginal tax rates of shareholders (as will often be the case) and if profits are retained in companies and reinvested for considerable periods of time. The second sub-variant assumes that profits are retained in companies forever, so the personal tax rate becomes irrelevant, and costs of capital depend solely on the company tax rate.

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[2] OECD. *OECD.Stat*. Public Sector, Taxation and Market Regulation > Taxation > Corporate Tax Statistics > Effective Tax Rates. https://stats.oecd.org/

[3] By contrast, the OECD analyses costs of capital and EMTRs for investments that are either fully equity financed or fully debt financed and then assumes that partially debt-financed cases can be analysed as a weighted average of these two cases.

OECD company tax model

1.5 Assume that foreign equity investors demand the real return, r_e, on their equity finance and as much equity capital as wanted can be attracted at this fixed rate of return. Debt finance is attracted at a real interest rate, r_d. A fixed proportion, *b*, is borrowed and the remaining $1-b$ is financed by equity. The OECD study ignores any withholding taxes on dividends or interest and, for the time being, we also ignore these taxes.

1.6 Let r_w be the pre-tax real weighted average cost of funds to a capital importing economy so

$$r_w = (1-b)r_e + br_d \qquad (1)$$

1.7 For a marginal investment, the present value of the after-tax benefits should be equal to the present value of the costs. The OECD modelling is examining how changes in tax parameters will affect hurdle rates of returns or costs of capital and EMTRs for these marginal investments.

1.8 Suppose that the real discount rate or the real after-tax weighted average cost of funds to a firm is r_w'. Assume that a dollar invested in a project at the end of year 0 generates *c* in real revenue (net of any non-financing costs) at the end of year 1, $c(1-d)$ at the end of year 2, $c(1-d)^2$ at the end of year 3 and so forth. The present value of the future net revenues will be

$$PV = \frac{c(1-\tau)}{1+r_w'}\left(1+\frac{1-d}{1+r_w'}+\left(\frac{1-d}{1+r_w'}\right)^2+\ldots\right)$$
$$= \frac{c(1-\tau)}{r_w'+d}$$

1.9 Purchasing a dollar of capital goods will lead to a stream of deductions as the cost of the investment is depreciated over time or account is taken of any tax credits or investment allowances for investment. Let *A* denote the present value of the stream of tax savings. For a marginal investment

$$1-A = \frac{c(1-\tau)}{r_w'+d}$$

or

$$c = \frac{(1-A)(r_w'+d)}{1-\tau}$$

1.10 The variable *c* is sometimes referred to as the 'user-cost' or the 'implicit rental value of capital services'.[4] It is the equilibrium rental charge that would be needed to compensate a lessor for the costs of making a dollar of capital goods available to a lessee if there were no transactions costs of leasing. It is the return that would be required in equilibrium for a firm to acquire capital goods and then use them itself (which can be thought of as leasing capital goods to itself).

1.11 The cost of capital is the pre-tax rate of return on a marginal investment. This will be $p = c - d$. The asset provides a pre-tax gross return of *c.* However, each

[4] See Hall, R.E. and D.W. Jorgenson (1967).

year the net revenue is falling by d, which leads to economic depreciation of this amount. The cost of capital (or minimum real pre-tax rate of return at which an investment becomes profitable) is

$$p = \frac{(1-A)(r_w' + d)}{1-\tau} - d \qquad (2)$$

1.12 The present value of tax reductions, A, will involve discounting any depreciation deductions at a nominal discount rate. This discount rate will be the nominal after-tax weighted average cost of funds, i_w'.[5]

1.13 While terms are slightly more complex, it is sometimes easier to work in nominal terms. Suppose we have inflation at a rate of π per annum. Once more, assume a dollar is invested at the end of year 0. In this case, the nominal net revenue generated will be $c(1-\tau)(1+\pi)$ at the end of year 1, $c(1-\tau)(1+\pi)^2(1-d)$ at the end of year 2, and so forth. In equilibrium

$$PV = \frac{c(1-\tau)(1+\pi)}{1+i_w'}\left(1 + \frac{(1-d)(1+\pi)}{1+i_w'} + \left(\frac{(1-d)(1+\pi)}{1+i_w'}\right)^2 + \ldots\right)$$
$$= \frac{c(1-\tau)(1+\pi)}{i_w' - \pi + d(1+\pi)}$$

1.14 Similar reasoning to that discussed above means the cost of capital or hurdle rate of return for a marginal investment is

$$p = \frac{(1-A)(i_w' - \pi + d(1+\pi))}{(1-\tau)(1+\pi)} - d \qquad (3)$$

1.15 Equations (2) and (3) are just alternative ways of saying the same thing. We know that the relationship between the nominal interest rate, i_d, and the real interest rate, r_d, is given by $1 + i_d = (1 + r_d)(1 + \pi)$ or

$$r_d = \frac{i_d - \pi}{1+\pi}$$

1.16 Similarly, substituting $r_w' = (i_w' - \pi)/(1+\pi)$ into equation (3) gives equation (2).

1.17 The real after-tax discount rate will be the weighted average of the real after-tax costs of debt and equity finance. This will be given by $r_w' = (1-b)r_e + br_d'$ where r_d' is the real after-tax cost of borrowing. As is discussed below, this will mean

$$r_w' = (1-b)r_e + b\left(r_d(1-\tau) - \frac{\tau\pi}{1+\pi}\right) \qquad (4)$$

[5] Note that the OECD model involves discounting returns net of cash flows associated with borrowing (including borrowing, repayments of loans and interest payments) at the discount rate of shareholders rather than at a weighted-average interest rate. A marginal investment is one that just breaks even for shareholders when cash flows are discounted at this rate. But a marginal investment will also be one at which the net present value is zero when all cash flows (inclusive of those associated with borrowing) are discounted at the weighted average cost of funds. We take this second approach, which simplifies the model.

1.18 The fraction of each dollar that is equity financed costs r_e. As much debt finance as demanded can be attracted at the world real interest rate, r_d. The fraction that is debt financed is deductible. It would cost $r_d(1-\tau)$ in the absence of inflation. But deductions are allowed for nominal, rather than real, interest, and the final term $\tau\pi/(1+\pi)$ reflects the deduction for the inflationary component of interest.

1.19 To see this, note that the nominal after-tax interest rate on borrowed funds is

$$i_d' = i_d(1-\tau) = \left(r_d(1+\pi)+\pi\right)(1-\tau)$$

1.20 This means that the real after-tax interest rate on borrowed funds is

$$r_d' = \frac{i_d' - \pi}{1+\pi} = \frac{r_d\left((1+\pi)+\pi\right)(1-\tau)-\pi}{1+\pi} = r_d(1-\tau) - \frac{\tau\pi}{1+\pi}$$

1.21 We can write that the nominal after-tax weighted average cost of funds is

$$i_w' = (1-b)i_e + bi_d(1-\tau) \qquad (5)$$

where $i_e = r_e(1+\pi)+\pi$.

1.22 The term *A* in equation (2) is the present value of tax savings from the future stream of depreciation deductions, as well as any investment tax credits (such as the current R&D tax credit) if these are available. Different rates of tax depreciation will affect the cost of capital by changing the value of *A*. Suppose, for example, that there are no investment tax credits and an asset with an economic rate of depreciation of *d* can be depreciated at the diminishing value (DV) rate *d**. In this case

$$A = \tau\left(\frac{d^*}{1+i_w'} + \frac{d^*(1-d^*)}{(1+i_w')^2} + \ldots\right) = \frac{\tau d^*}{i_w' + d^*} \qquad (6)$$

1.23 The OECD's cost of capital expressions can be derived by substituting appropriate values of *A* into equation (2).

1.24 The OECD study examines the EMTR as the proportion of the pre-tax rate of return on a marginal investment that goes in tax. When foreign investors are marginal investors into companies, this can be defined as

$$EMTR = \frac{p - r_w}{p} \qquad (7)$$

where r_w is the pre-tax real weighted average costs of funds to a capital importing economy given by equation (1).

Domestic SME variant

1.25 An open question is how best to analyse investment incentives for domestic SMEs with no foreign shareholders. This is discussed in appendix 2, in 2.67 to 2.75. Incentives will depend on the opportunity cost of the capital invested in domestic SMEs and there are different cases that can be considered.

1.26 One possible case is where the owners of domestic SMEs would otherwise invest in New Zealand listed companies. If these listed companies are ones where non-residents are marginal shareholders, cost of capital expressions from the OECD

model above (as, for example, in equation (2) above) might be argued to continue to be relevant.

1.27 If instead the owners of domestic entities would invest in other assets such as interest-bearing securities or foreign equities, different cost of capital expressions will arise. There is no obvious best way of modelling the different possible cases when domestic residents can own a variety of such assets.

1.28 Here we explore two possible variants. In both variants, the alternative asset is interest-bearing securities.

Sub-variant 1: Full distribution sub-variant

1.29 In the first sub-variant, we assume that a corporate SME distributes all its taxable profits to shareholders each year so that the profits are fully taxed at the marginal tax rates of shareholders, *m*. We assume profits that are not taxed at the company level are not distributed as dividends but are instead retained in the company. Equivalently, we could assume that income is owned through an unincorporated enterprise and the profits are taxed directly in shareholders' hands.

1.30 Taxpayers can borrow or lend at the nominal interest rate, *i*, or the real interest rate, *r*. The nominal after-tax interest rate is $i' = i(1-m)$, and the real after-tax interest rate is $r' = r(1-m) - m\pi/(1+\pi)$.

1.31 For a marginal investment by an unincorporated investor, the present value of the after-tax costs must once more equal the present value of the after-tax benefits, so

$$1 - A = \frac{c(1-m)}{1+r'}\left(1 + \frac{1-d}{1+r'} + \left(\frac{1-d}{1+r'}\right)^2 + \ldots\right) = \frac{c(1-m)}{r'+d}$$

where *A* is found by discounting depreciation deductions at the net-of-personal-tax interest rate. The cost of capital is given by

$$p = \frac{(1-A)(r'+d)}{1-m} - d \qquad (2')$$

1.32 This replaces equation (2). Likewise, we could work in nominal terms and write

$$p = \frac{(1-A)(i' - \pi + d(1+\pi))}{(1-m)(1+\pi)} - d \qquad (3')$$

which would replace equation (3).

Sub-variant 2: Full retention sub-variant

1.33 In the second sub-variant, it is assumed that profits are earned by a domestic SME that retains and accumulates all profits. The company itself can borrow or lend at the nominal interest rate, *i*, or the real interest rate, *r.* In this case the cost of capital is given by

$$p = \frac{(1-A)(r'+d)}{1-\tau} - d \qquad (2'')$$

where $r' = r(1-\tau) - \tau\pi/(1+\pi)$ and depreciation deductions are discounted at a net-of-company tax interest rate.

APPENDIX 2

A deeper look at costs of capital and EMTRs for New Zealand

Introduction

2.1 The OECD benchmarking exercise discussed in chapter 3 of the draft LTIB rests on assumptions the OECD has made and applied to all OECD countries. In this appendix, we modify and extend the analysis in various ways. Some of the key results from this appendix are discussed in chapter 4 of the draft LTIB.

2.2 The OECD analysis provides a single estimated cost of capital and a single estimated EMTR for non-building tangible assets. However, there are different types of these assets, with different economic and tax depreciation rates. This will lead to a variety of costs of capital and EMTRs. Focusing on these different values allows potential tax biases between different types of these assets to be examined. This is discussed in 2.6 to 2.18.

2.3 The OECD analysis assumes a debt level of 35% and an inflation rate of 1% per annum. In 2.19 to 2.40, we rework this analysis to allow for a slightly higher debt level (which better reflects average debt levels in New Zealand) and a higher inflation rate of 2% (which is in the middle of the Reserve Bank's target range). We also consider a broader set of assets than the OECD study does and the impacts of different inflation rates, debt levels and real interest rates.

2.4 The OECD study ignores non-resident withholding tax (NRWT) on interest and the approved issuer levy (AIL). The OECD also does not consider how thin capitalisation rules might affect the analysis. In 2.41 to 2.67, we rework the analysis to take account of NRWT on interest and AIL. We also discuss how thin capitalisation provisions might affect the analysis. However, we are unable to provide a satisfactory way of allowing for changes in thin capitalisation provisions on costs of capital. We have also been unable to estimate how the restricted transfer pricing rules, which limited rates at which interest could be deducted for income years starting on or after 1 July 2018, will have impacted on costs of capital.

2.5 Finally, the analysis in this chapter rests on a variant of the OECD's model of companies where non-residents are marginal shareholders. However, SMEs operating in New Zealand may often have negligible amounts of foreign equity capital. In 2.68 to 2.76 we also consider the domestic SME model that was outlined in appendix 1. In that model, domestic residents who borrow and lend on world markets are assumed to be the marginal shareholders. In this case EMTRs may often be negative.

Variations in costs of capital and EMTRs for non-building tangible assets

2.6 We start by looking at non-building tangible assets – referred to by the OECD as 'tangible assets'.

2.7 The OECD analysis provides a single point estimate of a cost of capital for non-building tangible assets. For example, with a 3% real interest rate and when debt is 35% of capital, New Zealand is estimated to have a cost of capital of 3.9%, which is the second highest of the OECD countries.

2.8 This single point estimate approach has some costs and benefits. Presenting a single point estimate can allow a comparison of costs of capital across countries. However, for our purposes, it is more useful to have a range of possible values. If there is a large range of different costs of capital for different non-building

tangible assets, biases in the way different forms of these assets are taxed may be as important as any biases between the average for these assets and other classes of asset. Different possible tax changes may either increase or decrease these biases.

2.9 In New Zealand, depreciation deductions are set in an attempt to reflect 'economic depreciation', namely, how assets will actually decline in value. However, there has been no attempt to take account of inflation in setting these values. This was discussed in a 2004 New Zealand officials' issues paper on depreciation.[6] In practice, New Zealand and most other countries have very poor information on how assets fall in value. The OECD's estimates of economic depreciation are based on estimates by the Bureau of Economic Analysis (BEA) in the United States.[7] These appear to be the most widely used estimates of economic depreciation and have the benefit of being from an independent agency.

2.10 There are several difficulties in attempting to use these BEA estimates of economic depreciation for estimating costs of capital in New Zealand. An obvious concern is that the BEA estimates were derived for a different country (the United States) and reflect data that has been put together over a long period of time. The data can often be quite dated. However, another concern may be more important still. This is the fact that categories of assets used in the BEA study are often quite different from those New Zealand uses for tax purposes. It therefore becomes very difficult to match tax depreciation rates for non-building tangible assets in New Zealand against estimates of economic depreciation from the BEA study. This means that OECD estimates of costs of capital and EMTRs will be approximate at best.

2.11 To sidestep these problems as much as possible, we use an alternative approach. We examine what would happen if tax depreciation rates did successfully reflect how assets would depreciate in the absence of inflation. We see that even if we were perfectly successful in hitting our target, some important distortions will arise with even minor levels of inflation. Because we are likely to be some distance from successfully setting depreciation rates to mirror how assets would depreciate in the absence of inflation, New Zealand's range of costs of capital is likely to be larger than our estimated range.

2.12 Estimates of costs of capital and EMTRs for non-building tangible assets with an economic rate of depreciation, d, and an identical tax depreciation rate, d^*, are provided in table A2.1.

2.13 As in the OECD estimates presented in chapter 3, we assume that debt is 35% of capital and that the inflation rate is 1% per annum. We explore two possible real interest rates. As in the OECD study, we examine the case where the real interest rate, r, is 3% (that, is foreign providers of both debt and equity funds require a real return of 3% on their funds net of any domestic taxes). Results for this case are highlighted. However, studies have often assumed a higher real return is required and therefore we also consider a second possibility of a real interest rate of 5%. There does not yet appear to be a clear consensus on the most appropriate real interest rates to use in these costs of capital studies, and the most appropriate rates will depend on how interest rates change in the future. The real interest rate assumption is discussed further in appendix 3.

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[6] Inland Revenue and Treasury. (2004). *Repairs and maintenance to tax depreciation rules – an officials' issues paper*. https://taxpolicy.ird.govt.nz/publications/2004/2004-ip-depreciation

[7] These BEA estimates are available at https://search.bea.gov/search?affiliate=u.s.bureauofeconomicanalysis&query=depreciation+rates

Table A2.1: Costs of capital for non-building tangible assets debt = 35%, inflation = 1%

Non-building tangible assets							
d	100.0%	50.0%	20.0%	10.0%	4.0%	2.0%	0.0%
d*	100.0%	50.0%	20.0%	10.0%	4.0%	2.0%	0.0%
Costs of capital							
r = 5.0%	6.51%	6.50%	6.45%	6.39%	6.30%	6.24%	6.13%
r = 3.0%	4.01%	4.00%	3.96%	3.92%	3.83%	3.77%	3.62%
EMTRs							
r = 5.0%	23.2%	23.0%	22.5%	21.8%	20.6%	19.8%	18.4%
r = 3.0%	25.2%	24.9%	24.3%	23.4%	21.7%	20.3%	17.2%

2.14 We draw attention to the following points illustrated by table A2.1:

- When the world real interest rate is 3%, costs of capital fall from a value of 4.01% for assets that depreciate fully over the first year to a value of 3.62% for assets that do not depreciate at all. Likewise, EMTRs fall from 25.2% (that is, (4.01-3.00)/4.01) to 17.2%.
- The EMTR for assets that fully depreciate is considerably higher than the EMTR for assets that do not depreciate at all.
- The OECD estimated cost of capital of 3.9% for tangible assets in New Zealand (reported in chapter 3 for the case where r is 3%) is clearly reasonably central within this range of results. It seems plausible as an average estimate.
- For many non-building tangible assets with depreciation rates of 10% or more, costs of capital and EMTRs are within quite narrow ranges (for example, as economic depreciation rates fall from 100.0% to 10.0%, EMTRs fall from 25.2% to 23.4%). However, costs of capital and EMTRs fall quite quickly for depreciation rates below 10%. For an asset which does not depreciate at all, the EMTR is only 17.2%.

2.15 The results suggest a significant non-neutrality in the tax rules. Rather than leading to a uniform cost of capital, hurdle rates of return and EMTRs tend to be significantly higher for short-lived assets. This is the "inflation bias" issue discussed in several studies (see, for example, in Auerbach (1979) or in chapter 3 of the officials' issues paper on depreciation).

2.16 This is a consequence of inflation and a tax system that takes no account of inflation. If the inflation rate were zero, costs of capital would be uniform for any given real interest rate and EMTRs would be uniform irrespective of the real interest rate. This is shown in table A2.2.

Table A2.2: Costs of capital for non-building tangible assets debt = 35%, inflation = 0%

Non-building tangible assets							
d	100.0%	50.0%	20.0%	10.0%	4.0%	2.0%	0.0%
d*	100.0%	50.0%	20.0%	10.0%	4.0%	2.0%	0.0%
Costs of capital							
r = 5.0%	6.26%	6.26%	6.26%	6.26%	6.26%	6.26%	6.26%
r = 3.0%	3.76%	3.76%	3.76%	3.76%	3.76%	3.76%	3.76%
EMTRs							
r = 5.0%	20.2%	20.2%	20.2%	20.2%	20.2%	20.2%	20.2%
r = 3.0%	20.2%	20.2%	20.2%	20.2%	20.2%	20.2%	20.2%

2.17 We draw attention to the following points illustrated by table A2.2:

- In the absence of inflation, there would be strong arguments in favour of attempting to make depreciation deductions reflect 'economic depreciation'. This would mean neutral tax rules and the same EMTRs across assets with different economic depreciation rates.
- However, by comparing these results with those in table A2.1, we see that a small amount of inflation can upset these neutrality results.
- With a debt level of 35% and a real interest rate of 3%, EMTRs for most of these assets are higher when the inflation rate is 1% than when it is zero. Thus, often inflation will be adding to EMTRs.
- With a depreciation rate of 0%, the EMTR is *lower* when inflation is 1% than when it is 0% (17.2% rather than 20.2%).

2.18 Inflation normally adds to the tax burden, especially for short-lived assets. This is because inflation reduces the real value of depreciation deductions. However, firms have an offsetting benefit, because they can claim interest deductions for the inflationary component as well as the real component of interest expense. For an asset that does not depreciate (and receives no depreciation deductions), obviously no disadvantage arises from the erosion of depreciation deductions. Thus, firms can benefit from deducting more than real interest without facing any offsetting penalty.

Assumptions for debt level, inflation and asset type

2.19 The OECD analysis assumes that firms are financed with 35% debt and 65% equity (that is, the ratio of debt/(debt+equity) is 35%) and that the inflation rate is 1% across all the countries in their analysis.

2.20 Inland Revenue data from its International Questionnaire suggests a higher debt level of 43.1% for foreign-controlled companies in 2020 (the most recent year for which data is available). This data excludes the banks. It also excludes a small number of firms that have negative levels of equity.

2.21 Accounting information for NZX 50 firms in 2020 (excluding the two large banks that are included in the NZX50, namely, ANZ and Westpac) results in a very similar estimate of 43.7%.

2.22 In examining costs of capital in New Zealand, we will assume a debt ratio, which we denote by the symbol *b*, of 43%. This higher ratio will tend to reduce costs of capital and EMTRs somewhat, relative to the OECD estimates.

2.23 The OECD's assumption of 1% per annum inflation also seems low for New Zealand, given that 2% per annum is in the middle of the Reserve Bank's 1–3% target range. We replace this with an assumption of inflation of 2% per annum. A higher expected inflation rate will tend to increase costs of capital and EMTRs more for short-lived investment and decrease them more for long-lived investment.

2.24 We also report results for a somewhat broader set of assets than the OECD considers, namely:

- commercial and industrial buildings
- plant, machinery and equipment that is assumed to have a variety of economic and tax depreciation rates
- a zero-depreciation asset that is assumed to neither appreciate nor depreciate in real terms
- inventories
- appreciating assets, and
- assets for which capital expenditure can be deducted immediately (or expensed).

2.25 One class of asset is commercial and industrial buildings. These are assumed to have an economic depreciation rate of 2.69%, which is an OECD estimate of a weighted average of economic depreciation rates across these two types of buildings. The OECD assumes that commercial buildings depreciate at 2.47% per annum and industrial buildings depreciate at 3.14% per annum. This is in line with BEA estimates.[8]

2.26 We also consider a broad class of depreciable assets other than commercial and industrial buildings. We refer to these assets as plant, machinery and equipment (PME) for want of any better term. While they are likely to be mainly plant, machinery and equipment, this class includes other depreciating assets as well, such as software and structures other than buildings, including, dams, bridges and roadways. These assets can all be depreciated for tax purposes and are included in the PME category.

2.27 We also allow for a class of asset, zero-depreciation assets, that are assumed to neither appreciate nor depreciate in real terms. Land is an important asset in New Zealand and this zero-depreciation asset class might be thought of as including certain types of land. Other types of land might better be thought of as included in the appreciating assets which are also considered.[9]

2.28 As in the OECD study, we allow for trading stock or inventories. Inventories are assumed to be turned over at least once a year, which results in their full nominal economic income being taxed. This means the cost of capital and EMTR for inventories ends up equal to that of a very small group of PME assets that fully depreciate over their first year of life. Some assets that may be associated

[8] Treating buildings as being either commercial or industrial buildings with an economic depreciation rate of 2.69% is consistent with the approach the OECD used up until 2021. They have recently updated their work to include a wider group of structures within their definition of buildings. This has led them to estimate a slightly higher average economic depreciation rate of 3.29%. Because we are continuing to use the OECD's former approach, there is a slight inconsistency between how we define buildings and the OECD's current definition.

[9] Note that because land is in fixed supply, this will mean that a low EMTR for land is likely to produce little in the way of real investment distortions. It can, however, create ownership biases, with those on high marginal tax rates being attracted to investments with low EMTRs.

with technological diffusion, like computers and software, have high economic rates of depreciation and may be subject to high EMTRs.

2.29 Some assets may appreciate in real value. We allow for an appreciating asset that is expected to appreciate by 1% per annum in real terms. We assume that this gain is untaxed.

2.30 Finally, we consider investments in capital assets that can be immediately written off (or 'expensed'). This includes investment in planting and growing a forest, mining exploration expenditure, and repairs and maintenance expenditure where this provides ongoing benefits for many years. It also includes investment by a firm in building up intangible assets if the costs of the investment can be deducted immediately, for example, as salaries and wages. Capital expenditure on many intangible assets that are created by a firm itself can be expensed, including building up good information and data, and establishing reputation and customer goodwill.

2.31 Table A2.3 shows costs of capital assuming a real interest rate of 3.0% for our set of assets. The row labelled *d* denotes the economic rate of depreciation used and the row *d** denotes the tax depreciation rate allowed.

Table A2.3: Costs of capital and EMTRs, r = 3%, modifying OECD assumptions

	Commercial and industrial buildings	Plant, machinery and equipment					Zero-depreciating assets	Inventory	Appreciating assets	Expensing
d	2.69%	100.00%	50.00%	10.00%	4.00%	2.00%	0.00%		-1.00%	
d*	2.00%	100.00%	50.00%	10.00%	4.00%	2.00%	0.00%		0.00%	
Costs of capital										
Inflation = 1% b = 35%	3.94%	4.01%	4.00%	3.92%	3.83%	3.77%	3.62%	4.01%	3.23%	2.61%
Inflation = 1% b = 43%	3.81%	3.88%	3.87%	3.79%	3.71%	3.64%	3.50%	3.88%	3.11%	2.52%
Inflation = 2% b = 43%	3.77%	4.10%	4.07%	3.89%	3.71%	3.58%	3.34%	4.10%	2.95%	2.40%
EMTRs										
Inflation = 1% b = 35%	23.8%	25.2%	24.9%	23.4%	21.7%	20.3%	17.2%	25.2%	7.3%	-15.0%
Inflation = 1% b = 43%	21.4%	22.8%	22.5%	20.9%	19.2%	17.7%	14.3%	22.8%	3.6%	-19.1%
Inflation = 2% b = 43%	20.4%	26.8%	26.3%	22.8%	19.2%	16.3%	10.1%	26.8%	-1.8%	-24.9%

2.32 Focussing on the first of the cost of capital and EMTR rows (which are estimated on an inflation rate of 1% and a debt ratio of 35%, as is assumed by the OECD), we draw attention to the following points illustrated by table A2.3:

- For PME, costs of capital and EMTRs fall as depreciation rates fall, for reasons that were discussed earlier in this appendix. The cost of capital for an asset that fully depreciates over its first year is 4.01%, whereas the cost of capital for an asset that depreciates at a rate of 2% per annum is only 3.77%. The cost of capital for a zero-depreciation asset is lower still at 3.62%. The cost of capital for inventories is the same as the cost of capital for PME with an economic and tax depreciation rate of 100%. As we discussed earlier, costs of capital and EMTRs for all these assets would be the same in the absence of inflation. Inflation tends to bias

investment away from short-lived PME and inventories towards longer-lived PME and zero-depreciation assets.

- For commercial and industrial buildings, the cost of capital is 3.94% and the EMTR is 23.8%. Our estimates of costs of capital will be the same as the OECD's if we make the same assumptions about economic and tax rates of depreciation.[10] There can, however, be slight differences between our estimates and OECD estimates of EMTRs.[11]
- This suggests, with 1% inflation and 35% debt, the cost of capital for commercial and industrial buildings would be likely to be lower than for short-lived PME but higher than for very long-lived PME.
- Costs of capital and EMTRs for appreciating assets are lower than for zero-depreciation assets. This is unsurprising as part of the economic income of an appreciating asset is untaxed, which will tend to reduce costs of capital and EMTRs.
- Assets that can be expensed have an EMTR of -15.0%. The negative EMTR arises because the cost of capital of 2.61% is less than the 3.00% cost of capital that would be demanded in the absence of tax. These assets are being subsidised by the tax system.[12]

2.33 Comparing the first and second costs of capital and EMTR rows, we see that a higher debt level in New Zealand than the 35% OECD assumption will tend to reduce both costs of capital and EMTRs somewhat.

2.34 Comparing the second and third costs of capital and EMTR rows show that, as inflation increases, it tends to increase non-neutralities between assets. This can be seen by the ranges of both costs of capital and EMTRs increasing. Higher inflation tends to push up EMTRs for those assets that already face high EMTRs while reducing EMTRs for those assets with relatively low or negative EMTRs.

2.35 There would appear to be some significant non-neutralities in the tax system with 2% inflation and a debt level of 43%. An asset that can be expensed has an EMTR of -24.9% and needs to earn only 2.4% to be marginal. In effect, these investments are being subsidised by the tax system. At the same time,

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[10] It might be noticed that the cost of capital is slightly lower than the 4.1% figure that the OECD reports for New Zealand, discussed in chapter 3. This is just the definitional issue discussed in footnote 29 above. The OECD has recently updated its definition of "buildings" to be broader than commercial and industrial buildings, and it is now assuming a slightly higher economic depreciation rate of 3.29%, rather than the 2.69% for commercial and industrial buildings.

[11] The OECD calculates its EMTR as a weighted average of the EMTRs for a fully equity-financed and a fully debt-financed investment. This can make their estimates appear inconsistent with their cost of capital estimates. Our EMTR is always given by $EMTR = (p - r_w)/p$ where p is the cost of capital for the partially debt-financed investment and r_w is the real weighted average cost of funds to the economy. For example, suppose $r_w = 3\%$, the cost of capital for a 100% equity-financed investment is 4%, the cost of capital for a 100% debt-financed investment is 2% and the cost of capital for a 50% debt-financed investment is 3%. We would calculate the EMTR for a 50% debt-financed investment as being zero (because the cost of capital and cost of funds are both 3%). The OECD methodology would result in their estimate being -12.5% because the EMTR for a 100% equity-financed investment is 25% and the EMTR for a 100% debt-financed investment is -50%.

[12] One possible question is how economic depreciation differs from expensing in the case of an asset that fully depreciates over the first year it is used. In the model, assets are assumed to be acquired at the end of year 0 and provide a single positive cash flow in future years. For an asset that fully depreciates in one year, it would be treated as being acquired at the end of year 0 and generating a single positive cash flow at the end of year 1. Under economic depreciation, a deduction for the cost of the asset would be allowed in year 1. Under expensing, a deduction for the cost of the asset would be allowed in year 0.

short-lived assets and inventories have EMTRs of up to 26.8% and need to generate higher hurdle rates of return of up to 4.1%. This is considerably higher than would be required in the absence of tax.

2.36 In table A2.4, we explore how levels of debt could affect EMTRs across a broad set of possible debt levels, assuming that interest is fully deductible. We once again assume a 3% real interest rate and consider an inflation rate of either 2% or 0% per annum.

Table A2.4: EMTRs, r = 3%, different inflation and debt levels

	Commercial and industrial buildings	Plant, machinery and equipment					Zero-depreciating assets	Inventory	Appreciating assets	Expensing
d	2.69%	100.00%	50.00%	10.00%	4.00%	2.00%	0.00%		-1.00%	
d*	2.00%	100.00%	50.00%	10.00%	4.00%	2.00%	0.00%		0.00%	
Inflation = 2%										
b = 0%	34.6%	39.1%	38.7%	36.2%	33.6%	31.7%	28.0%	39.1%	20.6%	0.0%
b = 43%	20.4%	26.8%	26.3%	22.8%	19.2%	16.3%	10.1%	26.8%	-1.8%	-24.9%
b = 60%	13.0%	20.5%	19.8%	15.9%	11.7%	8.1%	0.3%	20.5%	-14.5%	-38.5%
b = 100%	-11.5%	0.0%	-0.9%	-6.5%	-13.2%	-19.2%	-34.1%	0.0%	-62.3%	-86.2%
Inflation = 0%										
b = 0%	30.7%	28.0%	28.0%	28.0%	28.0%	28.0%	28.0%	28.0%	20.6%	0.0%
b = 43%	21.4%	18.1%	18.1%	18.1%	18.1%	18.1%	18.1%	18.1%	8.4%	-13.7%
b = 60%	17.0%	13.5%	13.5%	13.5%	13.5%	13.5%	13.5%	13.5%	2.5%	-20.2%
b = 100%	4.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-14.9%	-38.9%

2.37 We draw attention to the following points illustrated by table A2.4:

- Consider the set of results when inflation is assumed to be 2%. If there is no debt, EMTRs vary, falling from 39.1% for very short-lived PME and inventories to 0.0% with expensing. No investments are subsidised, and there is often a substantial positive EMTR.
- However, with full debt finance and 2% inflation, EMTRs are never greater than zero. Required rates of return for marginal investments would not exceed, and would often be lower than, the cost of funds to the economy. They fall from 0.0% for very short-lived PME and inventories to -86.2% with expensing.
- At current average debt levels of around 43%, there is normally a positive EMTR and EMTRs can often be over 20%.
- Negative EMTRs are possible for some assets, especially if there are high levels of debt.
- When there is no debt, 2% inflation can increase EMTRs on short-lived assets and inventories significantly (from the company tax rate of 28.0% to 39.1%). Conversely, when there is 100% debt finance, 2% inflation can increase tax subsidies significantly. For example, with expensing the EMTR falls from -38.9% to -86.2%.
- The EMTR estimates were derived in a model where assets were assumed to fall in value at a constant DV economic rate. However, the estimates in the case of expensing apply generally. Appendix 4 provides a simple numerical example illustrating EMTRs for fully equity-financed and fully debt-financed investments when capital costs can be expensed.

2.38 We have noted that, with a world real interest rate of 3%, a small level of inflation of 2% per annum can add to investment biases significantly. As discussed in appendix 3, there is some uncertainty about the most appropriate real interest rate to use. The OECD considers a real interest rate of 3% is being demanded by foreign shareholders and lenders. However, other studies have used higher real interest rate assumptions and, until this year, the OECD also had a variant where a real interest rate of 5% was assumed. Interest rates appear to be on the rise worldwide and it may not be long before higher real interest rate assumptions appear once more.

2.39 Table A2.5 compares EMTRs for a company that is 43% debt financed, using a 3% real interest rate and a 5% real interest rate.

Table A2.5: EMTRs, debt = 43%, different values of r and inflation rates

	Commercial and industrial buildings	Plant, machinery and equipment					Zero-depreciating assets	Inventory	Appreciating assets	Expensing
d	2.69%	100.00%	50.00%	10.00%	4.00%	2.00%	0.00%		-1.00%	
d*	2.00%	100.00%	50.00%	10.00%	4.00%	2.00%	0.00%		0.00%	
r = 3%										
Inflation = 2%	20.4%	26.8%	26.3%	22.8%	19.2%	16.3%	10.1%	26.8%	-1.8%	-24.9%
Inflation = 0%	21.4%	18.1%	18.1%	18.1%	18.1%	18.1%	18.1%	18.1%	8.4%	-13.7%
r = 5%										
Inflation = 2%	19.1%	23.6%	23.1%	20.4%	18.0%	16.3%	13.5%	23.6%	7.3%	-20.1%
Inflation = 0%	20.5%	18.1%	18.1%	18.1%	18.1%	18.1%	18.1%	18.1%	12.6%	-13.7%

2.40 We draw attention to the following points:

- If there were no inflation and tax depreciation rates accurately measured economic depreciation, EMTRs would be the same for PME with different rates of economic depreciation, zero-depreciation assets and inventories. This would apply whether the world interest rate was 3% or 5%.
- With either real interest rate, inflation creates a tax bias that pushes up EMTRs for short-lived PME and inventories. With expensing, it makes the negative EMTRs more negative.
- However, inflation is considerably less distorting with a higher real interest rate assumption. With a real interest rate of 3%, inflation raises the EMTR for short-lived PME and inventories from 18.1% to 26.8%, while lowering the EMTR for a zero-depreciation asset from 18.1% to 10.1%. By contrast, with a 5% real interest rate, inflation only increases the EMTR for short-lived PMEs and inventories from 18.1% to 23.6% and only drops the EMTR for zero-depreciation assets from 18.1% to 13.5%. Inflation biases on costs of capital and EMTRs get large when the inflation rate is large relative to the real interest rate.

Non-resident withholding tax (NRWT), approved issuer levy (AIL), interest rates and thin capitalisation provisions

2.41 The OECD analysis does not take account of withholding taxes on interest. Nor does it consider how thin capitalisation rules may modify the analysis. We begin by discussing NRWT on interest and the AIL and how these taxes/levies can affect the real interest rates that firms will need to pay. We then discuss how thin capitalisation rules may affect the analysis. To keep the extent of the

discussion manageable, we do not consider NRWT on dividends or New Zealand's foreign investor tax credit. Including these could sometimes lead to lower costs of capital than we analyse, but this is left for further work.

NRWT, AIL and real interest rates

2.42 In New Zealand, there are two different types of taxes/levies on interest paid to non-residents. Non-resident withholding tax is withheld at a rate of 10% for countries with which New Zealand has a double tax agreement or 15% for other countries. Most often it will be withheld at a rate of 10%, and we use this rate in our analysis. Where debt is from a related party (for example, a foreign parent company), NRWT must be withheld. However, an alternative exists when debt is from third parties. This alternative is for the borrowing firms to pay AIL at a rate of 2% in lieu of NRWT.

2.43 A difference between the two types of taxes is that NRWT may give rise to tax credits overseas that reduce the amount of tax overseas lenders must pay on their interest income from New Zealand.[13]

2.44 Despite the rate of NRWT being higher than the 2% rate of AIL, it will generally be preferable for loans to be subject to NRWT if the foreign lender is able to make full use of the tax credits. However, very often foreign lenders may be non-taxpayers, in a tax loss position or unable to make full use of tax credits for other reasons.

2.45 Interest paid to third parties is most often subject to AIL rather than NRWT, and we assume this is the case in our analysis. However, AIL could, on occasion, be waived if a New Zealand borrower thought the foreign lender would prefer NRWT to be withheld. This would lead to slightly lower costs of capital than we estimate. We assume that all related-party loans from abroad are subject to NRWT at a rate of 10%, and all third-party loans from abroad are subject to AIL.

2.46 Third-party lenders are expected to require an after-tax return that provides them with the real return they could obtain from investing their money elsewhere. If there were no inflation, it would be expected that this would increase the real (and nominal) interest rate from (say) 3% to 3.06% so that, after AIL is levied, foreign lenders end up with the real return they require (3.06% = 3.00%/(1–0.02)).

2.47 With 2% inflation AIL is levied on the full nominal interest rate. With 2% inflation and a 3% real interest rate (and no AIL), the nominal interest rate will be 5.06%. Levying 2% AIL will raise the nominal interest rate to 5.16% and the real interest rate to approximately 3.10%.[14,15] This will tend to raise costs of capital and EMTRs slightly for all firms that are partly debt financed.

2.48 Foreign-controlled companies that are partly financed by related-party debt will also be affected by NRWT. At one extreme, if NRWT is fully creditable abroad, there should be no increase in the real interest rate demanded on related-party lending. At the same time, *the cost of borrowing to New Zealand as a whole would decrease*. The loans would cost New Zealand borrowers 3% real interest

[13] There is a second difference that will be incorporated later when deriving cost of capital expressions. While AIL is deductible from income tax, NRWT is not.

[14] More precisely, with inflation at rate π, the domestic real interest rate will rise to $r/(1-t_a)+\pi t_a/((1+\pi)(1-t_a))$.

[15] There is an exemption from AIL or NRWT for widely issued bonds. We assume the benefit of this concession is limited and that it cannot be used widely to step around AIL and negate any upward pressure on domestic interest rates.

or approximately 5% nominal interest. After this nominal interest payment is taxed at a rate of 10%, the after-tax real interest cost to New Zealand would fall to approximately 2.5% and the net real interest cost to New Zealand would be approximately 2.5%.[16] NRWT would be reducing the net amount that New Zealand as a whole pays for these loans because part of the interest payment would be flowing to the Government as a tax receipt. This tax receipt increases New Zealand's national income.

2.49 If NRWT is not creditable, it would be expected to push up the interest rate that borrowers must pay. The real interest rate on related-party lending would be expected to rise to 3.55%, while the net cost of borrowing to New Zealand as a whole would remain at 3%.[17]

2.50 Data on firms from whom Inland Revenue collects information as part of its International Questionnaire (IQ firms) is presented in table A2.6.

Table A2.6: IQ data on debt and equity

	Related-party interest-bearing debt	Other interest-bearing debt	Total interest-bearing debt	Equity	Debt + Equity
$ billion	14.72	24.78	39.5	52.19	91.69
% of debt + equity			43.1%	56.9%	100%
% of interest-bearing debt	37.3%	62.7%	100%		

2.51 Table A2.6 indicates that related-party debt was 37.3%, and other debt was 62.7%, of total interest-bearing debt for the foreign-controlled firms in the IQ database.

2.52 This allows us to consider how AIL and NRWT will affect costs of capital and EMTRs for the following types of average firms:

- For domestic companies that are not foreign controlled, it would increase the interest rate from 3% to 3.10% on the 43% of capital that is debt financed. The cost of debt finance to New Zealand as a whole would remain 3.00%.
- For foreign-controlled companies that can claim credits for NRWT on interest, it would increase the average real interest rate paid to 3.06%. It leaves the interest rate paid on the 37% of debt that is related-party debt unchanged, while pushing up the cost of other debt to 3.10%. At the same time, the average cost of debt finance to New Zealand of borrowing by these firms would fall to 2.81%.
- For foreign-controlled companies that are unable to claim credits for NRWT on interest, it would increase the average interest rate paid to 3.27% by pushing up the interest rate paid on the 37% of debt that is related party debt to 3.55% while pushing up the cost of other debt to 3.10%. The cost of debt finance to New Zealand as a whole would remain at 3.00%.

[16] More precisely, the real interest cost to New Zealand as a whole (net of NRWT) falls to $r(1-t_N)-t_N\pi/(1+\pi)$ where t_N is the rate of NRWT.

[17] The real interest rate rises to $r/(1-t_N)+\pi t_N/((1+\pi)(1-t_N))$ where t_N is the rate of NRWT.

2.53 We now have two separate ways in which taxes may be impacting on costs of capital:

- by depreciation rates and company tax rates affecting hurdle rates of return at a given set of real interest rates in New Zealand, and
- by NRWT on interest and AIL affecting real interest rates themselves.

2.54 Estimated effects on costs of capital are examined in table A2.7 assuming a world real interest rate of 3% and 2% inflation.[18]

Table A2.7: Costs of capital, r = 3%, inflation = 2%, debt = 43%, with AIL = 2% and NRWT = 10%

	Commercial and industrial buildings	Plant, machinery and equipment					Zero-depreciating assets	Inventory	Appreciating assets	Expensing
d	2.69%	100.00%	50.00%	10.00%	4.00%	2.00%	0.00%		-1.00%	
d*	2.00%	100.00%	50.00%	10.00%	4.00%	2.00%	0.00%		0.00%	
Costs of capital										
No AIL or NRWT All companies	3.77%	4.10%	4.07%	3.89%	3.71%	3.58%	3.34%	4.10%	2.95%	2.40%
AIL and NRWT Domestic companies with marginal foreign shareholders	3.81%	4.14%	4.11%	3.93%	3.76%	3.63%	3.38%	4.14%	2.99%	2.43%
AIL and NRWT - Foreign-controlled companies, NRWT creditable	3.80%	4.13%	4.10%	3.91%	3.74%	3.61%	3.36%	4.13%	2.98%	2.42%
AIL and NRWT - Foreign-controlled companies , NRWT **not** creditable	3.92%	4.25%	4.22%	4.03%	3.86%	3.73%	3.49%	4.25%	3.10%	2.51%

2.55 We draw attention to the following points illustrated by table A2.7:

- By comparing the third and fourth rows, we see that AIL pushes up costs of capital but only by very small amounts for domestic companies with marginal foreign shareholders that are not foreign controlled.
- By comparing the fourth and fifth rows, we see that the combination of AIL and NRWT has an even smaller effect on pushing up costs of capital for foreign-controlled companies that can claim credits for NRWT. Unlike AIL, NRWT is not increasing the cost of capital for these companies.
- By comparing the fourth and sixth rows, we see that the combination of AIL and NRWT has a bigger effect on costs of capital for foreign-controlled companies that cannot make use of credits for NRWT.
- Differences in costs of capital going down the rows seem small relative to differences in costs of capital going across the rows. This suggests that tax biases between these different types of company are likely to be small relative to tax biases between different types of asset.

[18] Note that EMTRs can become somewhat difficult to interpret when we start to take account of creditable taxes such as NRWT. Levying a fully creditable tax may increase the EMTR because it reduces the cost of borrowing to New Zealand even if it has no impact on costs of capital and incentives to invest in New Zealand. For this reason, we do not provide tables showing EMTRs when we are working with NRWT and non-residents are able to claim credits for NRWT.

Thin capitalisation rules

2.56 Non-residents investing into New Zealand can reduce the amount of corporate income tax they pay in New Zealand by having the subsidiary borrow from the parent and pay part of the return to the parent by way of deductible interest on a loan (rather than as a non-deductible dividend payment). Alternatively, the corporate group could lower the amount of tax it pays in New Zealand by having a New Zealand subsidiary take on a disproportionately large share of borrowing from third parties.

2.57 The thin capitalisation rules deny interest deductions if there are deemed to be excessive levels of debt in New Zealand. This can occur if both:

- the New Zealand group's debt ratio (that is, debt/(debt+equity)) is greater than 110% of the group's worldwide debt ratio, and
- the New Zealand group's debt ratio is greater than the 'safe harbour' of 60%.

2.58 We understand that the safe harbour test is normally the binding constraint. We assume that firms that fail to satisfy the safe harbour test are not able to use the worldwide test to qualify for a better interest deductibility result.

2.59 If borrowing is from a foreign parent company, interest payments will normally be taxed in the parent's hands. In this case, it will often be the difference between the New Zealand company tax rate and the foreign tax rate that determines incentives for debt financing. For example, suppose $100 of additional interest is paid from a New Zealand company in tax profit to a foreign parent. This reduces the New Zealand total tax payments by $18 (income tax falls by $28 but NRWT increases by $10). Also suppose that the parent is based in a country with a 20% company tax rate that can claim credits for New Zealand tax. In this case, additional tax of $10 would be paid by the foreign parent (income tax of $20 offset by a tax credit for NRWT of $10). This suggests that incentives to thinly capitalise New Zealand operations will often arise when the New Zealand company tax rate is higher than the tax rate in the country where the foreign parent resides.

2.60 New Zealand has a relatively high company tax rate within the OECD. Therefore, it might be thought a multinational enterprise with a foreign parent would normally have a tax advantage in thinly capitalising New Zealand operations. At the same time, slightly more than 50% of foreign direct investment (FDI) into New Zealand ($66.1 billion or 50.5% of a total stock of $130.9 billion as at 31 March 2021) is from Australia.[19] The Australian company tax rate for large companies is 30%, which is slightly higher than New Zealand's 28% company tax rate. Nonetheless, there are other factors to consider, and there can be incentives for Australian corporate parents to thinly capitalise New Zealand subsidiaries even if the Australian company tax rate is slightly higher.

2.61 Australia's full imputation system means that many firms will want to pay tax in Australia, rather than New Zealand, because franking credits (that is, imputation credits) are available for Australian, but not foreign, taxes. Many other factors may be important as well, including whether the foreign parent or the domestic subsidiary are in a taxpaying position and whether foreign tax credits can be claimed for taxes paid in New Zealand.

2.62 One possible way of examining the effects of thin capitalisation rules on the cost of capital, which has been used in prior studies, is to assume that firms are clustered at their thin capitalisation safe harbour limits and that this

[19] Statistics NZ National Accounts Data for the year to 31 March 2021.

determines the amount of debt they hold.[20] However, this would imply that foreign-controlled companies were all facing a debt ratio of 60%, which is considerably higher than the 43% ratio suggested by IQ data.

2.63 To examine whether there is major evidence of clustering, IQ data on debt ratios is provided in table A2.8. Firms are grouped by their debt ratio. A ratio of 0 means either no debt or a debt ratio below 1%, which is too low to register. There are 587 firms included in our sample.

Table A2.8: Debt/(debt+equity) ratios for IQ firms[21]

Debt / (Debt + Equity)	Numbers	% of total groups	Debt ($ billion)	% of total debt	Equity ($ billion)	% of total equity	Debt + equity ($ billion)	% of total debt + equity)
0%	259	44.1%	0.000	0.0%	14.263	27.3%	14.264	15.6%
to 10%	34	5.8%	0.320	0.8%	4.619	8.8%	4.939	5.4%
to 20%	28	4.8%	0.719	1.8%	3.879	7.4%	4.598	5.0%
to 30%	38	6.5%	1.514	3.8%	4.352	8.3%	5.866	6.4%
to 40%	44	7.5%	4.697	11.9%	9.043	17.3%	13.740	15.0%
to 50%	31	5.3%	2.516	6.4%	2.866	5.5%	5.383	5.9%
to 60%	55	9.4%	8.445	21.4%	6.748	12.9%	15.192	16.6%
to 70%	39	6.6%	8.294	21.0%	4.549	8.7%	12.842	14.0%
to 80%	19	3.2%	1.835	4.6%	0.586	1.1%	2.421	2.6%
to 90%	16	2.7%	5.213	13.2%	0.976	1.9%	6.189	6.7%
to 100%	24	4.1%	5.947	15.1%	0.310	0.6%	6.257	6.8%
Total	**587**	**100.0%**	**39.501**	**100.0%**	**52.191**	**100.0%**	**91.961**	**100.0%**

2.64 We draw attention to the following points illustrated by table A2.8:

- We might have expected high numbers of groups with a debt ratio in the 50–60% range or perhaps the 40–60% range.
- Only 14.7% of groups are within this 40–60% range, although they tend to be larger groups and hold 22.5% of debt+equity capital.
- By contrast, 44.1% of groups (with 15.6% of debt+equity) have no debt and more than two-thirds (68.7% of groups, with 47.3% of debt+equity) have debt ratios below 40%.

2.65 This suggests that modelling foreign-owned firms as being clustered at safe harbour limits is an oversimplification of what is happening at present. It may also be misleading when thinking about policy changes. For example, relaxing

[20] The Tax Review 2001 (commonly known as the McLeod Review) Final Report made this assumption (see Part B of Annex E, pp. 139–140) when it examined how the rules at that time could affect effective tax rates (ETRs). Note that a key difference between the ETRs being estimated by the McLeod Review and our EMTRs is that the McLeod Review assumed that income is always being taxed fully at the company level. The McLeod Review did not attempt to capture the way in which EMTRs can be affected, not only by tax rates and levels of debt finance but also by tax depreciation rules, and whether there are other incentives, such as R&D tax credits. These additional effects are being modelled in the OECD work and in our analysis.

[21] In presenting this data, we ignore a relatively small group of 40 firms with negative or zero levels of equity.

the thin capitalisation safe harbour limit may have no effect on costs of capital for most firms.

2.66 Some firms may be using the worldwide test rather than the thin capitalisation safe harbour test. However, for these firms an increase in the safe harbour would also have no effect on costs of capital.[22]

2.67 In our costs of capital estimates, rather than assuming that firms are clustered at thin capitalisation safe harbours, we normally consider firms with average debt levels of around 43% that do not face a binding thin capitalisation constraint. This will understate the importance of thin capitalisation safe-harbour constraints which will be constraining debt levels for some firms. In chapter 9 of the draft LTIB we discuss some international empirical evidence suggesting that thin capitalisation rules often do impact on levels of investment and also on the sensitivity of investment to the company tax rate. However, we do not see an easy and consistent way of analysing the impact of this on costs of capital and EMTRs.

SMEs where there may be little or no shareholding by non-residents

2.68 The OECD analysis assumes that non-resident shareholders are the marginal investors into companies in New Zealand. This assumption is a key reason for the high costs of capital and EMTRs for New Zealand reported in the OECD study as well as for those reported earlier in this appendix. However, for SMEs there is often little or no investment by non-resident shareholders. The company tax rate may have much less of an effect in driving up costs of capital for these firms than for companies where non-residents are likely to be marginal shareholders.

2.69 To analyse this case, we make use of the domestic SME model variants outlined in appendix 1. These consider incentives to invest by a domestic SME where domestic residents, rather than non-residents, are marginal shareholders. Domestic residents can invest in either interest-bearing securities or domestic SMEs so the opportunity cost of equity investment is the after-tax interest rate that could otherwise have been earned. The domestic interest rate is being raised by AIL so that, if inflation is 2% and the world real interest rate is 3.00%, the domestic real interest rate becomes 3.10%. Domestic residents can borrow or lend at that rate.

2.70 We consider two possible variants. In the first, we assume that income is taxed each year at the marginal tax rates of shareholders. This would be the case if the company fully distributed its taxable profits each year while paying no unimputed dividends. It is assumed that the shareholder faces a marginal tax rate of 33%. We refer to this as the 'full distribution case'.

2.71 In the second variant we consider a company taxed at 28% that retains its profits indefinitely. In this case, we assume that profits are being taxed at 28% as a final tax. We refer to this as the 'full retention case'.

2.72 The main point of these variants is to show that models like the OECD model we are drawing on for much of our analysis are only providing partial insights. Small changes in assumptions can lead to large differences in reported EMTRs. Moreover, as will be discussed in later chapters, they can affect conclusions

[22] An on-lending concession allows firms to have a higher safe harbour if they are on-lending funds. This means that some firms with debt ratios above 60% could possibly be within the thin capitalisation safe harbour and so clustering may be greater than is evident from the table. However, it is still likely that the majority of firms are not clustered at safe harbour limits. The data suggests that 74% of firms have debt ratios below 50%.

about the desirability of measures such as accelerated depreciation as ways of responding to cost of capital concerns.

2.73 We consider two possible world real interest rates of 3% and 5% and assume that inflation is 2% per annum.

2.74 Table A2.9 provides estimates for the full distribution case, and table A2.10 provides results for the full retention case. Unlike in the OECD model, costs of capital and EMTRs do not depend on levels of debt finance.

Table A2.9: Costs of capital and EMTRs for domestic SMEs – full distribution, m = 33%, inflation = 2.0%, AIL = 2%

	Commercial and industrial buildings	Plant, machinery and equipment					Zero-depreciating assets	Inventory	Appreciating assets	Expensing
d	2.69%	100.00%	50.00%	10.00%	4.00%	2.00%	0.00%		-1.00%	
d*	2.00%	100.00%	50.00%	10.00%	4.00%	2.00%	0.00%		0.00%	
Costs of capital										
r = 5%	4.71%	5.14%	5.10%	4.86%	4.63%	4.47%	4.18%	5.14%	3.68%	2.80%
r = 3%	2.72%	3.10%	3.07%	2.88%	2.67%	2.50%	2.14%	3.10%	1.64%	1.43%
EMTRs										
r = 5%	-6.1%	2.8%	1.9%	-2.9%	-7.9%	-11.8%	-19.7%	2.8%	-35.7%	-78.7%
r = 3%	-10.4%	3.3%	2.3%	-4.2%	-12.3%	-19.9%	-40.5%	3.3%	-82.6%	-109.7%

Table A2.10: Costs of capital and EMTRs for domestic SMEs – full retention, t = 28%, inflation = 2.0%, AIL = 2%

	Commercial and industrial buildings	Plant, machinery and equipment					Zero-depreciating assets	Inventory	Appreciating assets	Expensing
d	2.69%	100.00%	50.00%	10.00%	4.00%	2.00%	0.00%		-1.00%	
d*	2.00%	100.00%	50.00%	10.00%	4.00%	2.00%	0.00%		0.00%	
Costs of capital										
r = 5%	4.80%	5.14%	5.11%	4.91%	4.73%	4.60%	4.38%	5.14%	3.99%	3.15%
r = 3%	2.79%	3.10%	3.07%	2.92%	2.75%	2.62%	2.34%	3.10%	1.95%	1.68%
EMTRs										
r = 5%	-4.3%	2.8%	2.1%	-1.9%	-5.8%	-8.7%	-14.2%	2.8%	-25.3%	-58.6%
r = 3%	-7.5%	3.3%	2.4%	-2.9%	-9.1%	-14.7%	-28.3%	3.3%	-53.9%	-78.2%

2.75 We draw attention to the following points:

- A qualitatively similar profile of EMTRs exists whether firms are fully distributing or fully retaining their profits.
- There will be small positive EMTRs for very short-lived PME and inventories, but significantly negative EMTRs for long-lived PME, zero-depreciating assets, appreciating assets and assets where capital expenditure can be expensed.
- Changes in EMTRs across the different asset types are qualitatively similar to those provided by the OECD model. EMTRs are highest for inventory and PME with fast economic depreciation rates and lowest for assets where capital expenditure can be expensed.

- Unlike the OECD model, there are no large positive EMTRs. Not only is interest expense deductible, the opportunity cost of owners' own funds will also reflect an after-tax interest rate. This is because interest income would be taxable if the owners of a business earned interest rather than investing their money in a business.
- The negative EMTRs that arise for many assets are, to a large extent, the consequences of the impacts of inflation and an unindexed tax system.

2.76 Table A2.11 shows costs of capital and EMTRs in the full distribution case when there is no inflation.

Table A2.11: Costs of capital and EMTRs for domestic SMEs – full distribution m = 33%, inflation = 0.0%, AIL = 2%

	Commercial and industrial buildings	Plant, machinery and equipment					Zero-depreciating assets	Inventory	Appreciating assets	Expensing
d	2.69%	100.00%	50.00%	10.00%	4.00%	2.00%	0.00%		-1.00%	
d*	2.00%	100.00%	50.00%	10.00%	4.00%	2.00%	0.00%		0.00%	
Costs of capital										
r = 5%	5.32%	5.10%	5.10%	5.10%	5.10%	5.10%	5.10%	5.10%	4.61%	3.42%
r = 3%	3.23%	3.06%	3.06%	3.06%	3.06%	3.06%	3.06%	3.06%	2.57%	2.05%
EMTRs										
r = 5%	6.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	-8.5%	-46.3%
r = 3%	7.2%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	-16.8%	-46.3%

APPENDIX 3

Risk and the required real rate of return net of any New Zealand taxes

3.1 In studies of investment biases, a real required return of around 5% has often been assumed. For example, Zwick and Mahon (2017) assume a nominal after-tax rate of 7%, roughly corresponding to 2% inflation and a real after-tax rate of return of 5%. In a paper setting out the OECD methodology, Hanappi (2018) chooses a real interest rate of 5% and 2% inflation to assist in making an initial version of the OECD model comparable with other studies. As we have commented, the OECD is now using a 3% real required rate of return and 1% inflation in its analysis.

3.2 Summers (1987) has argued that different cash flows should be discounted at two different rates. He argues that, while many cash flows from investments should be discounted at a high rate that incorporates a risk premium, those associated with depreciation deductions are close to riskless and should, in principle, be discounted at something close to a riskless interest rate. He reports evidence from a survey of companies that found that, in practice, most companies appear to discount interest deductions at high (much higher than riskless) interest rates.

3.3 There are also some complex issues on how to account for risk more generally. Gordon (1985) and Weisbach (2004) present models in which companies are taxed on economic profits and where company tax involves a government sharing in economic profits and economic losses. In these models, any losses are assumed to be fully utilisable and able to be deducted against other profits, or the tax benefit is cashed out. In these models, only tax on the risk-free component of the return drives up the cost of capital. However, for these models to be applicable to investment in depreciable assets, not only would any losses need to be cashed out, but taxpayers would also need to be able to make deductions for actual economic depreciation (how assets actually fall in value), rather than deductions based on depreciation schedules reflecting how they are expected to fall in value. Bulow and Summers (1984) show that basing depreciation on schedule depreciation rates can add to risk and push up the cost of capital.

3.4 There seems to be no agreed consensus on how best we should take account of all these issues. However, a widespread assumption appears to exist in practice that cash flows are discounted at interest rates considerably higher than riskless rates and that this can be reasonably modelled by incorporating a risk premium in the real return that investors demand. In our analysis, we sometimes consider the possibility of either a 3% or a 5% real required rate of return.

APPENDIX 4

Marginal investments with expensing

4.1 Table A2.4 in appendix 2 presented results from our version of the OECD company tax model showing how expensing can lead to a zero EMTR for 100% equity-financed investment and a negative EMTR for 100% debt-financed investment. This appendix provides some simple cash flow examples to explain these results.

4.2 Suppose that non-residents demand a 3% real return on their capital, net of New Zealand taxes, and suppose there is no inflation (to keep things as simple as possible).

Equity-financed investment

4.3 Consider an asset that costs $1,000 at the end of year 0 and produces revenue of $230 at the end of year 1, $224 at the end of year 2, $218 at the end of year 3, $212 at the end of year 4, $206 at the end of year 5 and then expires.

4.4 In the absence of a company tax, this would be a marginal equity-financed investment because it generates a rate of return of exactly 3%. The cost of the asset is equal to the present value of its revenues.

$$1000 = \frac{230}{1.03} + \frac{224}{1.03^2} + \ldots + \frac{206}{1.03^5}$$

4.5 Thus, the cost of capital is $p = 3\%$, the cost of funds to the economy is $r = 3\%$ and the EMTR is $EMTR = (p - r) / r = (3\% - 3\%) / 3\% = 0\%$.

4.6 Now suppose that we have a 28% company tax rate and capital expenditure can be expensed. Suppose that the same investment is once more equity financed. It is straightforward to see that this investment should still be marginal.

4.7 Tax reduces all costs and all revenues in the same proportion. The cost of the investment, net of the tax benefit of expensing, is $720, which is 72% of its pre-tax cost. The revenue in each future year is just 72% of the pre-tax revenue. As costs and revenues fall in the same proportion, this investment will still be marginal because

$$720 = \frac{230(1-0.28)}{1.03} + \frac{224(1-0.28)}{1.03^2} + \ldots + \frac{206(1-0.28)}{1.03^5}$$

4.8 Thus, the cost of capital will remain 3% and the EMTR will remain 0%. As is recorded in table A2., for a fully equity-financed investment, the EMTR will be zero. For equity-financed investment in assets that can be expensed, the government is acting like a 28% partner in the investment. It bears 28% of the cost and reaps 28% of the benefits. Because pre- and post-tax rates of return are the same, expensing is not affecting the cost of capital for an equity-financed investment.

Debt-financed investment

4.9 Now consider a debt-financed investment. Once more assume that we have a 28% company tax rate. Suppose that firms can borrow at an interest rate of

3% (real and nominal) and the after-tax interest cost is 2.16% (that is, 3% x (1–0.28)). It will be a break-even investment for a firm to borrow at an interest rate of 3% to invest in an asset that earns just 2.16% if capital expenditure can be expensed, so long as the firm has profits against which it can set off any deductions. The EMTR will be -38.9% = (2.16%–3.00%)/2.16% (as was reported in table A2.).

4.10 Suppose that an investment costs $1,000 at the end of year 0 and generates revenue of $221.60 at the end of year 1, $217.28 at the end of year 2, $212.96 at the end of year 3, $208.64 at the end of year 4, $204.32 at the end of year 5 and then expires. It is straightforward to check that this generates a 2.16% pre-tax rate of return.

4.11 To finance the investment, the company borrows $720. Together with the $280 tax saving, this finances the investment. The loan is repaid evenly at a rate of $144 per annum over the next five years.

4.12 Cash flows are provided in table A4.1.

Table A4.1: Marginal debt-financed investment with expensing

Year	Capital outlay	Borrowing and (repayments)	Loan balance	Revenue	Interest	Tax	After-tax cash flow
0	-1,000.00	720.00	720.00			-280.00	0.00
1		(144.00)	576.00	221.60	21.60	56.00	0.00
2		(144.00)	432.00	217.28	17.28	56.00	0.00
3		(144.00)	288.00	212.96	12.96	56.00	0.00
4		(144.00)	144.00	208.64	8.64	56.00	0.00
5		(144.00)	0.00	204.32	4.32	56.00	0.00

4.13 This investment earns less than the cost of funds to the economy but is marginal on an after-tax basis. Borrowing at 3% to earn 2.16% is marginal and the EMTR is -38.9%. Just as in the equity-financed case, the firm undertaking the investment benefits from expensing. However, the firm also benefits from a stream of interest deductions in the debt-financed case.

APPENDIX 5

Tax changes since the 2000/01 income year and their impact on corporate costs of capital and EMTRs

5.1 There have been several tax changes to depreciation allowances, company tax rates, the thin capitalisation rules and tax incentives for R&D. All of these will have affected the levels and variability of both costs of capital and EMTRs. The aim of this appendix is to document what has happened and to estimate the impact of the various measures on costs of capital and EMTRs and how they have changed over time.

5.2 This appendix should be considered as only a first step towards examining this issue. It provides a rough estimate of the effects on costs of capital and EMTRs of some of the larger tax changes that have taken place. However, there is much that we are unable to analyse. In particular, we are unable to adequately examine the effects on changes to thin capitalisation provisions or the restricted transfer pricing rules within this framework.

5.3 Costs of capital will vary for different assets. A difficulty in attempting to estimate costs of capital is not knowing rates of economic depreciation for the different broad groups of capital assets that make up New Zealand's capital stock. Statistics NZ provides estimates of net capital stock for nine categories of assets: exploration; land improvements; non-residential buildings; other construction; plant, machinery, and equipment; residential buildings; research and development; software; and transport equipment. It is difficult to estimate how quickly broad categories of asset (like land improvements, or plant, machinery, and equipment) are likely to depreciate over time. It is also difficult to estimate what tax depreciation rates will apply to these various broad categories of asset. However, this is what we need to know if we are to estimate how tax provisions have been affecting costs of capital and EMTRs over time.

5.4 Statistics NZ has provided Inland Revenue with data on consumption of fixed capital and net capital stock for what they describe as 'market units' in New Zealand. A market unit's main objective is to operate in the market by selling its goods and services at competitive prices that are sufficient to generate a profit or surplus in the long term. Tax changes, such as a change in the company tax rate or a change in depreciation provisions, are likely to have a significant effect on investment by market units but much less effect on investment by non-market units.

5.5 Data from Statistics NZ is provided in table A5.1. This can be used to provide rough estimates of economic depreciation rates for different groups of assets. The data provided in the second column shows an average over three years (2017, 2018 and 2019) of gross fixed capital consumption (GFKC) to net capital stock (NKS) at the beginning of the year. Both variables are measured in constant dollar terms. We use these ratios to estimate average rates of economic depreciation for most of Statistics NZ's asset types where the asset type is sufficiently broad that it would seem impractical to us to estimate economic depreciation rates in any other way. There are, however, two narrower groups of assets where the BEA has provided estimates of economic depreciation for what appear to be comparable assets. These two groups of assets are non-residential buildings (mainly commercial and industrial buildings) and software.

5.6 Our estimates of economic depreciation rates are provided in the third columns. For non-residential buildings, we use an estimate of 2.69%. For software, we use the BEA estimate of 55%.

Table A5.1: Data used in estimating costs of capital

Asset type	Stats NZ GFKC/NKS	Estimated rate of economic depreciation	Assumed tax depreciation rate	Weighting
Exploration	7.9%	7.9%	Expensed	0.8%
Land improvements	5.8%	5.8%	5.8%	2.6%
Non-residential buildings	3.1%	2.69%	2.0%	23.4%
Other construction	3.3%	3.3%	3.3%	16.4%
Plant, machinery and equipment	16.8%	16.8%	16.8%	19.9%
Residential buildings	2.1%	2.1%	0.0%	24.4%
Research and development	14.6%	14.6%	Expensed	2.4%
Software	35.4%	55.0%	50.0%	3.7%
Transport equipment	19.8%	19.8%	19.8%	6.4%
Total				**100.0%**

5.7 Assumed tax depreciation rates are provided in the fourth column. For some types of asset, it is possible to identify what the tax depreciation rate in New Zealand is likely to be. For example, exploration expenditure and R&D expenditure can normally be deducted immediately (expensed). Non-residential buildings (commercial and industrial buildings) can be depreciated at a rate of 2.0% DV. Residential buildings receive no depreciation deductions.

5.8 For other assets, we assume an 'average tax depreciation rate' equal to the estimated rate of economic depreciation.[23] The weightings for the different assets are provided in the fifth column. These are averages over the three-year period (2017–2019) from Statistics NZ's net capital stock figures.

5.9 We use the economic depreciation rates and the weightings from table A5.1 to estimate the cost of capital for an aggregate asset that is a weighted average of the nine different types of capital asset. Tax depreciation rates in the table are used to estimate costs of capital at present. Tax depreciation rates applicable in earlier years are used to estimate costs of capital in those earlier years. In addition, we estimate how costs of capital for inventories have changed over time because of changes in the company tax rate.

Tax parameters that have changed since the 2000/01 year

5.10 We allow for the following changes in tax parameters over time.

Company tax rate

5.11 In the initial 2000/01 year, the company tax rate was 33% (which it had been since the late 1980s). It was reduced to 30% from the 2008/09 income year and then to 28% from the 2011/12 income year.

[23] Note that only certain diminishing value depreciation rates are allowed for tax purposes. For example, 2%, 4% and 8% are allowed as depreciation rates, but not 3.3% or 5.8%. In reality, land improvements will be depreciated at a variety of these allowed depreciation rates. Assuming a depreciation rate of 5.8% is only a rough, on-average approximation.

Depreciation

5.12 There have been several changes to the depreciation rules. From the 2000/01 income year until the 2004/05 income year, assets could be written off under one set of depreciation rules. In addition, a 20% depreciation loading applied for qualifying assets (that is, most depreciable assets other than buildings and land improvements). Buildings could be depreciated at a rate of 4% DV. From the 2005/06 income year, depreciation rates were changed in a way that speeded up depreciation deductions for most PME (especially short-lived PME) but reduced the depreciation rate on buildings. The 20% loading for qualifying assets continued. Budget 2010 announced several changes. Depreciation loading was terminated for assets acquired from 21 May 2010. This occurred in different income years for firms with different balance dates, but it applied for the majority of 2010/11 for companies with a standard balance date of 31 March. In our estimates we treat this as applying to assets acquired from the 2010/11 income year. In addition, depreciation deductions on buildings were removed with effect from the 2011/12 income year.

5.13 Depreciation deductions for non-residential buildings were restored at a rate of 2% DV from the beginning of the 2020/21 income year.

5.14 Table A5.2 shows the applicable depreciation rates at the end of the income years that relate to when the above changes were made. The figures in the last column come from table A5.1. Currently the DV rate of depreciation allowed for plant, machinery and equipment is given by $d = 2/T$ where T is the estimated useful life. Before the end of the 2004/05 income year, depreciation allowed was given by $d = 1 - 0.135^{1/T}$. This allows us to estimate average depreciation rates in prior years.[24] Figures reported in table A5.1 are inclusive of the 20% loading, if any.

Table A5.2: Tax depreciation rates

Asset type	2000/01 to 2004/05	2005/06 to 2009/10	2010/11	2011/12 to 2019/20	2020/21
Exploration	Expensed	Expensed	Expensed	Expensed	Expensed
Land improvements	5.60%	5.80%	5.80%	5.80%	5.80%
Non-residential buildings	4.00%	3.00%	3.00%	0.00%	2.00%
Other construction	4.00%	4.00%	3.30%	3.30%	3.30%
Plant, machinery and equipment	18.60%	20.20%	16.80%	16.80%	16.80%
Residential buildings	4.00%	3.00%	3.00%	0.00%	0.00%
Research and development	Expensed	Expensed	Expensed	Expensed	Expensed
Software	47.30%	60.00%	50.00%	50.00%	50.00%
Transport equipment	21.60%	23.80%	19.80%	19.80%	19.80%

R&D tax credits

5.15 Before the 2008/09 income year, R&D could normally be expensed and there were no additional tax credits for R&D. In the 2008/09 income year, a 15% R&D

[24] This assumes a single 'average' depreciation rate for each of the income periods. In practice, there were a discrete number of different depreciation rates allowed. Assets were depreciated at the closest depreciation rate for an asset with the relevant estimated useful life.

tax credit was introduced, but this was repealed the following year. A 15% R&D tax credit was reintroduced in the 2019/20 income year.

Thin capitalisation rules

5.16 Several changes made to the thin capitalisation rules could have affected costs of capital. We cannot be confident about their overall effects, as has been discussed in appendix 2. Our estimates may therefore understate increases in costs of capital over time to the extent that changes to the thin capitalisation rules have pushed up costs of capital. The estimates also do not take account of changes such as the restricted transfer pricing rules which are difficult to model.

Other assumptions

5.17 Costs of capital can be affected not only by tax changes but also by changes in other variables, such as corporate debt levels, real interest rates or inflation. Our focus is on how changes in tax parameters have affected costs of capital.

5.18 A potential difficulty is the number of different cases that can arise for firms in slightly different positions, such as foreign-controlled companies or domestic companies. In our estimates, we focus solely on the case of a domestic company with marginal foreign shareholders. This means that costs of capital and EMTRs are impacted by AIL but not by NRWT on interest.

5.19 Costs of capital will tend to be very slightly lower for foreign-controlled companies that can make use of tax credits for NRWT and somewhat higher for foreign-controlled companies that cannot. However, as was discussed in appendix 2, differences in costs of capital between these different types of firms are unlikely to be very large. Also, changes over time in costs of capital and EMTRs are likely to be much the same for the different types of firms.

Our estimates

5.20 Our estimates of the impact of changes to company tax rates, depreciation provisions and R&D tax credits on costs of capital are presented in table A5.3. Columns 2–10 provide estimates of costs of capital over time for the nine different types of assets for which Statistics NZ provides data on net capital stock. In making these estimates, we assume a constant world real cost of debt and equity of 3% and 2% per annum inflation. As a result of New Zealand's 2% AIL, the domestic real interest rate is 3.10%. We assume that investment is 43% debt financed. Our estimates are for domestic companies with foreign portfolio shareholders.

5.21 The eleventh column then aggregates these costs of capital into a weighted average for the nine types of asset. The weightings for net capital stock are averages over the last three years for 'market activities' provided by Statistics NZ. Restricting our data to market activities affects our estimates. For example, the estimates for residential buildings exclude owner-occupied residential housing and government assets, such as schools and hospitals, that are not employed in market activities.

5.22 Over the 20-year period, our estimates suggest there has only been a slight increase – from 3.75% to 3.83% – in the weighted average cost of capital for the nine types of asset that Statistics NZ includes in its estimates of net capital stock. The weighted average rose slightly to 3.78% in 2005/06 when depreciation rates were scaled back for buildings but increased for short-lived machinery and equipment. It dropped to 3.59% in 2008/09 (when the company tax rate was cut from 33% to 30% and the 15% R&D tax credit was introduced).

It climbed back to 3.68% in 2009/10 (when the R&D tax credit was repealed) and then to 3.77% in 2010/11 (when depreciation loading was removed). Despite a further cut in the company tax rate to 28%, the weighted average increased to 4.06% in 2011/12 because of the removal of building depreciation. In the last couple of years, there has been some decline in costs of capital because of the reintroduction of an R&D tax credit and the restoration of depreciation deductions for commercial and industrial buildings.

5.23 The final column shows costs of capital for inventories. They are estimated to have fallen from 4.44% to 4.14% over this period because of the cut in the company tax rate in 2008/09 and again in 2011/12.

Table A5.3: Costs of capital: r = 3%, inflation = 2%, b = 0.43 and AIL = 2%

	Exploration	Land improve-ments	Non-res buildings	Other construct	PM&E	Res buildings	R&D	Software	Trans equip	Wtd avge	Inven-tories
Weight	0.80%	2.60%	23.40%	16.40%	19.90%	24.40%	2.40%	3.70%	6.40%		
2000/01	2.33%	4.08%	3.62%	3.77%	4.12%	3.46%	2.33%	4.71%	4.16%	3.75%	4.44%
01/02	2.33%	4.08%	3.62%	3.77%	4.12%	3.46%	2.33%	4.71%	4.16%	3.75%	4.44%
02/03	2.33%	4.08%	3.62%	3.77%	4.12%	3.46%	2.33%	4.71%	4.16%	3.75%	4.44%
03/04	2.33%	4.08%	3.62%	3.77%	4.12%	3.46%	2.33%	4.71%	4.16%	3.75%	4.44%
04/05	2.33%	4.05%	3.62%	3.77%	4.12%	3.46%	2.33%	4.71%	4.16%	3.75%	4.44%
05/06	2.33%	4.05%	3.79%	3.77%	4.00%	3.62%	2.33%	4.24%	4.02%	3.78%	4.44%
06/07	2.33%	4.05%	3.79%	3.77%	4.00%	3.62%	2.33%	4.24%	4.02%	3.78%	4.44%
07/08	2.33%	4.05%	3.79%	3.77%	4.00%	3.62%	2.33%	4.24%	4.02%	3.78%	4.44%
08/09	2.39%	3.91%	3.69%	3.67%	3.87%	3.54%	-1.25%	4.08%	3.89%	3.59%	4.26%
09/10	2.39%	3.91%	3.69%	3.67%	3.87%	3.54%	2.39%	4.08%	3.89%	3.68%	4.26%
10/11	2.39%	3.91%	3.69%	3.79%	4.11%	3.54%	2.39%	4.40%	4.13%	3.77%	4.26%
11/12	2.43%	3.83%	4.43%	3.72%	4.01%	4.20%	2.43%	4.27%	4.03%	4.06%	4.14%
12/13	2.43%	3.83%	4.43%	3.72%	4.01%	4.20%	2.43%	4.27%	4.03%	4.06%	4.14%
13/14	2.43%	3.83%	4.43%	3.72%	4.01%	4.20%	2.43%	4.27%	4.03%	4.06%	4.14%
14/15	2.43%	3.83%	4.43%	3.72%	4.01%	4.20%	2.43%	4.27%	4.03%	4.06%	4.14%
15/16	2.43%	3.83%	4.43%	3.72%	4.01%	4.20%	2.43%	4.27%	4.03%	4.06%	4.14%
16/17	2.43%	3.83%	4.43%	3.72%	4.01%	4.20%	2.43%	4.27%	4.03%	4.06%	4.14%
17/18	2.43%	3.83%	4.43%	3.72%	4.01%	4.20%	2.43%	4.27%	4.03%	4.06%	4.14%
18/19	2.43%	3.83%	4.43%	3.72%	4.01%	4.20%	2.43%	4.27%	4.03%	4.06%	4.14%
19/20	2.43%	3.83%	4.43%	3.72%	4.01%	4.20%	-1.11%	4.27%	4.03%	3.98%	4.14%
20/21	2.43%	3.83%	3.81%	3.72%	4.01%	4.20%	-1.11%	4.27%	4.03%	3.83%	4.14%

5.24 Table A5.3 suggests that the lowest costs of capital are for R&D, where because of both expensing and the R&D tax credit, the hurdle rate of return is negative. This is of course in line with the policy intent of subsidising R&D because of concerns that R&D is likely to generate positive externalities. The cost of capital for exploration is less than the 3% real assumed cost of funds to the economy because of expensing. Other investments have hurdle rates of return that exceed the 3% real cost of funds.

5.25 Not too much should be read into the exact numbers provided for the different types of assets because they depend on a reasonably tenuous method of estimating economic depreciation. This method involves dividing Statistics NZ estimates of consumption of fixed capital by net capital stock at the beginning of the year. Small changes in assumptions can have substantial effects. For

example, the BEA estimates that stand-alone houses or small groups of connected dwellings with four or fewer dwellings have an economic depreciation rate of 1.14%, and that larger developments of five or more dwellings have an economic depreciation rate of 1.4%. Using either of these estimates of economic depreciation would reduce estimated costs of capital for these assets to 3.82% or 3.93% respectively. We have not adjusted the costs of capital calculated for residential buildings as a result of the recent denial of interest deductibility. Interest on new builds of rental property continues to be deductible.

5.26 Table A5.4 presents estimates of EMTRs, once again assuming a world real interest rate of 3%, a debt level of 43% and 2% inflation. For R&D, the cost of capital is negative in three years (see table A5.5) and the tax wedge is also negative. This leads to very high positive EMTRs, which are meaningless. If the cost of capital were to fall, the calculated EMTR would rise. In cases where costs of capital are negative, EMTRs are not reported and are recorded with the '***' symbol.

Table A5.4: EMTRs: r = 3%, inflation = 2%, b = 0.43, AIL = 2%

	Exploration	Land improve-ments	Non-res buildings	Other construct	PM&E	Res buildings	R&D	Software	Trans equip	Wtd avge	Inven-tories
Weight	0.80%	2.60%	23.40%	16.40%	19.90%	24.40%	2.40%	3.70%	6.40%		
2000/01	-29.02%	26.47%	17.02%	20.47%	27.15%	13.38%	-29.02%	36.36%	27.88%	20.00%	32.38%
01/02	-29.02%	26.47%	17.02%	20.47%	27.15%	13.38%	-29.02%	36.36%	27.88%	20.00%	32.38%
02/03	-29.02%	26.47%	17.02%	20.47%	27.15%	13.38%	-29.02%	36.36%	27.88%	20.00%	32.38%
03/04	-29.02%	26.47%	17.02%	20.47%	27.15%	13.38%	-29.02%	36.36%	27.88%	20.00%	32.38%
04/05	-29.02%	25.84%	17.02%	20.47%	27.15%	13.38%	-29.02%	36.36%	27.88%	19.99%	32.38%
05/06	-29.02%	25.84%	20.85%	20.47%	25.02%	17.08%	-29.02%	29.29%	25.30%	20.60%	32.38%
06/07	-29.02%	25.84%	20.85%	20.47%	25.02%	17.08%	-29.02%	29.29%	25.30%	20.60%	32.38%
07/08	-29.02%	25.84%	20.85%	20.47%	25.02%	17.08%	-29.02%	29.29%	25.30%	20.60%	32.38%
08/09	-25.50%	23.32%	18.69%	18.33%	22.52%	15.23%	***	26.55%	22.79%	16.45%	29.50%
09/10	-25.50%	23.32%	18.69%	18.33%	22.52%	15.23%	-25.50%	26.55%	22.79%	18.43%	29.50%
10/11	-25.50%	23.32%	18.69%	20.83%	26.99%	15.23%	-25.50%	31.75%	27.40%	20.45%	29.50%
11/12	-23.25%	21.67%	32.23%	19.32%	25.18%	28.53%	-23.25%	29.77%	25.56%	26.13%	27.59%
12/13	-23.25%	21.67%	32.23%	19.32%	25.18%	28.53%	-23.25%	29.77%	25.56%	26.13%	27.59%
13/14	-23.25%	21.67%	32.23%	19.32%	25.18%	28.53%	-23.25%	29.77%	25.56%	26.13%	27.59%
14/15	-23.25%	21.67%	32.23%	19.32%	25.18%	28.53%	-23.25%	29.77%	25.56%	26.13%	27.59%
15/16	-23.25%	21.67%	32.23%	19.32%	25.18%	28.53%	-23.25%	29.77%	25.56%	26.13%	27.59%
16/17	-23.25%	21.67%	32.23%	19.32%	25.18%	28.53%	-23.25%	29.77%	25.56%	26.13%	27.59%
17/18	-23.25%	21.67%	32.23%	19.32%	25.18%	28.53%	-23.25%	29.77%	25.56%	26.13%	27.59%
18/19	-23.25%	21.67%	32.23%	19.32%	25.18%	28.53%	-23.25%	29.77%	25.56%	26.13%	27.59%
19/20	-23.25%	21.67%	32.23%	19.32%	25.18%	28.53%	***	29.77%	25.56%	24.55%	27.59%
20/21	-23.25%	21.67%	21.30%	19.32%	25.18%	28.53%	***	29.77%	25.56%	21.72%	27.59%

REFERENCES

Auerbach, A.J. (1979). Inflation and the choice of asset life. *Journal of Political Economy*, 87(3), 621–638.

Bulow, J.I. and Summers, L.H. (1984). The taxation of risky assets. *Journal of Political Economy*, Vol 92, No 1, 20–39.

Gordon, R.H. (1985). Taxation of corporate capital income: tax revenues versus tax distortions. *Quarterly of Economics*, Vol C, Issue 1, 1–27.

Hall, R.E. and D.W. Jorgenson (1967). Tax policy and investment behavior. *American Economic Review*, Vol. 57, No. 3, 391–414.

Hanappi, T. (2018). Corporate effective tax rates: model description and results from 36 OECD and non-OECD countries. *OECD Working Papers No. 38*, https://dx.doi.org/10.1787/a07f9958-en

Inland Revenue and Treasury. (2004). *Repairs and maintenance to tax depreciation rules – an officials' issues paper*. https://taxpolicy.ird.govt.nz/publications/2004/2004-ip-depreciation

Summers, L.H. (1987). Investment incentives and the discounting of depreciation allowances. In M.S. Feldstein (Ed.), *The effects of taxation on capital accumulation*. pp. 295–304, University of Chicago Press.

McLeod Review. (2001). *Tax Review 2001 – Final report*. https://www.treasury.govt.nz/sites/default/files/2007-11/taxreview2001-report.pdf

Weisbach, D. (2004). The (non-)taxation of risk. Chicago Law School.

Zwick, E. and Mahon, J. (2017). Tax policy and heterogeneous investment behavior. *American Economic Review*, Vol 107, No 1, 217–48.