Tax, foreign investment and productivity

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

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OVERVIEW

1. Inland Revenue's 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. They provide further analytical detail on the formal models being used and discussion on implications of the formal modelling. Following submissions from stakeholders and external reviews, these are an update of the technical appendices that accompanied the draft LTIB.[2]

2. The technical appendices are as follows:

   - **Appendix 1** provides two formal economic models of how taxes can affect costs of capital and effective marginal tax rates (EMTRs). The first of these is the main OECD model that is being used throughout the LTIB. A crucial assumption in this first model is that non-residents are marginal shareholders. This model may, or may not, be relevant for small and medium enterprises (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 relative to those in many other countries, 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** provides some cash flow examples illustrating the impacts of taxes and inflation on costs of capital and EMTRs for equity-financed and debt-financed investments.
   - **Appendix 4** discusses risk and its likely impact on costs of capital and EMTRs.
   - **Appendix 5** provides a simple cash flow example to show how some debt-financed investments can end up with negative EMTRs. Rather than investments being taxed, they can end up being subsidised, and higher rates of inflation will tend to lead to higher subsidies for these subsidised assets.
   - **Appendix 6** 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, that we have not been able to analyse.

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

[2] The draft LTIB and former technical appendices are available at: 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.[3] Our 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 consider 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.[4] We focus primarily on this variant and 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 invest either 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. 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

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

[4] While our cost of capital measures are identical, there is a difference in our estimates of EMTRs because of the indirect way that the OECD calculates these. 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%.

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.

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 levies or non-resident withholding tax on interest and, for the time being, we also ignore these levies and taxes. The asterisk denotes that these are world rates of return. Levies or non-resident withholding taxes on interest can increase domestic real interest rates above world real interest rates.

1.6 Let r_w * be the pre-tax real weighted average cost of funds to New Zealand so

$$r_w^* = (1-b)r_e^* + br_d^* \quad (1)$$

1.7 In the absence of any levies or withholding taxes on interest or on dividends paid abroad, the real cost of debt to companies operating in New Zealand will be $r_d = r_d^*$, the real cost of equity will be $r_e = r_e^*$ and the real weighted average cost of funds will be $r_w = r_w^*$.

1.8 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

$$r_w' = (1-b)r_e + b\left(r_d(1-\tau) - \frac{\tau\pi}{1+\pi}\right) \qquad (2)$$

where τ is the company tax rate and π is the inflation rate.

1.9 The fraction of each dollar of investment that is equity-financed costs r_e. As much debt finance as demanded can be attracted at the world real interest rate, r_d. Debt finance 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.

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

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

where i_d is the nominal interest rate.

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

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

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

$$i_w' = (1-b)i_e + bi_d(1-\tau) \qquad (3)$$

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

1.13 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.

1.14 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

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

1.15 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 from the future stream of depreciation deductions, together with any investment allowances or investment tax credits (such as the current R&D tax credit). Different rates of tax depreciation or other capital allowances will affect the cost of capital by changing the value of *A*.

1.16 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] 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

$$A = \tau\left(\frac{d^*}{1+i_w'}+\frac{d^*(1-d^*)}{(1+i_w')^2}+\ldots\right) = \frac{\tau d^*}{i_w'+d^*} \qquad (4)$$

1.17 For a marginal investment

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

or

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

[5] Note that the OECD in their modelling (see Hanappi, 2018) discount 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 variable *c* is sometimes referred to as the 'user-cost' or the 'implicit rental value of capital services'.[6] 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 transaction 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).

1.19 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 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

$$p = \frac{(1 - A)(r_w' + d)}{1 - \tau} - d \qquad (5)$$

1.20 The OECD's cost of capital expressions can be derived by substituting appropriate values of *A* into equation (5).

1.21 The OECD study examines the EMTR which is 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

$$EMTR = \frac{p - r_w^*}{p} \qquad (6)$$

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

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

1.23 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.

1.24 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.

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

Sub-variant 1: Full distribution sub-variant

1.26 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

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

at the company level are not distributed as dividends but are instead retained in the company.

1.27 As a result of New Zealand's full imputation system, taxable profits end up being taxed at the rate of shareholders. Imputation credits are available for company tax that has been paid, and company tax operates like a withholding tax. If the company tax rate is 28% and *m* is 33%, a company that earns $100 in pre-tax profits would pay $28 of company tax. When the $72 is paid as a dividend, the shareholder would be taxed on $100 (the dividend plus the $28 imputation credit). This leads to $33 of gross income tax, but this is offset by $28 of imputation credits. The shareholder is only required to pay $5 in net additional tax. This tops up the total tax rate on company profits to the shareholder's marginal rate. Once profits are distributed, they are taxed at the tax rates of shareholders.

1.28 Equally, we might assume that income is owned through an unincorporated enterprise and the profits are taxed directly in shareholders' hands. Whether profits are earned within an unincorporated enterprise or a company, the profits end up being taxed at shareholders' marginal tax rates.

1.29 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 $r' = r(1-m) - m\pi/(1+\pi)$.

1.30 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

$$p = \frac{(1-A)(r'+d)}{1-m} - d \qquad (5')$$

1.31 This replaces equation (5).

Sub-variant 2: Full retention sub-variant

1.32 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

$$p = \frac{(1-A)(r'+d)}{1-\tau} - d \qquad (5'')$$

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

Augmenting the OECD model for approved issuer levy (AIL) and non-resident withholding tax on interest

1.33 In chapter 4 of the LTIB and in Appendix 2 below we augment the basic OECD model to take account of AIL and NRWT on interest. These levies and taxes may potentially lead to domestic real interest rates being higher than world real interest rates. We will consider two potential types of company with marginal foreign shareholders.

1.34 As is discussed in Appendix 2, for domestic companies with marginal foreign portfolio shareholders, AIL is likely to be relevant and be increasing domestic interest rates while NRWT on interest is unlikely to be relevant. AIL is levied at a rate of $t_a = 2.0\%$ on nominal interest payment paid abroad. Suppose that $i_d^* = r_d^* (1+\pi) + \pi$ is the nominal interest rate that non-residents receive. The nominal interest rate that domestic firms will be paying inclusive of AIL will be $i_d = i_d^* (1+t_a)$ and the real interest paid will be

$$r_d = \frac{i_d - \pi}{1+\pi} = \frac{r_d^* \left((1+\pi)+\pi\right)(1+t_a) - \pi}{1+\pi} = r_d^* (1+t_a) + \frac{t_a \pi}{1+\pi}$$

1.35 To derive costs of capital and EMTRs for domestic companies with marginal foreign portfolio shareholders in Appendix 2 we use this value of r_d and equations (1) to (6) above.

1.36 For foreign-controlled companies, interest payments to related parties abroad will be subject to NRWT at a rate t_w whereas interest payments to third parties are likely to be subject to AIL. Interest payments to related parties abroad are likely to need to be grossed up for NRWT on interest if NRWT is not creditable abroad but not if NRWT is fully creditable abroad. We introduce a dummy variable α which takes a value of 1 if NRWT is not creditable and 0 if NRWT is fully creditable. We denote the fraction of debt that is related party by θ.

1.37 The average nominal interest rate paid by these firms is assumed to rise to

$$i_d = i_d^* \left(\frac{\theta}{1-\alpha t_w} + (1-\theta)(1+t_a) \right)$$

1.38 The real domestic interest rate will be

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

1.39 To derive costs of capital and EMTRs for foreign controlled companies with marginal foreign direct shareholders in Appendix 2 we use this value of r_d and equations (1) to (6) above.

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 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 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. The OECD analysis assumes a debt level of 35% and an inflation rate of 1% per annum. 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). Currently, inflation is running at a significantly higher rate. CPI inflation over the year ending with the June quarter 2022 was 7.3%. However, over time, inflation is expected to move back towards the middle of the Reserve Bank target range. In its Budget and Economic Fiscal update 2022, the Treasury is estimating the CPI inflation will have been reduced to 2.2% by 2026. The OECD study ignores non-resident withholding tax (NRWT) on interest and the approved issuer levy (AIL). In 2.6 to 2.32 we rework the OECD analysis in a model that, like the OECD's analysis, ignores both NRWT on interest and AIL.

2.3 In 2.33 to 2.64, we extend the analysis to take account of NRWT on interest and AIL. The OECD does not consider how thin capitalisation rules might affect the analysis. We also have some discussion of this issue. 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 costs of capital.

2.4 In most of the analysis, we use the OECD assumption that non-resident marginal providers of debt and equity finance require a 3% real return on their capital, net of New Zealand taxes.[7] Some studies have assumed that marginal

[7] One referee expressed concerns about our use of the OECD assumption that the real costs of debt and equity are the same. He commented that our assumption was incompatible with capital market equilibrium. In many countries income from abroad on debt instruments is taxed more heavily than income from abroad on equity instruments. This suggests that debt instruments should be required to generate higher risk-adjusted returns than equity instruments. A practical problem though is in deciding an appropriate premium for debt given differences of tax treatments in different countries. There are similar issues with modelling inflation. We assume that a fixed real return is required on debt instruments irrespective of the domestic interest rate. If interest receipts are taxed at income tax rates while exchange losses are deducted at a lower capital gains tax rate, it is possible for higher domestic inflation rates to push up the real interest rate the New Zealand is required to pay on its debt. These are complex issues which we ignore in this study. Boadway, Bruce and Mintz (1984) is a formal model which works through these issues. As is

investors require higher returns than this. Implications of higher required returns for costs of capital and EMTRs are explored in 2.65 to 2.67.

2.5 The analysis discussed so far 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 2.74 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.

Extending the OECD model to take account of New Zealand settings – no NRWT on interest and no AIL

2.6 In this section we make a start on extending the OECD model to take account of New Zealand settings. We consider a broader set of assets and examine how costs of capital and EMTRs can be affected by inflation. As in the OECD analysis we ignore non-resident withholding tax (NRWT) on interest and the approved issuer levy (AIL). These taxes and levies will be considered later in this appendix.

2.7 The OECD analysis provides a single point estimate of a cost of capital for assets they describe as 'tangible assets', which are tangible assets other than buildings. 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%.

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 tangible assets other than buildings, biases in the way different types 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. In setting depreciation rates, inflation has been ignored (or taken to be zero). This was discussed in a 2004 New Zealand officials' issues paper on depreciation.[8] 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.[9] 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

discussed later, we do, however, check whether results are sensitive to the assumption that the real required returns on debt and equity are the same. Changing this assumption slightly has little effects on our estimates of EMTRs.

[8] 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

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

(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 even more important. 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 tangible assets other than buildings 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 would 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 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).

2.13 Commercial and industrial buildings 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.[10]

2.14 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 a 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.

2.15 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

[10] 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. The OECD has 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.

including certain types of land. Other types of land might better be thought of as included in appreciating assets, which are also considered.[11]

2.16 As in the OECD study, we allow for trading stock or inventories. Inventories are taxed on a first-in, first-out (FIFO) basis in New Zealand. They 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.

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

2.18 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.[12]

2.19 It should be noted that there is an important difference between the EMTRs we are calculating and the effective tax rates (ETRs) calculated in the McLeod Review.[13] The McLeod Review assumed an underlying effective statutory tax rate equal to the company tax rate for all equity-financed corporate investments (see footnote 1 of page 139 of the Final Report). The implicit assumptions in the McLeod Review analysis are that tax depreciation for all assets reflects economic depreciation, and that either there is no inflation or tax rules are comprehensively indexed to take account of inflation. This means that some of the biases we are identifying, such as those produced when depreciation is accelerated or capital expenditure can be expensed, or those that can result from inflation, are ones that were not examined in the McLeod Review's analysis of ETRs. Appendix 3 provides some cash flow examples which illustrate these issues.

2.20 As was noted earlier, 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. Inland Revenue data from its International Questionnaire suggests a higher book level of debt 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. Accounting information for NZX 50 firms in 2020 (excluding the two large banks included

[11] 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.

[12] It should be noted that even for assets that depreciate extremely quickly and are fully depreciated over the year they are first used, an important difference exists between economic depreciation and expensing. An asset acquired at the end of year 0 that is subject to economic depreciation is assumed to be depreciable in year 1, whereas an asset that can be expensed is assumed to be depreciable in year 0, the year in which it is acquired. This is consistent with the OECD methodology.

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

in the NZX 50, namely, ANZ and Westpac) results in a very similar estimate of 43.7%.

2.21 In examining costs of capital in New Zealand, we will often 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.

2.22 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. In table A2.1 below, we consider two possible inflation rates, namely, 0% and 2%. An inflation rate of 0% is helpful in showing what would happen if economic depreciation were deductible for many assets. An inflation rate of 2% is likely to be a more realistic average inflation rate in the longer run.

2.23 Table A2.1 shows costs of capital, assuming, as in the OECD study, that non-residents require a real return of 3.0% net of New Zealand taxes on both debt and equity finance. We denote the common assumed real cost of debt and equity finance by $r^* = 3\%$. The row labelled *d* denotes the economic rate of depreciation used and the row *d** denotes the tax depreciation rate allowed. We assume that tax depreciation is allowed on a diminishing value (DV) basis. In New Zealand, taxpayers are normally given an option of claiming tax depreciation on a straight-line or DV basis, with a higher rate of depreciation being allowed for those using DV. We consider PME with five different possible rates of economic and tax depreciation.

Table A2.1: Costs of capital and EMTRs for companies with marginal foreign shareholders, r* = 3%, no AIL or NRWT

	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 = 0%										
b = 0%	4.33%	4.17%	4.17%	4.17%	4.17%	4.17%	4.17%	4.17%	3.78%	3.00%
b = 100%	3.14%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	2.61%	2.16%
b = 43%	3.82%	3.67%	3.67%	3.67%	3.67%	3.67%	3.67%	3.67%	3.28%	2.64%
Inflation = 2%										
b = 0%	4.59%	4.93%	4.89%	4.70%	4.52%	4.39%	4.17%	4.93%	3.78%	3.00%
b = 100%	2.69%	3.00%	2.97%	2.82%	2.65%	2.52%	2.24%	3.00%	1.85%	1.61%
b = 43%	3.77%	4.10%	4.07%	3.89%	3.71%	3.58%	3.34%	4.10%	2.95%	2.40%
EMTRs										
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 = 100%	4.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-14.9%	-38.9%
b = 43%	21.4%	18.1%	18.1%	18.1%	18.1%	18.1%	18.1%	18.1%	8.4%	-13.7%
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 = 100%	-11.5%	0.0%	-0.9%	-6.5%	-13.2%	-19.2%	-34.1%	0.0%	-62.3%	-86.2%
b = 43%	20.4%	26.8%	26.3%	22.8%	19.2%	16.3%	10.1%	26.8%	-1.8%	-24.9%

2.24 We draw attention to the following points:

- First, consider the case when there is no inflation and investment is fully equity-financed (so b = 0%). In this case, costs of capital for PME where economic depreciation is deductible, zero-depreciation assets and inventory would all be 4.17%. The fact that hurdle rates of return are the same for many assets suggests that tax settings would be treating many different forms of investment neutrally. EMTRs for all these assets would be equal to 28.0%, the statutory company tax rate.
- Suppose, instead, these investments were 100% debt-financed and inflation was still zero. While economic income is being fully taxed, interest expense is deductible, so costs of capital would all be equal to the real interest rate of 3.0%. EMTRs for these assets would all be zero.
- If these investments were 43% debt-financed and inflation was still zero, the EMTRs for all these assets would be 18.1%. By contrast, consider commercial and industrial buildings. These would have a slightly higher EMTR of 21.4% because tax depreciation is assumed to be slightly less than economic depreciation (tax depreciation is 2% DV, whereas economic depreciation is assumed to be 2.69% DV in line with BEA estimates). By contrast, appreciating assets are tax preferred because capital gains are not being taxed. They would have an EMTR of 8.4%. Assets that can be expensed (where capital expenditure is immediately deductible rather than only being allowed as assets depreciate) would also be tax preferred. They would have a cost of capital of only 2.64% and an EMTR of -13.7%. These assets would be subsidised by the tax system.

2.25 To understand how investments that can be expensed end up with negative EMTRs, it is helpful to consider first the case of a fully equity-financed investment. If there were no company tax, the hurdle rate of return would be 3%. An investment that cost $10,000 and generated revenue of $300 per annum would be a break-even investment because this would provide the marginal foreign shareholders with the demanded 3% return on their funds.

2.26 Now consider what happens if there is a company tax rate of 28% and investments can be expensed. The same investment would now cost the company 72% of $10,000 (or $7,200) after taking account of the immediate deduction for the capital cost. The after-tax revenues would be 72% of $300 in each future year (or $216). As costs and benefits are all reduced by 28%, this provides an after-tax return of 3% and so is still marginal on an after-tax basis. Thus, with expensing, company tax should not affect the cost of capital and the EMTR remains zero for equity-financed investment. For a fully debt-financed investment, not only does the cost of the investment and future revenues fall by 28%, but there is also a deductible interest stream. This reduces the cost of capital to 2.16% and the EMTR to -38.9%. With debt of 43%, the EMTR ends up being -13.7%. Appendix 5 provides additional cash-flow examples showing that these costs of capital and EMTRs apply to depreciating assets as well.

2.27 Now consider the impact of inflation. This will have two separate effects.

2.28 First consider a fully equity-financed investment that has a DV economic depreciation rate of 10% per annum. If the investment cost $10,000 at the end of year 0 and there was no inflation, it would be worth $9,000 (90% of $10,000) at the end of year 1, $8,100 (90% of $9,000) at the end of year 2 and so forth. Over the first year, economic depreciation of $1,000 is a true business cost and needs to be deductible for the company to be taxed on its economic income. Likewise, over the second year, $900 needs to be deductible, and so forth.

2.29 Now suppose, however, that there is 2% per annum inflation but, under New Zealand's historical cost depreciation system, depreciation deductions are not adjusted to take account of inflation. Tax depreciation remains only $1,000 over the first year, $900 over the second year, and so forth, despite there being inflation. Inflation will be eroding the real value of depreciation deductions, which will tend to increase costs of capital and EMTRs. The value of money is falling by 2% per annum. To maintain the real value of depreciation deductions, the firm would need to be able to deduct $1,020 in the first year, $936.36 in the second year, and so forth. It is important to note that this is a problem only for depreciating assets. A zero-depreciation asset is not receiving any depreciation deductions, so the firm is missing out on nothing by not having these inflation-indexed. Thus, if investment is fully equity-financed, inflation will tend to push up costs of capital and EMTRs for investment in depreciable assets but not in zero-depreciation assets. This creates a tax bias. For assets with very low rates of economic and tax depreciation ($d = d^*$), the penalty from depreciation deductions being eroded by inflation has a much smaller effect on costs of capital than for assets with higher economic and tax depreciation rates.

2.30 For investments that are fully or partially debt-financed, inflation has a second effect. Firms are allowed to deduct nominal interest expense. With inflation, firms will be deducting more than their real interest expense, and this can subsidise debt-financed investment. If the real interest rate is 3% and inflation is 2%, so the nominal interest rate is approximately 5%, firms will be deducting 5% when only 3% is a true business expense. This is a balancing factor that will tend to lower costs of capital and EMTRs for partially debt-financed investments. From table A2.1 we see that if investment is fully debt-financed, costs of capital fall and EMTRs become negative for not only non-depreciating assets but also for depreciating PME with depreciation rates below 100%.

2.31 Finally, consider the impact of 2% inflation on EMTRs, assuming investment is 43% debt-financed. First, consider zero-depreciation assets. Firms with these assets are not facing any penalty from historical cost depreciation and inflation eroding depreciation deductions. In this case, the EMTR falls from 18.1% to 10.1% because of the over-deduction of interest. Similarly for appreciating assets, the EMTR falls from 8.4% to -1.8%. For assets that can be expensed, the EMTR falls from -13.7% to -24.9%. Costs of capital and EMTRs fall for all these assets because more than the real interest cost is being deducted without any offsetting tax penalty. Inflation is not eroding the real value of depreciation deductions for these assets. By contrast, consider a depreciating asset with an economic and tax depreciation rate of 50%. The EMTR for this asset increases from 18.1% to 26.3% because the erosion of the real value of depreciation deductions has a bigger effect on the EMTR than the over-deduction of interest. Inflation tends to push up costs of capital and EMTRs for shorter-lived PME and for inventories.

2.32 Making tax depreciation rates as close as possible to economic depreciation rates would be attractive as a way of promoting neutrality in the absence of inflation. However, if the tax system is not adjusted to take account of inflation, significant biases may be introduced by relatively small levels of inflation. This is the 'inflation bias' issue discussed in several studies (see, for example, Auerbach (1979) or chapter 3 of the officials' issues paper on depreciation, Inland Revenue and Treasury, (2004)).

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

2.33 The OECD analysis does not take account of NRWT on interest or AIL. By contrast, these taxes and levies were included in the effective tax rates

calculated in the McLeod Review (2000). The OECD analysis also does not 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.

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

2.35 We also do not consider local authority rates in our analysis. It might be argued that these rates will also be adding to costs of capital and EMTRs and discouraging investment in real property. However, recurrent taxes on real property such as local authority rates are not normally included in international studies of costs of capital and EMTRs such as the OECD study or the work by Bazel and Mintz (2021). Some would argue that they are, at least in part, a charge levied by local authorities for the provision of public services including the provision of infrastructure as well as services such as water, sewerage and so forth. This is another issue which merits further consideration in the future.

NRWT, AIL and real interest rates

2.36 In New Zealand, there are two different types of taxes/levies on interest paid to non-residents. NRWT 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 allows the borrowing firm to pay AIL at a rate of 2% in lieu of NRWT.

2.37 A difference between NRWT and AIL 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. By contrast, other countries do not provide their residents with tax credits for AIL.

2.38 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 tax credits for NRWT. 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.

2.39 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.

2.40 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%x(1+0.02)).

2.41 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 AIL at a rate of $t_a = 2\%$ 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.

2.42 In table A2.2 below, we update the data presented in table A2.1 to consider the effects of AIL on costs of capital and EMTRs for domestic companies with marginal foreign portfolio shareholders. By 'domestic companies' we are referring to companies that are not foreign controlled. Accordingly, NRWT on interest is not normally an issue because these firms prefer to pay AIL rather than NRWT. As in the earlier table, we assume there is a world real interest rate and a required real return on equity of 3.0% net of New Zealand taxes. We consider debt levels of 0%, 100% and 43% once more.

Table A2.2: Costs of capital and EMTRs for domestic companies with marginal foreign portfolio shareholders, r* = 3%, 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										
Inflation = 0%										
b = 0%	4.33%	4.17%	4.17%	4.17%	4.17%	4.17%	4.17%	4.17%	3.78%	3.00%
b = 100%	3.20%	3.06%	3.06%	3.06%	3.06%	3.06%	3.06%	3.06%	2.67%	2.20%
b = 43%	3.84%	3.69%	3.69%	3.69%	3.69%	3.69%	3.69%	3.69%	3.30%	2.66%
Inflation = 2%										
b = 0%	4.59%	4.93%	4.89%	4.70%	4.52%	4.39%	4.17%	4.93%	3.78%	3.00%
b = 100%	2.79%	3.10%	3.07%	2.91%	2.75%	2.61%	2.34%	3.10%	1.95%	1.68%
b = 43%	3.81%	4.14%	4.11%	3.93%	3.76%	3.63%	3.38%	4.14%	2.99%	2.43%
EMTRs										
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 = 100%	6.3%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	-12.3%	-36.2%
b = 43%	22.0%	18.7%	18.7%	18.7%	18.7%	18.7%	18.7%	18.7%	9.1%	-12.9%
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 = 100%	-7.6%	3.2%	2.4%	-3.0%	-9.2%	-14.8%	-28.4%	3.2%	-54.0%	-78.3%
b = 43%	21.3%	27.6%	27.0%	23.7%	20.1%	17.3%	11.2%	27.6%	-0.3%	-23.3%

2.43 We draw attention to the following points:

- As would be expected, AIL has no impact when investment is fully equity-financed. If b = 0%, costs of capital and EMTRs are the same as in table A2.1.

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

[15] There is an exemption from AIL and 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.

- If there is no inflation, economic depreciation is deductible and investment is fully debt-financed, AIL increases EMTRs from the value of 0.0% reported in table A2.1 to 2.0%. This is, of course, just the rate at which AIL is being levied.
- If we allow for 2% inflation, AIL ends up increasing EMTRs a bit more for fully debt-financed investment in assets that depreciate quickly and for inventory. For example, the EMTR for inventory rises to 3.3%. This is because AIL is levied on nominal, rather than real, interest expense.
- But the general pattern of EMTRs is similar to that in table A4.1. With an average debt level of b = 43%, there are high EMTRs for short-lived PME and for inventories. There are negative EMTRs for assets that can be expensed. EMTRs fall as debt levels increase.[16]

2.44 Foreign-controlled companies would normally be subject to AIL on their third-party borrowing. However, if they are partly financed by related-party debt, they will also be subject to 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 because any higher taxes in New Zealand will lead to equal and offsetting lower taxes abroad. If, instead, 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%.[17]

2.45 Data on firms from whom Inland Revenue collects information as part of its International Questionnaire (IQ firms) is presented in table A2.3.

Table A2.3: 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%		

2.46 Table A2.3 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.

[16] These results rest on the OECD's assumption that the real costs of debt and equity capital (net of any New Zealand taxes and adjusted for risk) are the same. One reviewer questioned whether this assumption might be creating an inconsistency as non-residents are often taxed more heavily on interest receipts than on equity returns. It could be argued that capital market equilibrium should require higher risk-adjusted returns on debt than on equity because in many countries debt is taxed more heavily than returns on equity. These sorts of issues could possibly be explored further in future work. For this LTIB, we are using the OECD's assumption that the risk-adjusted costs of the two forms of finance are the same. We did examine a run where the required return on equity was 3.0% while the required return on debt was 3.5%, but this had very little effect on EMTRs. The broad conclusions of this appendix are unlikely to be very sensitive to the exact assumptions being made about whether costs of debt and equity are identical.

[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.

2.47 This allows us to consider how AIL and NRWT would affect costs of capital for three different types of companies with foreign marginal shareholders. In each case, we consider firms with average levels of debt:

- 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 and subject to AIL if the inflation rate is 2% per annum.
- 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%.
- 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%.

2.48 Estimated effects on costs of capital are examined in table A2.4, assuming a world real interest rate of 3% and 2% inflation.[18] The third row shows costs of capital for companies with marginal foreign shareholders (which might or might not be foreign controlled) if there is no AIL or NRWT. The fourth row show costs of capital for domestic companies (that is, companies with marginal foreign shareholders that are not foreign controlled) when we have AIL and NRWT. The fifth row shows costs of capital for foreign-controlled companies when we have AIL and NRWT and NRWT is fully creditable. The sixth row shows costs of capital for foreign-controlled companies when we have AIL and NRWT, and NRWT is not creditable.

[18] Note that EMTRs can become somewhat difficult to interpret when we start to take account of creditable taxes, such as NRWT. To see this, suppose inflation is zero and the interest rate that is required to be paid on related-party debt is 3%. In the absence of NRWT or AIL, firms borrowing from related parties abroad do so at an interest rate of 3%. Now suppose that NRWT at a rate of 10% is levied and this is fully creditable. The borrower continues to pay 3% but 0.3% goes to the New Zealand government in tax. The net cost of interest to New Zealand of this loan as a whole (taking account of the tax received by the Government) falls to 2.7%. This tax would not affect the cost of capital as the tax is fully creditable. However, depending on how EMTRs are defined, it might be thought to increase EMTRs. While it would not be affecting the cost of capital for firms, it would lower the cost of funds to New Zealand as a whole. This sort of increase in EMTR obviously can have very different welfare consequences to those from an increase in EMTRs because of increases in costs of capital. To minimise potential confusion, we do not provide tables showing EMTRs when we are working with NRWT and non-residents are able to claim credits for NRWT.

Table A2.4: Costs of capital for domestic companies with marginal foreign portfolio shareholders and for foreign-controlled companies, r* = 3%, inflation = 2%, debt = 43%

	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	3.77%	4.10%	4.07%	3.89%	3.71%	3.58%	3.34%	4.10%	2.95%	2.40%
Domestic companies with marginal foreign shareholders AIL = 2%	3.81%	4.14%	4.11%	3.93%	3.76%	3.63%	3.38%	4.14%	2.99%	2.43%
Foreign-controlled companies: AIL = 2% and NRWT = 10%										
NRWT creditable	3.80%	4.13%	4.10%	3.91%	3.74%	3.61%	3.36%	4.13%	2.97%	2.42%
NRWT not creditable	3.88%	4.21%	4.18%	4.00%	3.83%	3.70%	3.45%	4.21%	3.06%	2.49%

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

- The third row of table A2.4 comes from table A2.1 and the fourth row comes from table A2.2. By comparing these 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. This is because the 10% rate of NRWT is greater than the 2% rate of AIL.
- 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 assets.

Thin capitalisation rules

2.50 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.

2.51 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%.

2.52 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.

2.53 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.

2.54 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.

2.55 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.

2.56 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 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.

2.57 To examine whether there is major evidence of clustering, IQ data on debt ratios is provided in table A2.5. Firms are grouped by their debt ratio. A ratio

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

[20] 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 by inflation. These additional effects are being modelled in the OECD work and in our analysis.

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 A2.5: 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%**

2.58 We draw attention to the following points illustrated by table A2.5:

- We might have expected high numbers of groups with a debt ratio in the 50–60% range or perhaps the 40–60% range.
- There may be a slightly elevated percentage of groups in the 50-60% range (9.4% of MNEs in this range is somewhat higher than for other deciles, other than 0% to 10% once we add in firms with no debt) and 16.6% of capital is owned by firms in this range.
- Only 14.7% of groups are within the 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%.

2.59 This suggests that modelling foreign-owned firms as being clustered at safe harbour limits is likely to be an oversimplification of what is happening in practice. It may also be misleading when thinking about policy changes. For example, relaxing the thin capitalisation safe harbour limit may have no effect on costs of capital for most firms.

2.60 At the same time, it would be good to explore the results further in future work to get a better idea of what is driving behaviour. Incentives to cluster close to the thin capitalisation threshold are obviously relevant for firms that are in a taxpaying position but not for those in a tax loss position. Also, some firms may be using the worldwide test rather than the thin capitalisation safe harbour test.

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

For these firms, an increase in the safe harbour would be likely to have no effect on costs of capital.[22]

2.61 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 understates the importance of thin capitalisation safe-harbour constraints that will be constraining debt levels for some firms. In chapter 9 of the LTIB, we discuss some international empirical evidence suggesting that thin capitalisation rules often do impact on levels of investment and 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.

2.62 Different levels of debt can have a significant effect on EMTRs. In table A2.6, we estimate EMTRs for a domestic company with marginal foreign portfolio shareholders with an average debt level of 43%. We compare EMTRs for this firm to those that arise for foreign-controlled companies with a set of different possible debt levels of 0%, 43%, 60%, 75% and 100%.

2.63 In each case, we assume that interest expense is fully deductible. This is clearly the appropriate assumption if debt is 0%, 43% or 60%, as in these cases companies will be within their thin capitalisation safe-harbour thresholds. EMTRs for the higher ratios of 75% and 100% are not the EMTRs that arise under current thresholds. They show the EMTRs that would arise if the threshold were relaxed to allow interest to be fully deductible for foreign-controlled companies with these higher levels of debt. For foreign-controlled companies, we assume that 37.3% of debt is associated-party debt. We make the 'worst case' assumption that NRWT on interest is not creditable abroad. We also assume a world real interest rate of 3% and inflation of 2% per annum.

Table A2.6: EMTRs for domestic companies with marginal foreign portfolio shareholders and for foreign-controlled companies with varying levels of debt

	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%	
Domestic companies										
b= 43%	21.3%	27.6%	27.0%	23.7%	20.1%	17.3%	11.2%	27.6%	-0.3%	-23.3%
Foreign-controlled companies										
b= 0%	34.6%	39.1%	38.7%	36.2%	33.6%	31.7%	28.0%	39.1%	20.6%	0.0%
b= 43%	22.7%	28.8%	28.3%	25.0%	21.6%	18.8%	13.1%	28.8%	2.1%	-20.7%
b= 60%	16.8%	23.7%	23.1%	19.5%	15.5%	12.3%	5.4%	23.7%	-7.9%	-31.4%
b= 75%	6.5%	15.0%	14.3%	10.0%	5.1%	1.0%	-8.4%	15.0%	-26.2%	-50.6%
b= 100%	-9.0%	2.0%	1.2%	-4.3%	-10.7%	-16.4%	-30.5%	2.0%	-57.0%	-81.2%

[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%.

2.64 We draw attention to the following points illustrated by table A2.6:

- For domestic companies with marginal foreign portfolio shareholders and an average level of debt of b = 43%, EMTRs vary between 27.6% and -23.3%.
- For foreign-controlled companies with the same level of debt, EMTRs are slightly higher and vary between 28.8% and -20.7%. The slightly higher EMTRs are the consequence of the higher tax rate for NRWT compared with AIL.
- For foreign-controlled companies sitting on the thin capitalisation threshold of 60%, EMTRs would vary between 23.7% and -31.4%. They would be slightly lower than for domestic companies with average levels of debt.
- Allowing higher thin capitalisation thresholds of 75% or 100% would lower EMTRs further for firms that avail themselves of these higher debt levels. This would be providing an advantage to foreign-controlled companies that are currently likely to be clustered close to the 60% safe harbour. This would not be reducing EMTRs for firms facing the highest EMTRs at present.

Different real interest rate assumptions

2.65 We have seen how small amounts of inflation can create biases between different types of investment. However, throughout our analysis, we have used the OECD's assumption of a 3% required real return on both debt and equity finance. As is discussed in appendix 4, there is some uncertainty as to the most appropriate real interest rate to assume. Higher real interest rates have been used in some other studies. In this section, we compare EMTRs for our set of assets with real interest rates of both 3% and 5%.

2.66 A higher real interest rate will tend to reduce the biases caused by inflation. The biases caused by inflation will tend to be large when inflation rates are high relative to real interest rates.

Table A2.7: EMTRs for domestic companies with foreign marginal portfolio shareholders, t = 28%, debt = 43%, different values of r* and inflation

	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 = 0%	22.0%	18.7%	18.7%	18.7%	18.7%	18.7%	18.7%	18.7%	9.1%	-12.9%
Inflation = 2%	21.3%	27.6%	27.0%	23.7%	20.1%	17.3%	11.2%	27.6%	-0.3%	-23.3%
r = 5%										
Inflation = 0%	21.1%	18.7%	18.7%	18.7%	18.7%	18.7%	18.7%	18.7%	13.2%	-12.9%
Inflation = 2%	19.9%	24.3%	23.8%	21.1%	18.8%	17.2%	14.4%	24.3%	8.3%	-18.9%

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

- In the absence of inflation, EMTRs would be 18.7% for PME where tax depreciation is assumed to be equal to economic depreciation, zero-

depreciation assets and inventory. This would be true irrespective of whether the real interest rate demanded by non-residents was 3% or 5%.

- A higher real interest rate assumption does not affect qualitative conclusions much. It is still the case that minor amounts of inflation can reduce the neutrality of investment decisions. It leads to increasing EMTRs on short-lived PME and inventories as well as increasing tax subsidies for investment in assets that can be expensed.
- However, with a lower real interest rate of 3%, the biases caused by inflation tend to be larger. For example, both the increases in EMTRs for short-lived PME and inventory and the decreases in EMTRs for assets where capital expenditure can be expensed are larger than is true when the real interest rate is 5%.

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 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 Costs of capital and EMTRs are provided for this case in table A2.8. We consider two possible real interest rates and two possible inflation rates. As AIL is increasing the domestic real interest rate, costs of capital and EMTRs do not depend on debt levels because, whether investment is debt- or equity-financed, the opportunity cost of capital is the after-tax real interest rate.

Table A2.8: Costs of capital and EMTRs for domestic SMEs without foreign marginal shareholders, full distribution, m = 33%, 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* = 3%										
Inflation = 0%	3.23%	3.06%	3.06%	3.06%	3.06%	3.06%	3.06%	3.06%	2.57%	2.05%
Inflation = 2%	2.71%	3.10%	3.07%	2.88%	2.67%	2.50%	2.13%	3.10%	1.64%	1.43%
r* = 5%										
Inflation = 0%	5.31%	5.10%	5.10%	5.10%	5.10%	5.10%	5.10%	5.10%	4.61%	3.42%
Inflation = 2%	4.71%	5.14%	5.10%	4.86%	4.63%	4.47%	4.17%	5.14%	3.68%	2.80%
EMTRs										
r* = 3%										
Inflation = 0%	7.2%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	-16.8%	-46.3%
Inflation = 2%	-10.5%	3.2%	2.2%	-4.3%	-12.4%	-20.0%	-40.6%	3.2%	-82.8%	-109.9%
r* = 5%										
Inflation = 0%	5.9%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	-8.5%	-46.3%
Inflation = 2%	-6.2%	2.7%	1.9%	-3.0%	-8.0%	-11.9%	-19.8%	2.7%	-35.8%	-78.8%

2.72 We draw attention to the following points:

- In cases where economic depreciation is deductible or for inventories, EMTRs would be 2.0% in the absence of inflation. This is, of course, the rate of AIL, which would be pushing up the domestic real (and nominal) interest rate. This would be true whether the real interest rate was 3% or 5%. EMTRs would be lower for appreciating assets or assets where capital expenditure can be expensed as these are being taxed concessionally. EMTRs would be somewhat higher for commercial and industrial buildings, where it is being assumed that tax depreciation is slightly lower than economic depreciation.
- Unlike the case of companies with marginal foreign shareholders, there would be no cases of very high EMTRs. With a world real interest rate of 3%, the highest EMTR is 7.2% for commercial and industrial buildings.
- The impact of small amounts of inflation is similar to what we found earlier for 100% debt-financed investment by domestic companies with marginal foreign shareholders. This is because, whether investment is debt- or equity-financed, the opportunity cost of investing is the after-tax real interest rate. Inflation can increase EMTRs slightly for very short-lived PME and for inventories. Its major impact, though, is to make EMTRs more negative for concessionally taxed assets.
- 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 in combination with the fact that some assets (such as those for which capital expenditure can be expensed) are concessionally taxed to start off with.
- It should be noted that the fact that EMTRs are negative is because the (risk adjusted) cost of capital ends up being less than the real interest rate. It does not mean that those who invest their own capital in a

business will pay negative amounts of tax. All that it is saying is they end up paying less tax than they would if they were earning interest. Another valid question is whether the tax impost on other forms of saving such as interest-bearing securities is appropriate.[23]

- Standard arguments in favour of reducing high EMTRs look weaker for domestic SMEs without foreign shareholders than for companies with marginal foreign shareholders. This is because EMTRs tend to be much lower for these firms.

2.73 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'.

Table A2.9: Costs of capital and EMTRs for domestic SMEs without foreign marginal shareholders, full retention, t = 28%, 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* = 3%										
Inflation = 0%	3.20%	3.06%	3.06%	3.06%	3.06%	3.06%	3.06%	3.06%	2.67%	2.20%
Inflation = 2%	2.79%	3.10%	3.07%	2.91%	2.75%	2.61%	2.34%	3.10%	1.95%	1.68%
r* = 5%										
Inflation = 0%	5.27%	5.10%	5.10%	5.10%	5.10%	5.10%	5.10%	5.10%	4.71%	3.67%
Inflation = 2%	4.79%	5.14%	5.10%	4.90%	4.72%	4.60%	4.38%	5.14%	3.99%	3.15%
EMTRs										
r* = 3%										
Inflation = 0%	6.3%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	-12.3%	-36.2%
Inflation = 2%	-7.6%	3.2%	2.4%	-3.0%	-9.2%	-14.8%	-28.4%	3.2%	-54.0%	-78.3%
r* = 5%										
Inflation = 0%	5.2%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	-6.1%	-36.2%
Inflation = 2%	-4.3%	2.7%	2.0%	-2.0%	-5.8%	-8.7%	-14.2%	2.7%	-25.4%	-58.7%

2.74 We draw attention to the following points:

- The general structure of EMTRs is similar to the full distribution case.
- In the absence of inflation, EMTRs for PME where economic depreciation is assumed to be deductible or inventories would be equal to the 2% rate of AIL. For appreciating assets or assets where capital expenditure can be expensed, EMTRs could be significantly negative.
- Small amounts of inflation could make these EMTRs more negative.
- Note that the case in A2.9 with full retention is the same as would be true of full distribution if shareholders were taxed at a rate of m = 28%.

[23] The LTIB discusses the possibility of inflation indexation and of a dual income tax with a possibly lower flat rate of tax on capital income. Either of these might relieve tax biases not by taxing business income from SMEs more heavily but by reducing taxes on some relatively heavily taxed forms of saving.

APPENDIX 3

Economic depreciation and EMTRs for equity-financed and debt-financed investments

3.1 In the OECD model, assets are acquired in one year and provide a stream of cash flows starting in the next year. In reality, investments will generate streams of cash flows throughout different years, but the model is simplifying things and assuming a single cash flow each year. It seems most consistent to think of assets as being acquired at the end of an initial year, say year 0, which is why they produce no revenue in the initial year.

3.2 In the OECD model, depreciation deductions start in year 1, the year after an asset is acquired. This is slightly less generous than New Zealand tax rules. Suppose, for example, that an asset costing $10,000 is acquired in the 12th month of an income year and qualifies for 10% DV depreciation. A depreciation deduction of 1/12 of a full year's deduction, namely, $83.33 would be allowed in the year it is acquired. This first year allowance is ignored in the OECD model. Assuming that depreciation deductions start in year 1 allows us to model 'economic depreciation'. Strictly, if assets provide no cash flows in the year they are acquired, they would not be expected to depreciate in that year. Any depreciation in the initial year would be accelerated.

3.3 It might be thought that assuming depreciation deductions start in the initial year could understate the generosity of depreciation deductions considerably for assets acquired earlier in an income year. For example, an asset acquired halfway through an income year would qualify for half of a full year's depreciation in that initial year. However, a firm is also likely to be taxed in the initial income year on any earnings from that asset in that year. The OECD's assumption of an asset being acquired in year 0, starting to earn revenue in year 1 and normally starting to claim depreciation deductions in year 1 seems reasonable as a way of analysing tax settings in New Zealand.

3.4 The cost of capital and EMTR estimates from appendix 2 can be most easily understood by considering the following four specific assets:

- A zero-depreciation asset (d = 0%) that is acquired at a cost of $10,000 at the end of year 0 and provides a constant real revenue stream in each future year.
- A two-period asset that is acquired at a cost of $10,000 at the end of year 0 and fully depreciates over the first year it is used (d = 100%). Thus, it provides a single positive cash flow at the end of year 1 and then expires.
- A depreciating asset with an intermediate rate of DV economic depreciation, (say d = 10%). This is acquired at the end of year 0 at a cost of $10,000 and provides cash flows that decline at this constant DV rate.
- An item of inventory that is acquired at the end of year 0 at a cost of $10,000 and sold one year later.

3.5 We use these examples to consider the effects of company income tax and inflation. We first consider fully equity-financed investments and then consider fully debt-financed investments.

Equity-financed investment, no inflation or taxes

3.6 Suppose that marginal foreign shareholders require a real return of 3% on their capital. The following would all be marginal investments:

- A zero-depreciation asset earning $300 at the end of year 1 and at the end of each subsequent year.
- A two-period asset that earns $10,300 at the end of year 1 and then expires.
- An asset with a 10% DV economic rate of depreciation that earns $1,300 at the end of year 1 (of which $300 covers the return required on capital and $1,000 covers economic depreciation), $1,170 at the end of year 2 (which is 90% of $1,300) and cash flows in later years that decline by 10% DV in each future year.
- Inventory that is sold for $10,300 at the end of year 1.

Equity-financed investment, no inflation, 28% company tax rate

3.7 In all these cases, the cost of capital would rise to 4.167% = 3%/(1-0.72) and the EMTR would rise to 28%:

- For a zero-depreciation asset earning $416.67 at the end of year 1 and at the end of each subsequent year, tax would be $116.67 each year (28% of $416.67) and the after-tax revenue would be $300, which leaves marginal shareholders with the return they demand.
- Now consider a two-period asset that earns $10,416.67 at the end of year 1 and then expires. The firm would be able to deduct depreciation of $10,000 in year 1, so it would have taxable income of $416.67 in that year and pay $116.67 in tax, leaving marginal shareholders with the $10,300 they demand.
- An asset with a 10% DV economic rate of depreciation that earns $1,416.67 at the end of year 1 of which $416.67 covers the return required on capital before tax, ($116.67 covers tax and $300 covers the return marginal shareholders require), and $1,000 covers economic depreciation. So long as the asset also generates $1275.00 at the end of year 2 (which is 90% of $1,416.67) and cash flows in later years decline by 10% DV in each future year, the asset would continue to be exactly cover the return required on capital and economic depreciation in each future year so it would be a marginal investment.
- Inventory that is sold for $10,416.67 at the end of year 1 would be marginal. The company would be required to pay $116.67 in tax, leaving shareholders with the $10,300 they demand.

3.8 Thus, these examples show why economic depreciation would lead to EMTRs all being 28% if there was no inflation, economic depreciation was deductible for depreciating assets and there was FIFO treatment of inventories.

Equity-financed investment, 2%* inflation*, 28% company tax rate

3.9 Here we drop the asset with the 10% DV economic rate of depreciation from the discussion because it becomes a bit more complex to analyse. However, in any event, this ends up just being an intermediate case between the zero-depreciation asset and the two-period asset.

- For a zero-depreciation asset earning real income of $416.67 at the end of year 1 and at the end of each subsequent year, real tax payments would be $116.67 each year (28% of $416.67) and the real after-tax revenue would be $300 at the end of each year, which leaves marginal shareholders with the return they demand. (This would require revenues that increase by 2% per annum to offset inflation. Thus, the nominal revenue in year 1 would be $425.00 (namely, $416.67x1.02), the nominal revenue in year 2 would be $433.50 (namely, $416.67x1.02x1.02) and so forth.) This asset receives no depreciation deductions and is not penalised by historical cost depreciation. Its cost of capital remains 4.167%, and its EMTR remains 28.0%.

- The two-period asset, however, is penalised because depreciation deductions are not indexed for inflation. Inflation erodes the real value of the depreciation deduction. Rather than the firm being able to claim a real depreciation deduction of $10,000 in year 1, it can only claim a real depreciation deduction of $9,803.92. Because of this, the cost of capital rises to 4.9292%. If the asset generates real revenue of $10,492.92, the company will be taxed on $689.00 of real revenue ($10,492.92 minus $9803.92) and pay tax of $192.92. This will leave the $10,300 ($10,492.92 minus $192.92) of real revenue that marginal shareholders require. Because depreciation deductions are not indexed for inflation, the cost of capital increases to 4.9292% and the EMTR increases to 39.1%. There can be a material rise in EMTRs of depreciating assets with relatively fast rates of economic depreciation.

- Inventories are, of course, very similar to the two-period depreciating assets. Because there are no inflation adjustments for inventories, the real deduction allowed in year 1 also falls to $9803.92, which means that the cost of capital increases to 4.9292% and the EMTR rises to 39.1%.

Debt-financed investment, no inflation or taxes

3.10 Similar examples with each asset costing $10,000 at the end of year 0 can be used to consider the case where investments are fully debt-financed and where foreign lenders require a real interest rate of 3% on their loans. To keep things as simple as possible, we assume that there is no approved issuer levy or NRWT on interest so that 3% is the real interest rate that domestic firms end up paying. In the absence of inflation or tax, the costs of capital would all be 3.0% and the EMTRs would all be 0%. The examples are as follows:

- For a fully debt-financed zero-depreciation asset which earns $300 at the end of each year starting in year 1, the revenue earned would match the $300 of interest that needs to be paid each year, making the investment marginal. The $10,000 cost of the investment would be financed by borrowing $10,000. As the asset is fully debt-financed and does not depreciate the loan is assumed to never be repaid.

- For a two-period that earns $10,300 at the end of year 1 and then expires, the investment would once more be marginal. The cost of the investment would once more be financed by the firm borrowing $10,000. In year 1 the revenue of $10,300 would provide $300 to meet the interest payment on the loan as well as $10,000 to repay the loan.

- An asset which costs $10,000 at the end year 0 which depreciates at a DV economic rate of 10% and which generates revenue of $1,300 at the end of year 1, $1,170 at the end of year 2 and so forth would be marginal. The cost of the asset could be financed by borrowing $10,000. Revenue of $1,300 would finance interest expense of $300 plus a loan repayment

of $1,000. As the asset has economic depreciation of $1,000 this loan repayment is keeping the investment fully debt-financed. In year 2, revenue of $1,170 would finance interest of $270 on the loan outstanding plus a repayment of $900 to match economic depreciation on the asset. The same pattern would ensure that revenue fully covers interest and loan repayments in future years making this a marginal investment.

- If $10,000 is borrowed to acquire $10,000 of inventory at the end of year 0 and this is sold for $10,300 at the end of year 1, this is once more a marginal investment. The loan as well as interest on the loan can be repaid out of the revenue from selling the inventory in year 1.

Debt-financed investment, no inflation, 28% company tax rate

3.11 With debt-financed investment, a company tax rate of 28% (or any other rate) would not affect the cost of capital so long as economic depreciation is deductible. In all these cases, the cost of capital would remain 3.00% and the EMTR would remain 0.0% because interest payments are deductible:

- For a zero-depreciation asset earning $300 at the end of year 1 and at the end of each subsequent year, this revenue would be taxable, but interest expense of $300 would be deductible. The tax liability would be zero so this would continue to be a marginal investment.

- A two-period asset that earns $10,300 at the end of year 1 and then expires would continue to be marginal. The revenue would be taxable in year 1 but this would be balanced by a deduction for interest expense of $300 as well as depreciation of $10,000. Again, there would be no tax to pay so the investment would remain marginal.

- An asset with a 10% DV economic rate of depreciation that earns $1,300 at the end of year 1 would also have no tax to pay in that year. The revenue would be taxable but this would be fully offset by an interest deduction of $300 and depreciation of $10,000. In future years, taxable revenue, interest deductions and depreciation deductions would all be reduced by 10% each year leading to no tax liabilities in any future year.

- Inventory that is sold for $10,300 at the end of year 1 would also be marginal. The firm could claim a deduction for the $10,000 costs as well as for $300 of interest expense in year 1 and this would balance the $10,300 of revenue generated by selling the asset. Again, there would be no tax to pay.

3.12 Thus, these examples show why economic depreciation would lead to EMTRs all being 0% for fully debt-financed investments if there is no inflation and economic depreciation is deductible for depreciating assets and there is FIFO treatment of inventories.

Debt-financed investment, 2%* inflation*, 28% company tax rate

3.13 Here we once more drop the asset with the 10% DV economic rate of depreciation from the discussion because it becomes a bit more complex to analyse.

- First consider a zero-depreciation asset. The first thing to note is that if this asset continued to provide a real revenue stream of 3%, the investment would be better than marginal. This is because while the real revenue of $300 per annum was being taxed, the firm would not only be allowed a deduction for the $300 per annum of real interest expense, it would also be allowed a deduction for the inflationary component of

interest as well. This means that it would benefit from a stream of net tax deductions and the cost of capital will fall below 3%. Table A2.1 reports the required real rate of return on a marginal investment is roughly 2.24% or, more accurately, is 2.2375%. To see why this is marginal, consider an investment costing $10,000 which provides a real revenue stream of $223.75 in each future year. With a real interest rate of 3% and inflation of 2%, the nominal interest cost becomes 5.06%. Thus, the firm will be able to deduct nominal interest of $506.00 which is a real deduction of $496.08 ($506.08/1.02). The company's real taxable income will be -$272.33 (real revenue of $223.75 minus a real deduction of $496.08). This leads to tax falling by $76.25 (28% of $272.33). This tax subsidy of $76.25 exactly balances the difference between the real revenue generated and the real interest expense ($223.75 + $76.25 = $300).

- Now consider the two-period asset. Table A2.1 reports that the cost of capital for this investment remains 3.00% and the EMTR remains 0.0%. This is because the overdeduction of interest expense (by allowing a deduction for the inflationary component of interest) is exactly balanced by the overtaxation of income (because depreciation deductions are not indexed for inflation). If the asset costs $10,000 at the end of year 0 and provides real revenue of $10,300 in a year's time, the real revenue is taxable while the real depreciation deduction is only $9,803.92 ($10,000/1.02). Thus, before taking interest expense into account, the firm would be taxed on real income of $496.08 even though real income is only $300. This overtaxation of $196.08 exactly balances the overdeduction for interest of $196.08.

- Under FIFO, the tax treatment is much the same as for the two-period depreciating asset. If inventory is acquired at the end of year 0 for $10,000 and sold at the end of year 1 for $10,300, the firm only gets a deduction in year 1 for $9,803.92 in real dollars.

3.14 These examples have aimed to provide some intuition for the numbers reported in Table A2.1. In the absence of inflation, EMTRs for fully equity-financed investments would all be equal to the statutory company tax rate of 28.0% so long as economic depreciation is deductible and inventory receives FIFO treatment and is turned over at least once a year. With inflation, costs of capital would increase for fully equity-financed investment in depreciating assets and inventory but not for assets which do not depreciate.

3.15 Now consider fully debt-financed investment. If there were no inflation, EMTRs would all be 0.0% for investment in depreciating assets so long as economic depreciation is deductible and for investment in inventories. With positive inflation, EMTRs will remain 0.0% for depreciating assets with an economic depreciation rate of 100% and for inventory but will fall (and become negative) for depreciating assets which depreciate less quickly.

APPENDIX 4

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

4.1 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.

4.2 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.

4.3 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 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. 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.

4.4 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 have considered the possibility of either a 3% or a 5% real required rate of return.

APPENDIX 5

Marginal investments with expensing

5.1 Table A2.1 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, additional cash-flow examples to explain these results for both equity-financed and debt-financed investments. As in table A2.1, we assume there is no AIL or NRWT on interest.

5.2 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

5.3 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.

5.4 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.

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

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

5.6 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.

5.7 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

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

5.8 Thus, the cost of capital will remain 3% and the EMTR will remain 0%. As is recorded in table A2.1, 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

5.9 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 A2.1).

5.10 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.

5.11 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.

5.12 Cash flows are provided in table A5.1.

Table A5.1: 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

5.13 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 6

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

6.1 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.

6.2 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 of changes to thin capitalisation provisions or the restricted transfer pricing rules within this framework.

6.3 Costs of capital will vary for different assets. A difficulty in attempting to estimate costs of capital is not knowing the 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 (PME); 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.

6.4 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.

6.5 Data from Statistics NZ is provided in table A6.1. 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 Bureau of Economic Analysis (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.

6.6 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 A6.1: 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%**

6.7 Assumed tax depreciation rates are provided in the fourth column. For some types of assets, 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.

6.8 For other assets, we assume an 'average tax depreciation rate' equal to the estimated rate of economic depreciation.[24] 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.

6.9 We use the economic depreciation rates and the weightings from table A6.1 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

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

[24] 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.

Company tax rate

6.11 In the 2000/01 income 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.

Depreciation

6.12 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 sped 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 the 2010/11 income year 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.

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

Table A6.2: 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%

6.14 Table A6.2 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 A6.1. 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.[25] Figures reported in table A6.2 are inclusive of the 20% loading, if any.

R&D tax credits

6.15 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 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

6.16 Several changes made to the thin capitalisation rules could have affected costs of capital, and 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 other changes that are also difficult to model, such as the restricted transfer pricing rules.

Other assumptions

6.17 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.

6.18 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.

6.19 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

6.20 Our estimates of the impact on costs of capital of changes to company tax rates, depreciation provisions and R&D tax credits are presented in table A6.3. 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.

6.21 The eleventh column then aggregates these costs of capital into a weighted average for the nine types of assets. The weightings for net capital stock are averages over the last three years for 'market activities' provided by Statistics

[25] 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.

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.

6.22 Over the 20-year period, our estimates suggest there has been a slight increase – from 3.75% to 3.83% – in the weighted average cost of capital for the nine types of assets 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.

6.23 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 A6.3: 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%

6.24 Table A6.3 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.

6.25 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 and 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% and 3.93% respectively. We have also not adjusted the costs of capital calculated for residential buildings for the recent denial of interest deductibility. Interest on new builds of rental property continues to be deductible.

6.26 Table A6.4 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 A6.3) 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 A6.4: 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%

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