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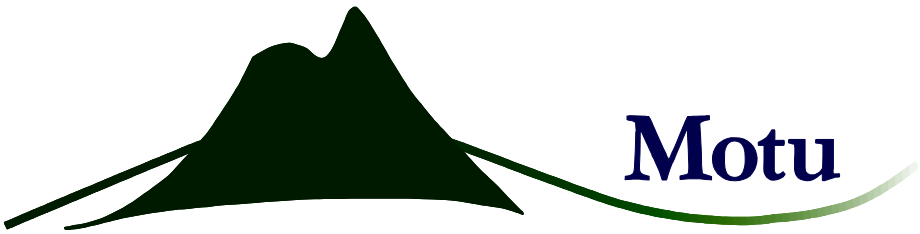

Estimating Firm-Level Effective Marginal Tax Rates and the User Cost of Capital in New Zealand

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This paper was undertaken while Richard Fabling and Lynda Sanderson were on secondment to Statistics New Zealand. The results in this paper are not official statistics, they have been created for research purposes from the Integrated Data Infrastructure prototype (IDI) managed by Statistics NZ. The opinions, findings, recommendations and conclusions expressed in this paper are those of the authors. Statistics NZ, the New Zealand Treasury, Victoria University of Wellington, the University of Nottingham and Motu take no responsibility for any omissions or errors in the information contained here.

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Abstract

Effective marginal tax rates (EMTRs) can be very different from the statutory rate and vary across firms, reflecting such factors as the extent and nature of taxable deductions (losses, depreciation), asset and ownership structures, and debt/equity financing. We estimate firm-specific EMTRs and related user cost of capital (UCC) measures allowing for shareholder-level taxation using data for 1999/00-2009/10 from the Longitudinal Business Database. Examining distributions of various UCC measures we find substantial firm-level heterogeneity, systematic changes as a result of tax reforms between 2004 and 2012, and systematic differences between foreign-owned and domestically-owned firms. Choices among alternative UCC measures make a difference to interpretations.

JEL CLASSIFICATION

D22 – Firm Behaviour: Empirical Analysis
G30 – Corporate Finance and Governance
H25 – Business Taxes and Subsidies

KEYWORDS

User cost of capital; tax reform; EMTR; New Zealand

Executive Summary

Although the system of corporate taxation applies at the national level, impacts differ across firms reflecting differences in the extent and nature of taxable deductions (losses, depreciation), asset and ownership structures, and financing methods. As a result, after-tax costs of capital and effective tax rates depend on firms' asset composition, the nature of investment financing (e.g. debt versus equity) and characteristics of the marginal investor (e.g. foreign versus domestic; corporate versus personal).

These differences are of direct interest to policymakers, as the identification of potential tax distortions and appropriate tax policy settings relies on accurate information on the effective tax rates that firms face. For example, do 'successful' and 'failing' firms face similar tax treatment? Are the effective marginal tax rates (EMTRs) faced by foreign-owned firms systematically higher or lower than their domestic counterparts? In addition, differences in EMTRs across firms and over time provide an opportunity to investigate the impact of corporate tax policy on firm behaviour.

This paper uses data from the Longitudinal Business Database (LBD) to estimate firm-specific user costs of capital (UCCs) and associated EMTRs. The user cost of capital refers to the before-tax rate of return on a dollar of investment that must be earned if the after-tax rate of return is equated to the potential earnings from an alternative asset. The EMTR can be defined as the (hypothetical) tax rate which, if applied to the pre-tax rate of return on the marginal investment, would yield the net-of-tax rate of return.

Following Devereux and Griffith (2003), we construct a forward-looking measure of user costs, which captures the effective tax burden of a hypothetical investment project. This approach assumes that firms' future investment projects and financing options are structured in the same way as their existing investments. While this is a strong assumption, forward-looking measures are preferred to backward-looking measures (which can be constructed using data on firms' profit tax payments and operating profits) as past tax liabilities are likely to be affected by the firms' tax planning activities and thus prone to endogeneity. Moreover, forward-looking measures are particularly helpful when assessing the potential consequences of tax reforms.

We examine the distribution of UCCs and EMTRs across firms by taking account of their characteristics: foreign or domestic ownership; asset structures; and debt/equity financing. We also examine changes in this distribution over time, particularly in relation to two reviews of corporate taxation parameters – the increase in fiscal depreciation allowances for most asset types in April 2005, and reductions to the company tax rate and top marginal tax rate and removal of 20% depreciation loading across all asset types which took place over the 2010/11 and 2011/12 financial years. In addition, as New Zealand's imputation system requires that UCC and EMTR measures take account of taxation at the shareholder level, we produce UCCs and EMTRs under both corporate and shareholder-level taxation to examine how the imputation system affects the distribution of capital costs for New Zealand firms.

These comparisons show systematic changes in the UCC and EMTRs between 2000/01 and 2011/12 due to changes in the tax treatment of corporate profits. While the combined changes in the corporate tax rate and depreciation allowances made in 2010/11 and 2011/12 increased the estimated cost of capital for almost all firms, the 2005/06 changes

had a much more heterogeneous impact, increasing UCCs for many firms while decreasing them on average.

Observed differences in the distribution of UCCs for foreign- and domestically-owned firms relate to both the imputation system and differences in financing. Under shareholder-level taxation, variation in the debt/equity financing decision becomes irrelevant for domestic firms. The imputation system therefore has the effect of reducing variation in UCCs among domestic firms, and (under current tax parameters) reducing the average UCC compared to foreign-owned firms, relative to corporate-level taxation.

However, when all firms are assumed to face the same corporate taxation treatment, foreign-owned firms experience a lower cost of capital than domestic firms on average. This occurs because foreign-owned firms are more likely to be primarily debt-financed, reducing the required rate of return due to tax relief on both the real and inflationary components of nominal interest payments.

Finally, we find that the New Zealand system of corporate and personal taxes has a modest impact on the pre-tax rate of return required to achieve a given post-tax return since, on average, EMTRs appear to be only modestly higher than the statutory corporate and top marginal personal tax rates.

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Estimating Firm-Level Effective Marginal Tax Rates and the User Cost of Capital in New Zealand

1 Introduction

The impact of corporate profit taxation on firms' costs, and the consequent effects on their investment decisions have long been a focus of attention. The framework commonly used to examine the impact of capital taxation at the firm level is the user cost of capital concept or effective capital tax rates (see Hall and Jorgensen, 1967; Auerbach, 1979, 1983; King and Fullerton, 1984).[1] In the absence of firm-specific data, however, many empirical studies have examined differences for 'average' firms across industries or changes in effective corporate tax rates over time at the country or industry level (see CBO, 1985; Devereux et al, 2002; Devereux, 2007; Gilchrist and Kakrajsek, 2007, and studies referenced therein).

Recent evidence on the heterogeneity of productivity levels across firms, even within quite narrowly defined industries, has highlighted the importance of firm-level factors in determining costs and revenues (Syverson, 2011). Typical corporate tax regimes, in addition to various parameters that are common across all or most firms (e.g. statutory tax rates, minimum profit thresholds), also contain features that vary substantially across firms. Thus, for example, loss-use rules, depreciation allowances and interest deductibility generally imply different firm-specific post-tax capital costs, even if pre-tax capital costs are similar. As Egger and Loretz (2010) note: 'effective tax rates are determined non-linearly by key parameters, some of which are specific to the firm, others specific to an industry, and yet others are country specific' (p.1024).

This paper reports on firm-specific estimates of the user cost of capital (UCC) and associated effective marginal tax rates (EMTRs) of corporate income tax for New Zealand firms using data from the Longitudinal Business Database (LBD) over 11 financial years, from 1999/00 to 2009/10.[2] We construct UCC and EMTR measures for New Zealand for a set of parameters assumed common across firms (e.g. inflation rates and discount rates), and a set of firm-specific parameters (composition of assets, equity/debt financing, foreign/domestic

[1] See Gravelle (1982) and CBO (1985) for excellent summaries of the early conceptual and applied literature and Auerbach (2002) and Bond and Van Reenen (2007) for later reviews.

[2] Annual data in the LBD is recorded on the basis of firms' financial years. Around 80% of all employing firms observe a financial year from 1 April to 31 March, consistent with the standard tax year. Throughout the analysis we treat all firms as observing a March financial year, aligning firms with other balance dates to the March year with the greatest overlap with their own financial year, as per LBD convention.

ownership). This yields firm-specific UCCs and EMTRs for a given marginal investment by each firm.

Following Devereux and Griffith (2003), we construct a forward-looking measure of user costs, which captures the effective tax burden of a hypothetical investment project. This approach assumes that firms' future investment projects and financing options are structured in the same way as their existing investments. While this is a strong assumption, forward-looking measures may be preferred to backward-looking measures (which can be constructed using data on firms' profit tax payments and operating profits)[3] as past tax liabilities are likely to be affected by the firms' tax planning activities, investment choices and outcomes, as well as ex ante tax rates and are thus prone to endogeneity. Moreover, forward-looking measures are particularly helpful when assessing the potential consequences of tax reforms, since they are unaffected by any responses to those reforms.[4]

Unlike previous estimates for other countries, which generally ignore shareholder-level taxation and focus only on the corporate tax regime, New Zealand's imputation system requires that UCC and EMTR measures take account of taxation at the shareholder level. By producing UCC and EMTR measures both including and excluding shareholder level taxation, we can examine how the shareholder imputation system affects capital costs for New Zealand firms.

The motivation for our examination is three-fold. Firstly, the identification of potential tax distortions, and appropriate tax policy settings for New Zealand firms, requires accurate information on the effective tax rates they face. For example, do 'successful' and 'failing' firms face similar tax treatment? Are the EMTRs faced by foreign-owned firms systematically higher or lower than their domestic counterparts?

Secondly, evidence from other countries (see, for example, Bond and Xing, 2010; Egger et al, 2009) suggests that investment choices may be quite sensitive to UCCs and/or EMTRs. Our estimates provide the necessary inputs into any investigation of this issue for New Zealand.

Thirdly, a great deal of interest in the performance of New Zealand firms centres around the relationship between firm size, investment and innovation decisions, and exporting success. Testing for relationships among those variables is hampered, however, by the potential endogeneity among them (see, for example, Fabling and Sanderson, 2013). That is, it can be difficult to separately identify when/whether greater investment is a response to exporting or a cause of export success. Since the UCC might reasonably be hypothesised to directly affect investment, but not exporting performance, this suggests that exogenous changes in the UCC may provide a convenient instrument when testing for causal firm-level relationships between investment and export behaviour. The development of firm-specific user cost measures, therefore, is a first step towards understanding impacts of tax reform on firm performance and behaviour.

This paper examines the distribution of UCCs and EMTRs among New Zealand firms, addressing the following questions:

1. To what extent do UCCs and EMTRs differ across firms and industries?

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[3] On the use of micro-data to construct backward-looking effective profit tax rates using firms' profit tax payments and operating profits, see Kemsley (1998) and Desai et al. (2004).

[4] For more on the comparison between backward- and forward-looking marginal tax rates, see Sørensen (2004).

2. How have tax reforms such as changes in statutory corporate and personal income tax rates and depreciation allowances affected these measures?

3. Does foreign versus domestic ownership of firms make a difference?

4. How important is shareholder-level taxation for UCC and EMTR estimates?

The remainder of the paper is organised as follows. Section 2 outlines the UCC and EMTR measures as applied in New Zealand's imputation system of corporate taxation, and shows how the 'tax component' of the UCC measure is related to the conventional EMTR. Section 3 describes the LBD and provides sample statistics. Section 4 describes and discusses the UCC and EMTR measures over the period, considering both inter-firm and inter-industry heterogeneity. Section 5 examines the impact of corporate tax reforms in 2005/06, 2010/11 and 2011/12. Section 6 concludes.

2 Approaches to User Cost and EMTR measurement

2.1 User Cost measures

The user cost of capital framework has become a standard tool to investigate the effective tax burden on a marginal investment. There are numerous variants of the user cost definition in the literature, depending on the circumstances of its application, such as the relevance of different financing methods, different tax rates on alternative forms of investment, presence of capital gains, etc. Here we broadly follow the definitions and nomenclature of Benge (1997, 1998) who developed the UCC concept for a corporate tax regime with imputation (in Australia) similar to that in New Zealand. For more detailed expositions of the relevant theory see Auerbach (1983), Benge (1997, 1998), Devereux and Griffith (2003) and Egger et al. (2009).

Consider a capital investment of \$1. The real user cost of capital, C, measures the cost of employing (or 'real rental cost' of) that \$1 of investment for one year. In equilibrium, where there are no further arbitrage opportunities, this is equal to the competitive real return on \$1 of investment available in the market, r, plus any depreciation at rate δ per period, less any real capital gain given by $\theta - \pi$, where θ is the nominal capital gain and π is the inflation rate (of the general price level) over the period. Thus, in the presence of inflation but *in the absence of taxation*:

$$C = r + \delta - (\theta - \pi) \tag{1}$$

To simplify the exposition below, we assume that there are no real capital gains, $\theta = \pi$; hence the real user cost is simply the real market rate of interest plus depreciation.

Now, in the presence of taxation, the user cost of capital is defined as the *before-tax* rate of return on \$1 of investment, C, that must be earned if the *after-tax* rate of return is equated to that which could be earned from investment in an alternative asset. In equilibrium this is equal to the sum of the *net-of-tax* rate of return, r^*, taxes and depreciation.

Taxation affects the real user cost in three ways: (i) by causing the pre- and post-tax real rates of returns, r and r^*, to differ; (ii) by the taxation of *nomina*l interest income, i, which

taxes both the real and inflationary components of interest; and (iii) by the *fiscal depreciation rules* that affect the after-tax value of depreciation.

In addition, the applicable tax rates typically depend on the identity of the marginal investor; in particular whether that is a personal taxpayer subject to the domestic tax regime (personal or corporate), or a foreigner, and the method of financing adopted to fund the investment. Investment financing is generally subject to different tax rules depending on whether debt or equity is used. Interest on debt financing is generally tax deductable at the corporate level, with the corresponding interest income subject to tax by domestically-resident recipients. Equity financing, on the other hand, is typically not eligible for a tax deduction, but dividend income faces some form of taxation at the personal level.

Unlike most other OECD countries, New Zealand's imputation system means that, in principle, the corporate tax is merely a withholding tax for domestic resident personal taxpayers, with personal tax rates representing 'final' tax rates on investment and tax credits for corporate-level tax paid being deductible from personal tax liabilities of residents. In practice there can be a number of reasons why this may not hold exactly, so that the present value of each $1 of tax paid by the investor at the corporate and personal levels differ (e.g. deferral of tax credits or dividend taxation, avoidance of personal tax rates via trusts, etc).

Most analyses of user cost in other OECD countries have ignored shareholder (personal) level taxation, in part due to the difficulties of identifying the marginal investor and because, without imputation in those countries, corporate-level taxation can more readily be analysed independently of personal taxation.

Ignoring personal (shareholder) taxation for the moment, but allowing for corporate taxation, equation (1) can be rewritten to give the standard Hall-Jorgensen (1967) formula for the real user cost of capital, C, as:[5]

$$C = \frac{\{1-\tau(Z+k)\}(r^*+\delta)}{1-\tau} \qquad (2)$$

where:

τ = statutory corporate tax rate

Z = present value of depreciation allowances (discounted at the nominal interest rate, i^*)

k = tax allowance value of any investment tax credits available (captured by 'depreciation loadings' in New Zealand)[6]

δ = rate of economic depreciation (asset-value-weighted average based on the depreciation rates applicable to each of the firm's asset classes)

r^* = real cost of funds, equal to the required after-tax rate of return.[7]

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[5] This is the standard Hall-Jorgensen formula in which the price of capital goods does not appear, due to the assumption of 'static expectations of the price of capital goods' (p.393), and equivalent to $\theta = \pi$ in (1).

[6] In the New Zealand case, depreciation loadings are expressed as a percentage so that Z and k in (2) would be expressed as a percentage of Z, rather than $Z + k$.

[7] Where interest deductibility leads to the taxation of funds differing by debt and equity sources, this cost of funds will be a value-weighted average of debt and equity financing.

Equation (2) can be thought of as defining a gross-of-depreciation real user cost or real pre-tax return on capital, since it is defined as ($r^* + \delta$), adjusted for taxes. The term $\{1-\tau(Z+k)\}/(1-\tau)$ is sometimes described as the 'tax component' of the user cost. Dividing by $(1 - \tau)$ yields the pre-tax user cost on the right-hand side, and $\{1-\tau(Z+k)\}$ captures the combined effect of tax depreciation-related deductions to reduce the required real gross-of-depreciation return, ($r^* + \delta$). This only captures the full effect of the tax regime on the user cost, however, where r* = r; that is, where the real pre-tax, and after-tax, returns are equal, as they are in the New Zealand case only when foreign equity is the marginal source of investment finance (see below).

The present value of depreciation deduction allowances, Z, is given by the discounted value of the future stream of depreciation deductions which, as Benge (1998) and others have shown, is given by:

$$Z = \frac{\delta'}{1+i^*}\left(1+\frac{1-\delta'}{1+i^*}+\left(\frac{1-\delta'}{1+i^*}\right)^2+\ ...\right)=\frac{\delta'}{i^*+\delta'} \tag{3}$$

Where δ' is the (asset specific) rate of *fiscal* depreciation and i^* is the nominal discount rate. Note that $Z + k = 0$ implies a zero impact of fiscal depreciation deductions on the user cost, and tax effects operate simply via the statutory corporate tax rate, τ, in the denominator of (2).

In the presence of inflation, and because nominal rather than real interest income is taxed (and tax deductible), the relationship between nominal and real after-tax interest rates is important for the user cost in (2). Using the conventional definition of the nominal interest rate as:

$$i^* = r^*(1+\pi)+\pi \tag{4}$$

where i^* is the after-tax nominal interest rate, it follows that $r^* = (i^* - \pi)/(1 + \pi)$ which, when substituted into (2), reveals that taxation of the required after-tax real rate of return is affected by taxation of both the nominal interest rate component, i, and of the inflation rate component, π.

Equation (2) can be thought of as a 'gross-of-depreciation' rental price of capital. Where decisions relate to gross investment this may be the most relevant capital price expected to affect that decision. However, many investment decisions are likely to concern *net* investment. In this case, the relevant (net-of-depreciation) real user cost is simply obtained from (2) by subtracting δ, hence:

$$C_{net} = \frac{\{1-\tau(Z+k)\}(r^*+\delta)}{1-\tau}-\delta \tag{5}$$

From (5), in the absence of taxation, this 'net' user cost of capital reduces simply to $C_{net} = r^*$.

As noted above, the relevant real cost of funds, r^*, in (2) or (5), for a particular investment will depend on the source of those funds and the tax rate applicable to the marginal investor. For New Zealand, we distinguish between debt and equity sources of funds, and whether the marginal investor is a foreign or domestic resident.

For foreign-sourced equity funds, this investor is not generally subject to New Zealand taxation on the equity return, hence we may set:

$$r^* = r_E \tag{6}$$

where r_E = real return on equity demanded by the investor (and available elsewhere).

Foreign-sourced debt finance is assumed to be available at a world interest rate, $r_w = r$. However, since *nominal* interest expenses are tax deductible under the corporate tax code, the required rate of return, r^*, when financed by foreign debt is *lower* than r, due to tax relief on both the real and inflationary components of nominal interest.

This can be seen by re-writing equation (4) as:

$$r^* = \{i(1-\tau) - \pi\} / (1+\pi) \tag{7}$$

where $i^* = i(1 - \tau)$. Substituting for $i = r(1 + \pi) - \pi$ in (7), the after-tax real interest rate, r^* becomes in this case:

$$r^* = \left[r(1-\tau) - \frac{\tau\pi}{1+\pi} \right] \tag{8}$$

Thus, the required after-tax real return for foreign debt financing is lower due both to the tax relief on real interest expense, $r(1 - \tau)$, and to the tax relief on the inflationary component, given by $\tau\pi/(1 + \pi)$.

Where the marginal source of funds is a domestic New Zealand resident, the personal tax status of that investor becomes important. With an imputation system, and assuming all profits are distributed as dividends to shareholders (with the associated imputation credits), the corporate tax rate is merely a withholding rate, as noted above. The final rate is the marginal investor's effective marginal tax rate on investment (capital) income, m. This applies whether the investment is funded via domestic debt or equity since, in equilibrium the opportunity cost of both should be equal. Hence for domestic debt/equity finance, taking account of personal level taxation:

$$r^* = \left[r(1-m) - \frac{m\pi}{1+\pi} \right] \tag{9}$$

the user cost expression in (5) becomes:

$$C_{net} = \frac{\{1 - m(Z+k)\}(r^* + \delta)}{1-m} - \delta \tag{10}$$

For a New Zealand resident shareholder a natural tax rate to use would be the top marginal rate (since shareholders tend to be on higher incomes). Of course, prior to April 2000 the top personal and corporate rates were equal, hence $m = \tau$, (with both debt and equity financed investment subject to taxation at the shareholder level). To the extent that domestic shareholders can avoid personal level taxation, a lower rate such as the corporate rate may be more applicable. Between April 2000 and March 2008, for example, the use of trusts or incorporation allowed some taxpayers' dividend income to be taxed at the corporate (trust) rate of 33%, rather than the top marginal rate of 39%.

Within the LBD, the identity of the marginal investor cannot be determined. However, as described further in section 3, we are able to distinguish predominantly foreign and domestically-owned firms. For the former, we treat the marginal investor as foreign and use the relative share of the firm's debt and equity financing to weight the user cost.

For domestic firms, uncertainty around the relevant marginal tax rate faced leads us to consider two alternative user cost measures. The first treats domestic firms as being exposed to the corporate taxation system in the same way as foreign firms and effectively treats the corporate-level user cost as the relevant cost measure for marginal investment decisions. The second measure treats the marginal investor as an individual facing the top marginal personal income tax rate (m), and treats debt and equity financing as equivalent for tax purposes. The relevant formulae in each case are given in table 1 below:

Table 1 – User Cost Measures for Different Sources of Finance

	Net UCC	**Gross UCC**
Foreign-sourced or corporate taxation:	$C_{net} = \frac{\{1-\tau(Z+k)\}(r^*+\delta)}{1-\tau} - \delta$ With debt financing: $r^* = \left[r(1-\tau) - \frac{\tau\pi}{1+\pi} \right]$	$C = \frac{\{1-\tau(Z+k)\}(r^*+\delta)}{1-\tau}$ With equity financing: $r^* = r_E$
Domestic shareholder-level taxation:	$C_{net} = \frac{\{(1-m(Z+k)\}(r^*+\delta)}{1-m} - \delta$ With debt or equity financing: where $r^* = \left[r(1-m) - \frac{m\pi}{1+\pi} \right]$	$C = \frac{\{(1-m(Z+k)\}(r^*+\delta)}{1-m}$

Whichever investor marginal tax rate is chosen, the complex non-linear interactions between tax rates, inflation rates and depreciation parameters in the (net) user cost of capital can be seen by substituting either (8) or (9) into (5). Based on corporate-only taxation and debt-financing, for example, this gives:

$$C_{net} = \frac{\{1-\tau(Z+k)\}[r(1-\tau)-\tau\pi'+\delta]}{(1-\tau)} - \delta \qquad (11)$$

where $\pi' = \pi/(1+\pi)$.[8] An equivalent expression defines C_{net} for domestic investors facing the top marginal rate by substituting m for τ in (11). Note that we are not assuming that domestically-owned firms are necessarily funded from domestic sources. Rather, whatever the origin of the investment finance, the tax rate applicable to a domestic resident is m, due to the assumed residence for tax purposes of this marginal shareholder.

Given assumptions regarding the identity of the marginal investor, UCCs will differ across firms due to differences in the extent of debt or equity finance in the case of foreign-sourced or corporate-level funding. In particular, we assume that firms fund each dollar of new

[8] This can be shown to be equivalent to equation (17) in Benge (1998, p.11) in the case of no capital gains taxation.

investment using the two financing sources in the same proportions as their current capital stock. The overall UCC for the firm is therefore a weighted average of the UCC expressions in table 1 based on debt and equity, where the weights are the shares of debt and equity in total financing.

Firm-level differences in UCCs also arise from differences in asset composition, which determine firm-specific values of Z, k and δ. For example, firms and industries where long-lived assets predominate will tend to have smaller values of δ and hence Z. As with financing, we assume that new investment has the same composition as the current asset structure. Firm-level UCCs are estimated by calculating asset-specific UCCs and aggregating to the firm level by weighting according to the current asset structure.

In addition, to the extent that differences in fiscal depreciation rates, δ', differ from economic depreciation rates, δ, this will generate further differences in Z across firms via asset composition. In general, (declining balance) fiscal depreciation rates, excluding loadings, have been set in New Zealand with the aim of mimicking economic depreciation. However, changes to fiscal depreciation rates in April 2005 appear to have been motivated by a recognition that fiscal depreciation had become out of line somewhat with 'true' economic depreciation. In order to examine possible responses to the fiscal depreciation changes, we assume that true economic depreciation remained constant throughout the analysis period, adopting the post-2005 rates (excluding loading) as the benchmark economic depreciation rates.

2.2 Effective Marginal Tax Rates

Effective tax rates on each marginal dollar of investment can be derived from the UCC measures. There are a number of different ways of defining the EMTR in the literature. The most common is the (hypothetical) tax rate which, if applied to the gross-of-tax rate of return on the marginal investment, would yield the net-of-tax rate of return.

Thus the EMTR is defined as the difference between the gross-of-tax return, r, and net-of-tax return, r^*, expressed as a proportion of the former:

$$EMTR = \frac{r - r^*}{r} \tag{12}$$

where r is the real pre-tax rate of return and r^* is the real after-tax rate of return.[9] This way of expressing the EMTR on an input (in this case, capital) is analogous to the marginal tax rate on output (such as GST) expressed as a *tax-exclusive* percentage rate (e.g. 15% of the tax-exclusive, or pre-tax, price).

However, just as GST can be expressed as a *tax-inclusive* rate (e.g. 13% of the tax-inclusive price, = 0.15/1.15) the EMTR on capital can also be expressed this way; hence:

$$EMTR = \frac{r - r^*}{r^*} \tag{13}$$

[9] Sørensen (2004) shows that the effective *average* rate of tax, EATR, on a firm's total investment is a weighted average of the EMTR and the statutory tax rate, with weights determined by the ratio of the net user cost of capital, C_{net}, to the pre-tax rate of return, r^*.

In the case of the EMTR on capital the choice between using (12) and (13) is not innocuous, since both r and r^* vary non-linearly with the finance and asset structures. As a result EMTRs expressed using (12) or (13) can look quite different and, importantly, the rank-ordering at the firm level can differ depending on tax and financing parameters.[10] We focus on the more common definition in equation (12), noting some differences in conclusions resulting from using equation (13).

In equilibrium, where all arbitrage opportunities have been exhausted, the pre-tax rate of return that delivers a post-tax return of r^* is simply C_{net}, so that, using (5), the EMTR can be rewritten as:

$$EMTR = \frac{(C_{net} - r^*)}{C_{net}} = 1 - \frac{(1-\tau)r^*}{\{1-\tau(Z+k)\}(r^*+\delta) - (1-\tau)\delta} \tag{14}$$

It can be seen from (14) that, if fiscal depreciation takes the form of immediate expensing (such that $k = 1$; $Z = 0$), then the EMTR = 0. That is, since capital costs are fully and immediately offset against tax, the effective tax rate is zero despite a statutory profit tax rate of τ. Alternatively, if fiscal depreciation is set equal to economic depreciation (and there is no inflation), the user cost in (5) becomes simply $C_{net} = r^*/(1-\tau)$ and the EMTR equals the statutory rate, τ.[11]

In addition, from (12) and (14), it can be shown that the tax component of the UCC, given by $T = \{1- \tau (Z + k)\} / (1 - \tau)$, is closely related to the EMTR. Representing this tax component by T, the net user cost from (5) becomes: $C_{net} = T (r^* + \delta) - \delta$, and substituting into (14) then gives:

$$EMTR = \frac{T-1}{T - \left(\frac{\delta}{(r^* + \delta)}\right)} \tag{15}$$

3 Data and Estimation

3.1 Estimating User Cost Measures from LBD Data

Estimation of forward-looking user cost measures requires decisions over which variables to treat as common across all firms and which to treat as firm-specific. The greater the firm-level detail of each variable, the greater potential heterogeneity it is possible to identify (potentially allowing more firm-specific effects on investment behaviour to be identified). However this also increases the risk that firm-specific values reflect endogenously determined firm-level elements, rather than being exogenously given. For example, firms may face different borrowing rates of interest reflecting differences in their perceived credit worthiness or more general investment risk. This in turn may be correlated with firm-specific

[10] As with the choice between using tax-inclusive or tax-exclusive prices, the choice of EMTR measure will depend on the question being addressed. On the alternative definitions of the EMTR see McKenzie et al. (1998), McKenzie et al. (1997), McKenzie and Mintz (1992).

[11] This result holds if inflation is zero or economic depreciation is zero, but not if both are non-zero. The result may be derived from (5) by setting $k = 0$, and $Z = \delta/(i^* + \delta)$, where $i^* = r^*$ when $\pi = 0$.

borrowing history and capital costs. Hence an exogenously set interest rate can serve to minimise this simultaneity but at the cost of some loss of precision in UCC estimates – some of which *may* be exogenous.

We follow Egger et al (2010) and others and assume the following parameter values are common across firms and years: an inflation rate, $\pi = 2\%$; a return on equity, $r_E = 5\%$; and world interest rate, $r = 5\%$. All other variables reflect observed differences across firms in asset composition, ownership, and finance structure. Firm-level information is sourced from Statistics New Zealand's Longitudinal Business Database (LBD), which draws together a range of administrative and survey data on New Zealand firms.[12]

Asset composition and debt/equity ratios are derived from Annual Enterprise Survey (AES) and Inland Revenue IR10 Accounts Information data, available for financial years ending March 2000 to March 2010. We aggregate assets into seven classes, with fiscal (declining balance) depreciation rates as shown in table 2. Economic depreciation is assumed constant at the post-2005 rates shown in the table excluding loading.

Table 2 – Asset Classes and Fiscal Depreciation Rates

Asset	**2000/01 – 2004/05**		**2005/06 – 2009/10***	
	Declining value	With loading (20%)	Declining value	With loading (20%)
Land	0.000	0.000	0.000	0.000
Buildings	0.040	0.040**	0.030	0.030**
Furniture and fittings	0.150	0.180	0.160	0.192
Plant, machinery & equipment and other fixed assets (PME)	0.220	0.264	0.250	0.300
Computer hardware/software	0.400	0.480	0.500	0.600
Motor vehicles	0.220	0.264	0.250	0.300
Intangibles	0.200	0.240	0.200	0.240

* Depreciation rates in the 2010/11 tax year are as in 2009/10 except for the removal of all loadings for assets purchased after 20 May 2010. In the 2011/12 year, depreciation on buildings was reduced to 0%. Depreciation rate changes in 2005 took effect for assets purchased on or after 1 April 2005, with the exception of buildings for which the change took effect on 19 May 2005. Throughout the analysis, we treat all depreciation rates as applying throughout the 1 April to 31 March tax year. **Buildings not eligible for loading. These representative rates are chosen by picking a benchmark asset from within the asset class (eg, the motor vehicles asset type is represented by the 'general lorry' asset).

Foreign ownership is derived from the Longitudinal Business Frame (LBF) and IR4 Company Account tax returns. Firms are classified as foreign owned if (a) they are recorded as having 50% or more foreign ownership in the LBF, or (b) they indicate being "controlled or owned by non-residents" in the IR4.[13]

[12] See Fabling (2009) for further information on the LBD.

[13] The source and derivation of firm-level variables are summarized in Appendix 1.

We restrict the population to firms with positive labour input (either working proprietors or employees) and total assets, in industries that are part of the AES survey population,[14] resulting in an analysis population of 166,527 firms in the year to March 2000, rising to 185,649 in 2010.[15] Most results are presented solely for the latest year (2010/11), or for a subset of representative years (2000/01, 2005/06, 2010/11) where changes over time are of potential interest.

In order to reflect the role of tax changes on investment decisions, forward-looking user costs for each year are calculated using the *anticipated* tax treatment in that year. Thus, reported UCCs for 2010/11 reflect firm characteristics at the end of the 2009/10 financial year (31 March 2010) but incorporate the change in corporate tax rates and depreciation allowances which applied from 1 April 2010 (the 2010/11 tax year). In section 4 we also consider a series of counterfactual examples, in which pre- and post-change tax treatments are applied based on the characteristics of firms in the pre-tax change year.

3.2 Descriptive Statistics

Given the nature of the UCC calculation, estimates can be thought of as containing firm-specific, industry-specific and time-specific components. Statutory tax rates, for example, are time-specific only, applying equally across all firms. Technologies specific to industries generate asset structures that reflect those industrial technologies, as well as firm-specific dimensions (related, in part, to the breadth of industry definitions within our data). Similarly, foreign/domestic ownership is likely to vary by industry for both industry-specific and firm-specific reasons; for example where industry-specific economies of scale or access to foreign technology or international finance provide incentives for ownership by foreign multinationals. We first present statistics showing the wide variation present in the parameters that affect estimates of the forward-looking UCC, before considering their combined influence on the UCC calculation.

Table 3 reports the numbers of firms in 2009/10 by industry[16] and foreign/domestic ownership. Four industries dominate the unweighted sample – Property & Business Services; Construction; Retail Trade; and Manufacturing (from largest to smallest), together accounting for more than 120,000 firms. Foreign ownership rates vary substantially across industries, from less that 0.5 percent in Services to Agriculture/Fishing and Personal/Other Services, to 15.5 percent in Mining. Across all industries, foreign firms make up only 1.5 percent of the population, but account for a much greater proportion of total assets.

Figure 1 shows the average firm-level asset composition in 2009/10 across the seven asset categories (land; buildings; furniture & fittings; plant, machinery, equipment & other fixed assets (PME); computer hardware & software; vehicles; and intangibles) for each industry. The overall sample averages are shown in the extreme right-hand bar. In terms of depreciation rates – the aspect which impacts on UCC calculations – the seven asset types can essentially be grouped into 'low' ($\delta' \approx$ 0-4%: land, buildings) and 'high' ($\delta' \approx$ 40-50%: computer hardware/software); with the remainder in a 'medium' group ($\delta' \approx$ 15-25%: furniture & fittings, PME, vehicles, intangibles).

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[14] Five two-digit industries are excluded: Agriculture (A01); Forestry and Logging (A03); Government administration and defence (M81 & M82); and Private households employing staff (Q97).

[15] All firm counts have been random rounded base 3 in accordance with Statistics New Zealand confidentiality protocols.

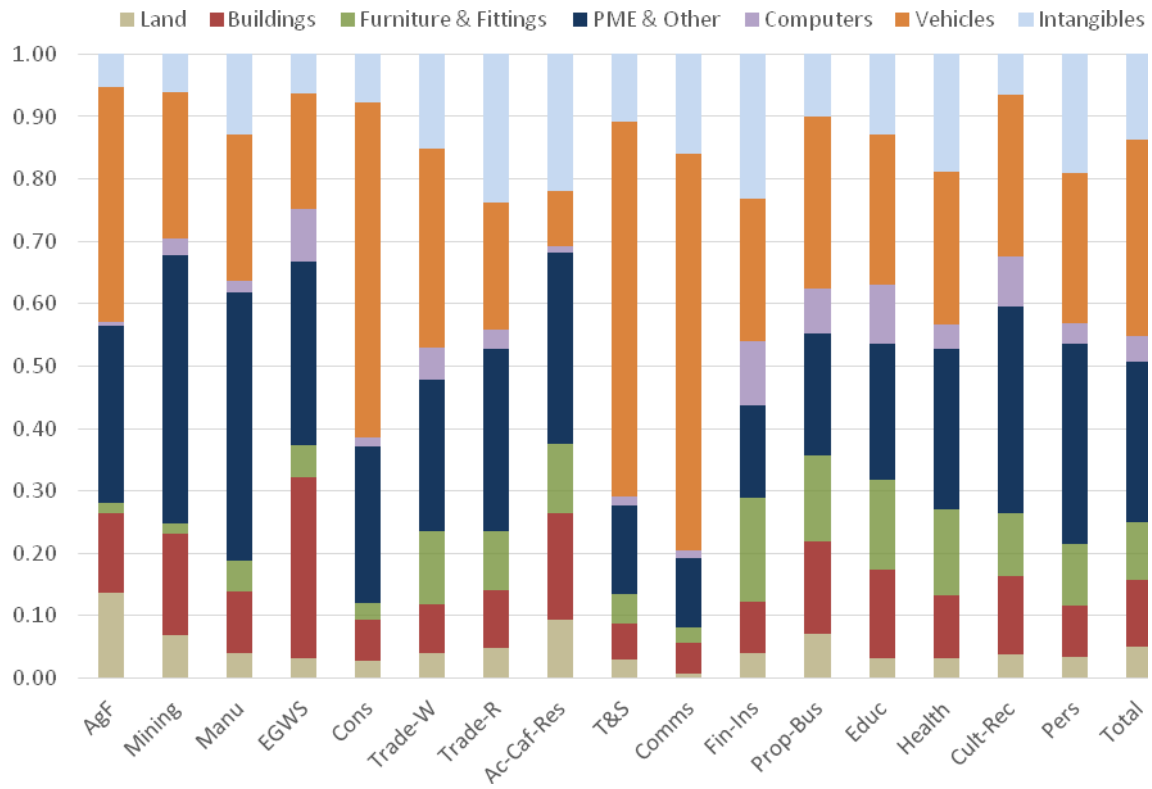
[16] Following the Australian and New Zealand Standard Industrial Classification 1996 (ANZSIC96).

Table 3 – Industry and Ownership, 2009/10 financial year

Industry	N(firms)	% foreign (firms)	% foreign (assets)
Services to Agriculture, and Fishing* (AgF)	5,628	0.2	0.6
Mining (Mining)	252	15.5	56.4
Manufacturing (Manu)	15,519	2.9	47.8
Electricity, Gas & Water Supply (EGWS)	99	**	**
Construction (Cons)	31,347	0.2	11.9
Wholesale Trade (Trade-W)	9,765	7.7	50.6
Retail Trade (Trade-R)	26,262	0.6	22.1
Accommodation, Cafes & Restaurants (Ac-Caf-Res)	8,682	1.3	24.7
Transport & Storage (T&S)	7,884	2.1	2.5
Communication Services (Comms)	2,106	0.9	**
Finance & Insurance (Fin-Ins)	3,432	5.2	76.0
Property & Business Services (Prop-Bus)	48,594	1.3	13.4
Education (Educ)	2,055	1.6	6.0
Health & Community Services (Health)	10,539	0.7	11.9
Cultural & Recreational Services (Cult-Rec)	5,454	1.0	11.0
Personal & Other Services (Pers)	8,031	0.4	**
Total	185,649	1.5	25.3

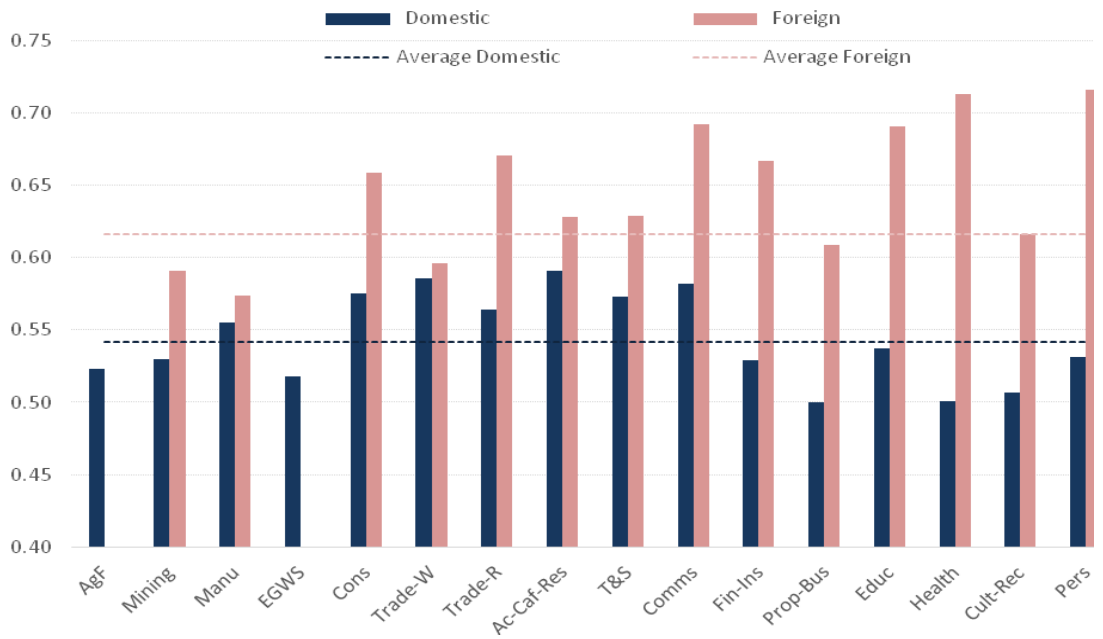
Column 3 reports the share of assets (book value of total fixed assets plus intangibles) accounted for by foreign owned firms. All firm counts have been random rounded base 3. * Excludes: Agriculture; Forestry and Logging. ** Foreign ownership percentages suppressed for these industries in accordance with Statistics New Zealand confidentiality protocols.

Figure 1 – Asset Composition by Industry, 2009/10 financial year



Asset shares averaged across firms.

Figure 2 – Debt-to-asset Ratio by Industry and Ownership, 2009/10 financial year



Debt-to-asset ratios for foreign-owned firms in Agriculture/Fishing and EGWS are suppressed under Statistics New Zealand confidentiality protocols. The average for foreign-owned firms includes suppressed values.

Buildings and land ownership varies considerably across industries, from a low of around 6% of total assets on average in Communications firms to a high of over 30% in the Electricity, Gas and Water Supply (EGWS) industry. Unsurprisingly, Agriculture/Fishing, Mining, Accommodation/Cafes/Restaurants, and Property/Business Services are also high at around 25%. Computer-related asset shares, though variable across industries, are a small share of total assets, only reaching around 10% in Education and Finance/Insurance. Vehicles, PME, and Intangibles, on the other hand, form substantial asset shares in most industries but are also highly variable. PME dominates in Mining and Manufacturing, while vehicles take an especially large share in Transport/Storage and Communications.[17] Intangibles generally vary around 5-15% (average = 12% across all firms) but exceed 20% in Retail Trade, Accommodation/Cafes/Restaurants, and Finance/Insurance.

Finance can be sourced through either debt or equity.[18] Figure 2 and appendix tables A1.1 & A1.2 show the variation in debt financing across industries, reporting average debt-to-asset ratios separately for foreign and domestically-owned firms. Arguably the ratio is of less importance for domestic firms if, as shareholder-level taxation measures assume, both debt and equity held by a domestic tax resident face the same statutory tax rates.

On average, foreign firms have higher debt-to-asset ratios at 0.62 compared to 0.54 for domestic firms (figure 2). With variances of 0.10 and 0.14 respectively, these economy-wide differences are statistically significant (*t*-ratio = 10.3); see Appendix table A1.1. This might be expected for two reasons. First, foreign firms may have access to a wider range of, and lower cost, debt options. In addition, with imputation credits available only to domestic resident shareholders, domestic firms have a greater incentive than foreign firms to use equity funding.[19]

Across industries, foreign firms' debt ratios are especially high, both absolutely and relative to domestic firms, in Construction, Retail Trade, and most of the remaining service industries (Finance/Insurance, Education, Health/Community Services, and Personal/Other Services). In Manufacturing, foreign and domestic debt ratios are very similar.

Within industries, the variances of debt-asset ratios can also be high. In 2010 these within-industry variances for foreign firms lay between a low of $(0.262)^2 = 0.07$ for Communications (which has less than 20 foreign firms, with a mean debt-asset ratio = 0.69) and 0.13 for foreign Retail Trade firms (mean debt-asset ratio = 0.67) (Appendix table A1.1). Over the 11 year period (2000-10), average debt-asset ratios appear to have fallen slightly for foreign firms, from 0.64 to 0.62, and risen slightly for domestic firms, from 0.52 to 0.54 (Appendix table A1.1 & A1.2).

[17] Under ANZSIC96 communications includes postal and courier services.

[18] Retained earnings are included within total equity.

[19] Benge (1997, 1998) discusses the optimal financing choices facing different firms in the presence of imputation credits.

3.3 User Cost and Effective Marginal Tax Rate Results

Before considering results based on firm-specific asset composition and debt-equity combinations, it is useful to consider the UCCs and EMTRs for a benchmark marginal investment in each asset class using the assumed inflation rates, interest rates, and year-specific statutory tax rates and depreciation allowances.

UCCs and EMTRs for each asset type

As noted earlier, the choice of marginal tax rate to use for a New Zealand resident investor is not clear-cut. A common treatment is to use the top personal marginal rate, since this rate is thought to be the relevant rate for the majority of investors. However, when the top marginal rate was raised in New Zealand from 33% to 39% in April 2000, the subsequent increased use of trusts and other savings vehicles allowed income to continue to be taxed at no more than 33%. In addition, the corporate rate was reduced from 33% to 30% in April 2008, increasing the incentive for the self-employed to incorporate.

As a result of increased use of trusts, incorporation by taxpayers and greater incentives for income to be earned jointly with (or allocated to) lower income taxpayers, the final tax rate applicable to New Zealand resident investors is less clear. For this reason we explore two alternative 'final' tax rates applicable at the personal level – the top personal marginal rate and the 33% (later 30%) corporate rate.[20]

Table 4 illustrates hypothetical UCCs and EMTRs for the 2010/11 tax regime (inflation rate: 2%; return on equity: 5%; world interest rate: 5%; $\tau = 0.30$; $m = 0.355$),[21] corresponding to the 2009/10 firm data. Fiscal depreciation rates are from table 2 (without loading), and economic depreciation is assumed equal to the 2010/11 fiscal rates (without loading). Both EMTRs and UCCs are shown as percentages. The former can be thought of as measuring the required rate of return (in percent per year), or the percentage rental cost per $1 ('cents per dollar') of investment.

Focusing first on the user costs, row 1 shows that, for a 100% debt-financed project in a foreign firm, the net UCC for each asset type ranges from 4.2 to 5.0 percent. Foreign equity financing generates a pronounced increase in the UCC for all asset classes to over 7%. The higher UCCs are to be expected given the tax relief available for debt-financed investments. Domestic firms face similar UCCs to foreign debt-financed investments.

Table 4 shows two EMTR measures. The conventional definition in (12) is shown in the middle panel of the table. The bottom panel shows EMTRs calculated as a percentage of r_w. This latter measure is similar to (13) but uses a common value of $r^* = r_w$ in the denominator which provides a benchmark to facilitate comparisons across financing methods. The EMTRs in the bottom panel should therefore be interpreted as the tax impost on the cost of capital relative to the (5%) world interest rate, r_w, which is also the after-tax rate of return on equity, r_E, for foreign firms.

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[20] The corporate - and some savings vehicle - rates were cut further to 28% in April 2011, while the top personal rate fell to 38% in April 2009 and 33% in October 2010. These changes are summarised in table 7 in section 5, where we discuss the impacts of these tax reforms on firm-level user costs.

[21] As the fall in the top marginal tax rate occurred in October, we use a composite marginal tax rate of 35.5% for the 2010/11 year.

Table 4 – Hypothetical Net UCCs and EMTRs in 2010/11 by asset class

Net UCC	Land	Buildings	Furniture	PME	Computers	Vehicles	Intangibles
100% Debt (foreign)	4.2%	4.5%	4.8%	4.9%	5.0%	4.9%	4.9%
100% Equity (foreign)	7.1%	7.4%	7.8%	7.8%	7.9%	7.8%	7.8%
Debt-Equity (domestic)	3.9%	4.4%	4.8%	4.9%	5.0%	4.9%	4.8%

EMTR	Land	Buildings	Furniture	PME	Computers	Vehicles	Intangibles
100% Debt (foreign)	30.0%	35.2%	39.7%	40.5%	41.3%	40.5%	40.2%
100% Equity (foreign)	30.0%	32.5%	35.6%	36.3%	37.0%	36.3%	36.0%
Debt-Equity (domestic)	35.5%	42.1%	47.3%	48.1%	49.0%	48.1%	47.7%
EMTRs expressed as percentage of r_w or r_E (5%):							
EMTR	Land	Buildings	Furniture	PME	Computers	Vehicles	Intangibles
100% Debt (foreign)	25.0%	31.6%	38.4%	39.7%	41.0%	39.7%	39.1%
100% Equity (foreign)	42.9%	48.2%	55.3%	56.9%	58.6%	56.9%	56.1%
Debt-Equity (domestic)	27.8%	36.8%	45.4%	46.9%	48.5%	46.9%	46.2%

Statutory tax rates: $\tau = 0.30$; $m = 0.35.5$ (tax year ending 31 March 2011).

With a statutory 30% corporate tax rate and a top marginal tax rate of 35.5% in 2010/11, it can be seen from table 4 (middle panel) that, with the exception of investments in land, the EMTRs lie close to but above the statutory rate. Recall that, in the absence of inflation, when fiscal depreciation equals economic depreciation for a given asset, the EMTR equals the statutory rate. However, the 2% inflation assumed in table 4 tends to raise EMTRs because *nominal* returns are taxed while only *real* depreciation is deductable.[22] These results therefore imply that the net effect of the corporate and personal tax system via taxation of returns and allowances for depreciation is to raise effective tax rates relative to statutory rates.[23] Higher inflation – 2% is at the lower end of recent inflationary experience in New Zealand – raises EMTRs further above statutory rate.

From the middle panel of table 4 it can be seen that EMTRs are similar across asset types (excluding land and, to a lesser degree, buildings) at around 33-41% for foreign firms and around 42-49% for domestic firms. Land, which has a zero fiscal depreciation rate, faces an EMTR equal to the statutory tax rate (τ or m), while investments in other assets face EMTRs in excess of the relevant statutory rates.

Interestingly, despite foreign equity financing facing a higher UCC than foreign debt financing (top panel), the EMTRs are lower for equity financing. This reflects the fact that, despite the tax impost being greater for equity financing, as captured by positive values of $C_{net} - r$ (the numerator of the EMTR calculation), this is not sufficient to outweigh the higher value of C_{net} in the denominator of the EMTR when equity financing is used. The bottom panel of table 4 confirms this. When the common 5% rate (r_w) is used as the denominator, EMTRs are all lower when investment is foreign debt-financed, and higher when foreign equity-financed. The overall outcome is that equity-financed investments now appear to have higher EMTRs than their debt-financed counterparts.

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[22] Recall also that the net present value of depreciation allowances, Z, is obtained using the *nominal* discount rate, i^*.

[23] Though depreciation loading tends towards EMTRs *lower* than the statutory tax rate, the taxation of *nominal* returns (see section 2) has the opposite effect in the presence of inflation (assumed here at 2%). Recalculating table 4 with the inflation rate set to zero, EMTRs are equal to statutory rates (except for land and buildings as fiscal and economic depreciation rates are assumed identical in the 2010/11 tax year.

Table 4 reveals that long-lived assets tend to have lower UCCs and EMTRs than shorter-lived assets (compare buildings to vehicles to computers) reflecting both tax and non-tax effects. As can be seen from table 1, the gross user cost expression $C = \{1-\tau(Z+k)\}(r^*+\delta)/(1-\tau)$ can be decomposed into the previously discussed tax component, $\{1-\tau(Z+k)\}/(1-\tau)$, and a real (gross) rate of return term, $(r^*+\delta)$. This latter component is unaffected by tax when equity finance is used: $r^* = r_E$, where r_E is untaxed for a foreign marginal investor.

Short-lived assets have a higher non-tax component because they require a higher gross rate of return to cover their higher depreciation rate, δ. However, this also implies a higher value of Z which serves to reduce the user cost, exacerbated if fiscal depreciation exceeds economic depreciation via loadings. As table 4 shows, in this case the former effect dominates and the balance of these two effects is to increase the UCCs and EMTRs for short-lived, relative to long-lived, assets.

A further inference to be drawn from table 4 is that industry differences in asset composition, as determined, for example, by technology differences, are unlikely to have large impacts on firms' UCC estimates, since it would seem from these hypothetical asset-specific UCCs that there is little inter-asset variation. This inference is consistent with the firm-level estimates below.

4 Firm-Level Estimates of User Costs and EMTRs, 2000/01-2010/11

Using the LBD, table 5 shows the mean and standard deviation of the firm-level UCCs and EMTRs calculated using the alternative assumptions (as given in table 1) regarding gross/net user costs and financing options.

Table 5 – Sample Average UCCs and EMTRs

	C_{net}	C^S_{net}	EMTR	EMTR^S
2000/01	0.062 (0.012)	0.046 (0.003)	0.392 (0.03)	0.494 (0.036)
2005/06	0.061 (0.012)	0.044 (0.002)	0.379 (0.019)	0.481 (0.019)
2010/11	0.062 (0.011)	0.048 (0.003)	0.374 (0.024)	0.467 (0.028)
	C_{gross}	C^S_{gross}	Implied average $\delta(C_{gross}$ - $C_{net})$	
2000/01	0.261 (0.089)	0.245 (0.09)	0.199	
2005/06	0.269 (0.082)	0.252 (0.083)	0.208	
2010/11	0.27 (0.082)	0.256 (0.082)	0.209	

Standard deviations in parentheses. UCCs and EMTRs calculated using firm characteristics at the end of the preceding financial year. Eg, UCCs for 2010/11 based on firm characteristics at the end of the 2009/10 financial year.

Results reported use the following abbreviations: C_{net} and C_{gross} for the net and gross measures of user cost when no distinction is made between foreign and domestic firms (that is, all firms are taxed at the corporate rate – table 1, line 1). The alternative measures, with an 'S' superscript: C^S_{net} and C^S_{gross}, indicate that, for domestic firms, shareholder level taxation has been allowed for, based on the top personal tax rate (table 1, line 2). EMTRs based on these two versions of the UCC are also reported in table 5 (EMTR and EMTR^S). The top part of table 5 shows that the average net user cost across the sample varies

between 0.046 and 0.062 in 2000/01 (0.048-0.062 in 2010/11), depending on the 'shareholder taxation assumption'. This is a fairly narrow range, partly reflecting the closeness of top personal and corporate tax rates in New Zealand.

Effective marginal tax rates based on those UCC estimates range between 37% and 47% in 2010/11 (and somewhat higher in 2000/01 and 2005/06, reflecting the higher statutory rates in those years). The UCC results in table 5 are *lower* using the shareholder-level taxation (C^{S}_{net}) compared to corporate-level taxation (C_{net}) because the latter include a mixture of debt and equity financing where the equity financing component raises the average UCC value. However, for EMTRs the opposite is the case: $EMTR^{S}$ > EMTR, as expected with statutory personal tax rates exceeding corporate rates.

The EMTRs in table 5 are modestly higher than the statutory corporate and top personal rates – 33% and 39% respectively for much of this period, with the top personal rate falling to 35.5% in 2010 – reflecting relatively low inflation rates and fiscal depreciation rates close to (presumed) economic depreciation rates. Removal of the 20% depreciation loadings in April 2010 has, other things equal, raised forward-looking EMTRs for the 2010/11 year – a result discussed in more detail in section 5. Nevertheless, using shareholder-level taxation, the $EMTR^{S}$ in table 5 is typically about ten percentage points above the comparable statutory rate. This captures the impact of even low rates of inflation *when combined with higher statutory tax rates* and real depreciation allowances (despite 20% loadings for most asset classes prior to 1 April 2010) on the real after-tax return to capital.

Table 5 also shows the average gross UCC estimates, C_{gross} and C^{S}_{gross}, which can be seen to be substantially higher, the difference between those estimates and the net equivalents in the table being the weighted average economic depreciation rate, δ. This is also shown in table 5 and turns out to be around 20-21%.

Table 6 shows the decomposition of this asset- and industry- weighted average. The final row of the table shows that the main asset contributors to the sample average are PME (31% = 0.065/0.205) and vehicles (38%). These high weights are due to PME and vehicles relatively high share of total assets (figure 1), combined with a moderate depreciation rate. In contrast, the high depreciation rate of computers has little impact on overall asset-weighted depreciation rates, as these receive a very low weight in most industries.

Table 6 (last column) also highlights a remarkable similarity in weighted average fiscal depreciation rates across industries, generally around 18% - 22%, despite the variable asset compositions shown in figure 1. It seems that, though specific asset types vary across industries, the balance of assets with low, medium and high depreciation rates is much more similar.

Table 6 – Sample Asset-Weighted Depreciation Rates, 2010/11 tax regime†

	Furniture	PME	Computers	Vehicles	Intangibles	Total
Fiscal depreciation rates	0.16	0.25	0.5	0.25	0.2	
	Asset-weighted depreciation rates					
Services to Agriculture, and Fishing	0.003	0.071	0.003	0.094	0.011	**0.181**
Mining	0.003	0.107	0.013	0.059	0.012	**0.194**
Manufacturing	0.008	0.108	0.010	0.059	0.026	**0.209**
Electricity, Gas & Water Supply	0.008	0.074	0.042	0.046	0.013	**0.182**
Construction	0.004	0.063	0.007	0.134	0.016	**0.224**
Wholesale Trade	0.019	0.061	0.026	0.080	0.030	**0.215**
Retail Trade	0.015	0.073	0.016	0.051	0.048	**0.202**
Accomm., Cafes, Restaurants	0.018	0.077	0.005	0.022	0.044	**0.166**
Transport & Storage	0.008	0.036	0.007	0.150	0.022	**0.222**
Communication Services	0.004	0.028	0.006	0.159	0.032	**0.229**
Finance & Insurance	0.027	0.037	0.052	0.057	0.046	**0.219**
Property & Business Services	0.022	0.049	0.036	0.069	0.020	**0.195**
Education	0.023	0.054	0.048	0.060	0.026	**0.211**
Health & Community Services	0.022	0.064	0.020	0.061	0.038	**0.205**
Cultural & Recreational Services	0.016	0.083	0.040	0.065	0.013	**0.217**
Personal & Other Services	0.016	0.080	0.016	0.060	0.038	**0.210**
Total	**0.015**	**0.065**	**0.020**	**0.079**	**0.027**	**0.205**

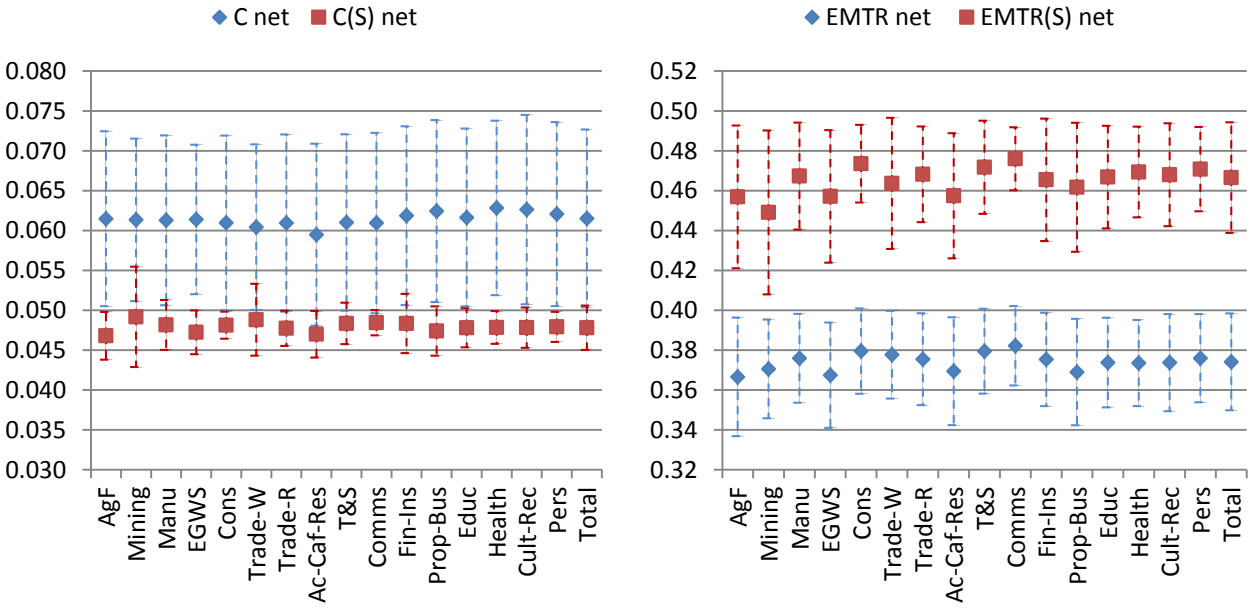
Depreciation rate on land and buildings = 0%. †These asset-weighted depreciation rates are based on the 2010/11 tax settings, applied to asset structure at the end of the 2009/10 financial year.

Industry- and Firm-Level Heterogeneity in the UCC

To examine differences across firms in their user costs and tax rates, figure 3 shows the average net UCC and EMTRs using both measures (company- and shareholder-level taxation) together with ±1 standard deviation bands. Two features immediately stand out. Firstly for all measures, but especially for C_{net}, heterogeneity *within* industries is much larger than heterogeneity *across* industries.[24] Secondly, heterogeneity for C_{net} is much greater than for C^S_{net}. This likely stems primarily from the assumed equality, in tax terms, of debt and equity funding at the shareholder level for domestic firms, which dominate the sample. Under the C^S_{net} specification, differences in debt/equity financing affect the UCC only for the small number of foreign-owned firms. In contrast, treating domestic firms as facing the corporate tax schedule provides an additional source of heterogeneity for these firms, adding to the relatively small effect of differences in asset structures.

[24] This finding holds at lower levels of industry aggregation. Industry dummies alone explain less than one percent of the variation in C_{net} across observations when industry is defined at either the 1- or 2-digit ANZSIC classification. Moving to a 4-digit classification increases this only slightly, giving an adjusted R^2 of 0.02. Industry explains somewhat more of the variation in C^S_{net}, with adjusted R^2 of 0.03, 0.09 and 0.13, at the 1-, 2-, 4-digit level respectively.

Figure 3 – UCC and EMTR Heterogeneity Across and Within Industries, 2010/11



Dotted lines show +/- 1 standard deviation.

Examination of the distribution across firms suggests however that these distributions can be highly skewed and even bi-modal. Figure 4 plots kernel density functions for both gross and net UCC measures in each of the three years (2000/01, 2005/06, 2010/11). Since the area under the kernel density function integrates to one, points on the function indicate the proportion of firms at each UCC level, allowing the distribution of estimated UCCs to be readily compared across different measures and time-periods.[25]

It is immediately obvious that the distribution of C_{net} differs markedly from that of C^{S}_{net}, and the distributions of net and gross UCC measures look very different. All four distributions reveal evidence of bi-modality. These results suggest that the choice between using a gross or net UCC measure as the relevant metric when studying investment behaviour (previous studies have used both) could be a potentially important factor in determining the conclusions reached. Secondly, in addition to the strong bi-modality of the distribution of C_{net}, it is clear that there is considerable heterogeneity across firms. That is, in addition to modes at around 0.050 and 0.077 in 2010/11, for example, there is also a substantial concentration of observations between these values. Using shareholder-level taxation (for domestic firms) in C^{S}_{net}, the distribution is much more concentrated, closer to being single peaked, and with a strong mode at about 0.049 in 2010/11.

In Appendix 2 (figure A2.3) we report kernel densities for EMTRs equivalent to the net UCC measures reported in figure 4. They again reveal strong bi-modality of the EMTR (but closer to single peaked-ness for $EMTR^{S}$ when shareholder taxation is included) and a systematic downward shift in the EMTR distributions from 2000/01 to 2005/06 across both specifications, and a further decrease in $EMTR^{S}$ in 2010/11. In contrast, the corporate-level EMTR exhibits reduced variance in 2010/11 with little change in the mean (as seen in table 5).

[25] The kernel density function can be thought of as a smoothed histogram, plotting the density of firms at each value of the UCC.

Finally in Appendix 2, figure A2.4, we show kernel densities for the four largest industries (in terms of firm numbers) in the sample: Manufacturing, Construction, Retail Trade and Property & Business Services. These plots confirm that *within*-industry differences in UCCs dominate *cross*-industry differences.

Foreign versus Domestic Firms

The 'twin peaks' in the UCC distribution are likely due to the foreign/domestic ownership distinction. We investigate this directly in figure 5 which shows separate kernel densities for foreign and domestic firms in 2010/11, using C_{net}, and C^{S}_{net}. The distributions look more similar for C_{net}, where shareholder level taxation is ignored, than when C^{S}_{net} is used, since shareholder-level taxation applies only to domestic firms. Nevertheless, C_{net} (left-hand chart) shows two distinct concentrations of domestic firms at around 0.049 and 0.077, whereas foreign firms are more equally distributed across the range of values with a smaller peak at 0.049-0.050. This difference becomes more pronounced using C^{S}_{net} (right-hand chart), where domestic firms are clustered around 0.048. As the domestic distribution using C^{S}_{net} is extremely concentrated, the distribution for foreign firms (which does not change between using C_{net} and C^{S}_{net}), becomes visually indistinguishable from an even distribution.[26]

The intuition behind this strong tendency towards homogeneity among domestic firms using C^{S}_{net} is that, with shareholder-level taxation dictating that the debt/equity financing decision becomes irrelevant for domestic firms, the major remaining source of difference is in depreciation rates. As noted above, since observed differences in asset structures give rise to only modest differences across firms in their asset-weighted average depreciation rates, this generates little variation in C^{S}_{net} across domestic firms. Of course, this does not apply to foreign firms, for whom the corporate marginal rate is the final rate.[27]

In unreported results, we also compared the UCCs for domestic and foreign firms whilst respectively holding each firm's asset composition and debt/equity financing proportions fixed at population means. This allows us to identify the extent to which domestic-foreign differences arise from asset-related or financing-related differences. The kernel density function obtained while holding asset composition fixed is very similar to that shown in figure 5. Conversely, holding the debt-equity ratio constant produces a very different distribution of UCCs. That is, most of the domestic-foreign differences relate to differences in financing (and the related tax assumptions) rather than to differences in asset composition.

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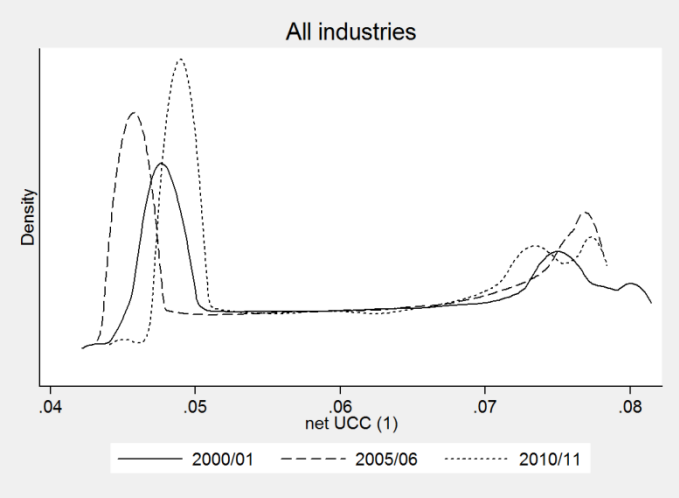
[26] The upper tail of C^{S}_{net} for foreign firms has been trimmed to allow the domestic distribution to be observable.

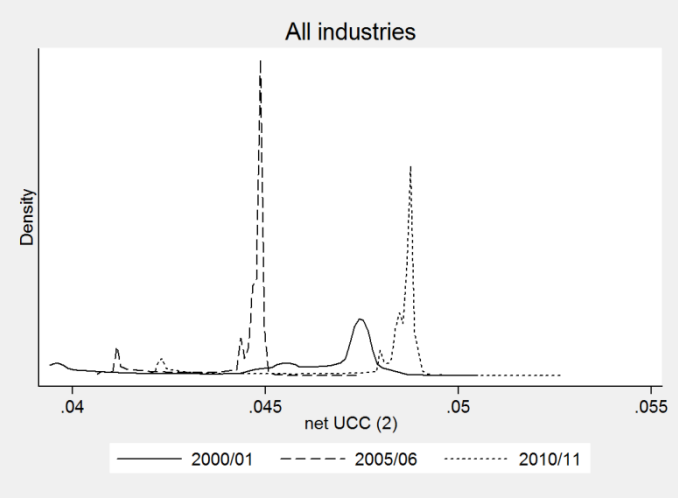
[27] We ignore non-resident withholding tax (NRWT) and the Approved Issuer Levy (AIL) in this analysis. Both represent only minor sources of tax liability for foreign firms in New Zealand.

Figure 4 – Kernel Density Functions for User Costs, 2000/01, 2005/06 & 2010/11

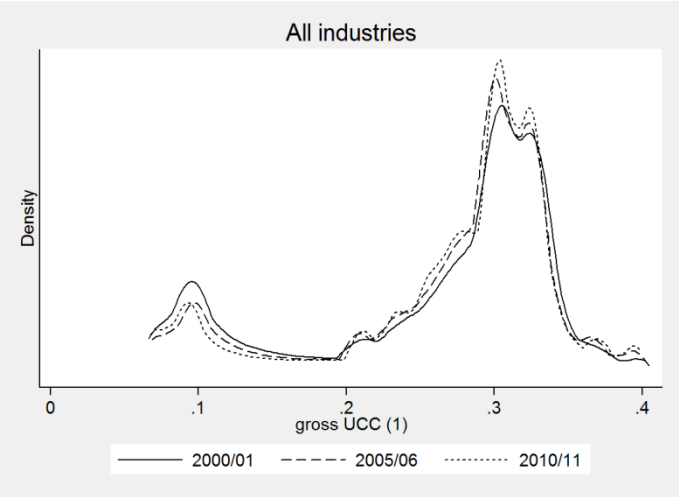
C_{net}



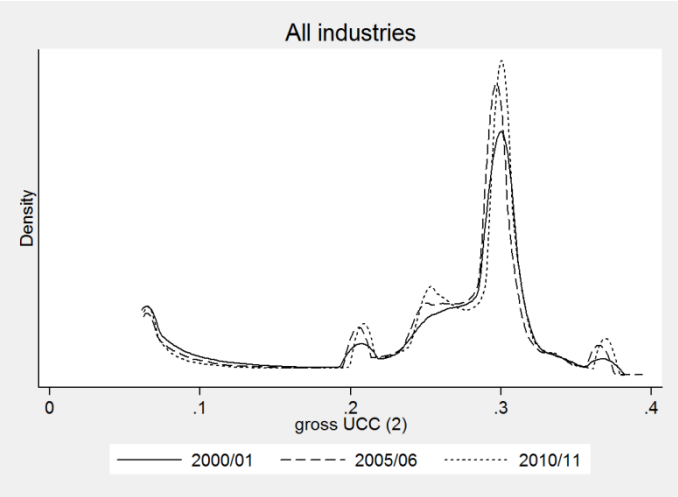
C^{S}_{net}



C_{gross}



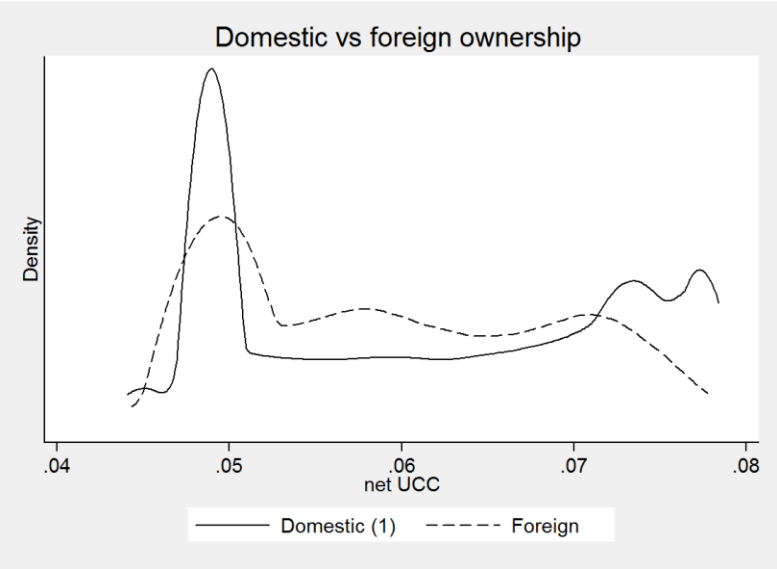
C^{S}_{gross}



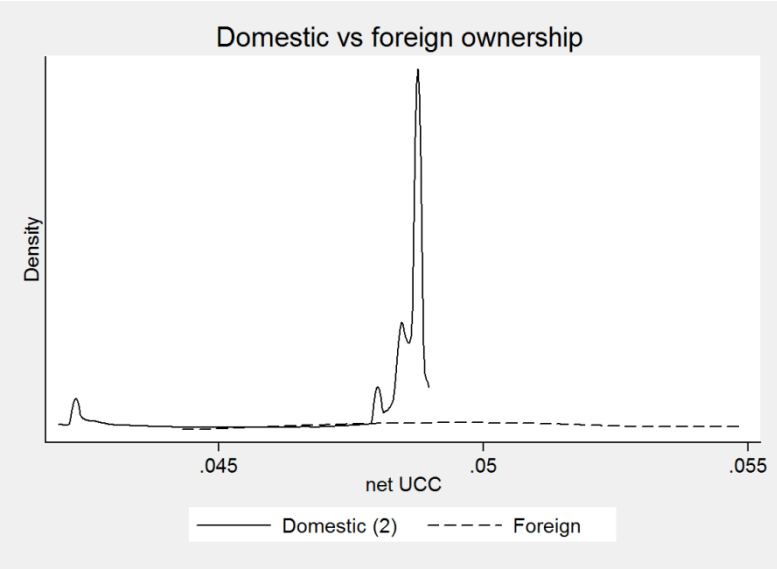
Top and bottom 1 percent of firms in each year trimmed in accordance with Statistics New Zealand confidentiality protocols.

Figure 5 – Foreign versus Domestic User Costs, 2010/11

C_{net}



C^{S}_{net}



Top and bottom 1 percent of firms of each type trimmed in accordance with Statistics New Zealand confidentiality protocols. Upper tail of foreign kernel density trimmed for C^{S}_{net} to allow domestic distributions to be identified. Foreign C^{S}_{net} distribution identical to C_{net} .

5 The Impact of Reforms, 2005 to 2012

A number of changes to tax parameters that affect UCC calculations have taken place between 2000 and 2012. These are shown in table 7 by the date of their implementation. The major changes were a general reduction in depreciation rates in 2005/06, cuts in the corporate tax rate in 2008/09 and 2011/12, cuts in personal top marginal rates in 2009/10 and 2010/11, and the removal of all (20%) depreciation loadings in 2010/11.

Changes in fiscal depreciation allowances have unambiguous effects on UCCs – higher fiscal depreciation rates raise Z, and therefore lower the UCC, and *vice versa* – while changes in statutory tax rates have ambiguous effects. Lower tax rates serve directly to reduce the UCC (a lower pre-tax return on capital is required to achieve a given post-tax return), but they also reduce the tax credit value of depreciation allowances, tending to raise the UCC. As can be seen from the tax component of the shareholder-level UCC, $\{1-m(Z+k)\}/(1-m)$, this expression is less than one if $Z + k > 1$. That is, there is a net subsidy to investment via depreciation if the net present value of \$1 of depreciation allowances, including any 'loading', exceeds \$1. More generally, higher values of Z or k reduce the UCC, *ceteris paribus.*

Table 7 – UCC-Relevant Tax Reforms

Tax year	Implementation date	Tax change
2005/06	1 April 2005	- Fiscal depreciation rates *increased* for most assets
	19 May 2005*	- Buildings depreciation rate *reduced*: 4% to 3%
2008/09	1 April 2008	- Company tax rate *reduced* from 33% to 30%
2009/10	1 April 2009	- Top personal tax rate *reduced* from 39% to 38%
2010/11	21 May 2010*	- 20% depreciation loadings *removed* from all assets
	1 October 2010	- Top personal tax rate *reduced* from 38% to 33%. This is treated as a tax rate of 35.5% applying from 1 April 2010 to 31 March 2011.
2011/12	1 April 2011	- Company tax rate *reduced* from 30% to 28%;
		- Building depreciation rate *reduced* from 3% to 0%.

* Depreciation rate changes occurring in May 2005 and 2010 are treated in our analysis as applying for the full 1 April-31 March tax year.

To illustrate the impact of tax reforms we follow two approaches. Firstly, in figure 6, we show the change in the average net UCC measures, C_{net} and C^{S}_{net} (here labelled C and C(S) respectively) by industry, between 2000/01 and 2005/06, and between 2005/06 and 2010/11. Secondly, in figure 7, we isolate the impact of the 2005 and 2010-2011 tax regime changes by reporting counterfactual calculations of firm-level UCCs before and after each change, based on the characteristics of firms in the earlier year. These plots show the UCC under each tax treatment, separately for foreign firms (in red) and domestic firms (in black), with points above or below the 45° line (thick grey line) indicating whether the firm's UCC increased or decreased respectively due to the reforms.

Figure 6 – Net UCC Changes by Industry, 2000/01-2010/11

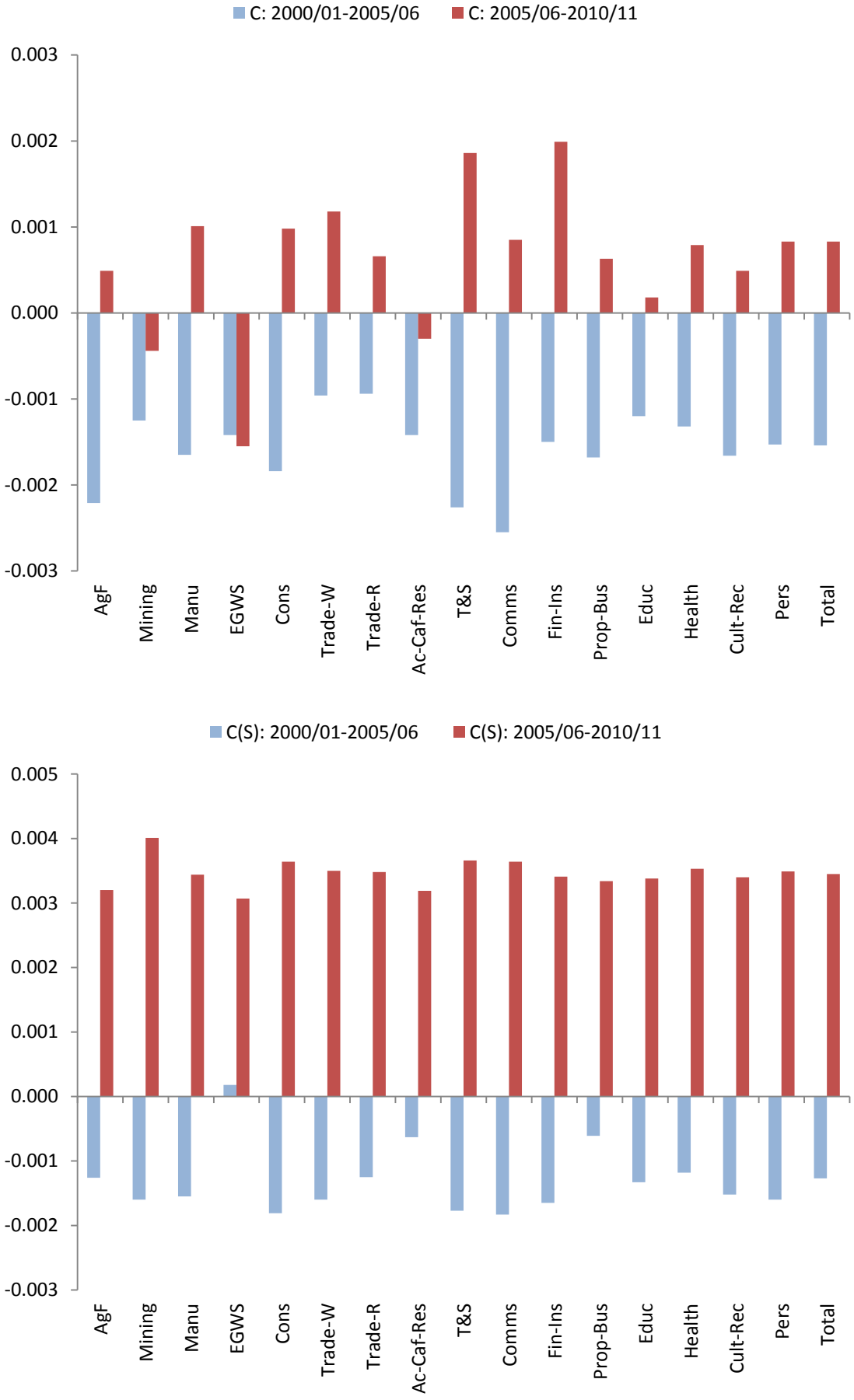


Figure 6 reveals relatively modest falls of around -0.1 to -0.25 percentage points in the net UCC (at company or shareholder levels) between 2000/01 and 2005/06, capturing the fiscal depreciation rate increases which occurred in 2005.[28] The far-right column shows the average change in UCCs across all industries, with falls of 0.15 and 0.13 percentage points for corporate and shareholder taxation respectively.

Changes between 2005/06 and 2010/11 reflect the effects of the depreciation rate changes in May 2010, as well as capturing the 2008/09 corporate rate reduction to 30% and the 2009/10 and 2010/11 cuts in the top personal rate from 39% to 35.5%. This latter change affects C^S_{net}, but not C_{net}. As a result it can be seen that, although both C_{net} and C^S_{net} generally increase between 2005/06 and 2010/11, the increase for C_{net} (upper half of figure) is positive for 14 of the 17 industries, but typically less than +0.1 percentage point, whereas an increase of around +0.3 to +0.4 percentage points affects all industries for C^S_{net}. These changes reflect the ambiguous effects of tax rate reductions discussed above (so that C_{net} does not necessarily rise for all industries), and the widespread cross-industry effect associated with changes in the top personal rate on domestic firms' UCC when applying shareholder-level taxation in C^S_{net}.

Importantly, because the 2005/06 depreciation regime including the 20% loading was relatively generous, reductions in the corporate or personal tax rates thereafter would tend to *raise*, rather than lower, the average user cost of capital. That is, the higher *tax deductions* arising from depreciation when tax rates are higher outweigh the direct higher tax liability due to the higher rate. The subsequent removal of these loadings would reduce this effect but it seems that user costs in most industries nevertheless rose, if only slightly, in 2010/11 compared to 2005/06.

Figure 7A provides more firm-level detail on the 2005/06 depreciation change showing the pre-reform ("2004/05 tax") UCC on the horizontal axis and the post-reform ("2005/06 tax") on the vertical axis. Despite the strong clustering of the 180,000+ observations, the left-hand chart reveals that, though the majority of firms experienced a fall in their net user cost, C_{net}, due to the overall increased depreciation allowances, there was also a substantial subset of firms experiencing an (albeit small) increase in their net UCC. This likely reflects, in part, the cuts in building depreciation, having greatest effect, for example, in the EGWS and Property industries. With this corporate tax-based UCC measure, it is not possible to distinguish the red (foreign) and black (domestic) dots on the chart – both sets of firms are similarly spread. Fitted values (represented by thin red and grey lines) show that the shift in the UCC associated with the tax changes were broadly neutral to past UCCs, in the sense that the downward shift in average UCCs was similar for firms at both the top and bottom of the initial UCC distribution.

The right-hand chart in 7A shows the equivalent plot for C^S_{net}. As noted previously, this generates a much greater bunching of domestic firms' UCCs between 0.39 and 0.49 C^S_{net} values. The figure also reveals a mixture of increased and decreased values in association with the reform. For foreign firms (red dots), there is a much greater preponderance of UCC declines in association with the reform, as well as a much wider range of values both before and after. Among domestically-owned firms (black dots) the fitted values (thin grey line) also show changes within the distribution of UCCs. Increases in UCC due to the depreciation rate changes are larger among those firms with initially low

[28] Note the different scales on the vertical axis for C_{net} (upper) and C^S_{net} (lower).

values, while those with initially high values are more likely to experience a fall in their UCC. Thus, the 2005/06 depreciation adjustment reduced the dispersion in UCCs among domestically-owned firms.

In Budget 2010, the elimination of depreciation deductions for buildings appeared motivated by a desire to increase the relative taxation of property. The removal of the 20% loading, on the other hand, owed more to a view that it was hard to justify deviations from perceived economic rates of depreciation, and as a tax base-broadening measure, as recommended by the Tax Working Group.[29] The accompanying cut in the statutory corporate rate appeared designed to avoid, or minimise, an average increase in the effective tax rate on companies as a result of these depreciation changes. These changes took effect over two years, with the removal of loading coming into effect in the 2010/11 tax year, alongside a fall in the top marginal tax rate from 38 to 33%,[30] while changes to the corporate tax rate and depreciation allowances for buildings came into place at the start of the 2011/12 tax year.

Figure 7B first displays the overall impact of the combined tax reforms across the two tax years (Figure 7B.1), then separates out the impact of changes occurring in each year. In all cases, the relevant tax treatment is applied to firm characteristics observed at the end of the 2009/10 financial year, such that all the observed change is attributable to the tax reforms. This suggests that the net effect, though far from uniform, was to raise the user cost of capital for almost all firms. The increase is most pronounced when shareholder-level taxation is taken into account, with the mean UCC^S increasing by 0.46 percentage points from 0.045 to 0.049, while the mean UCC increased by 0.26 percentage points from 0.059 to 0.061 (table 8).

Table 8 - Mean UCCs and EMTRs under 2009/10, 2010/11 and 2011/12 tax regimes

	2009/10	2010/11	2011/12
UCC	0.059 (0.011)	0.062 (0.011)	0.061 (0.010)
UCC^S	0.045 (0.002)	0.048 (0.003)	0.049 (0.002)
EMTR	0.345 (0.016)	0.374 (0.024)	0.360 (0.016)
$EMTR^S$	0.467 (0.021)	0.467 (0.028)	0.447 (0.014)

Standard deviations in brackets.

The overall change reflects an initial increase in both UCC measures for almost all firms due to the removal of depreciation loadings in 2010/11 (Figure 7B.2) alongside increased dispersion in UCCs among domestic firms under shareholder level taxation (right-hand panel of Figure 7B.2), followed by more mixed reactions to the corporate and personal rate reductions, and removal of depreciation allowances for buildings in 2011/12 (Figure 7B.3). This second round of tax changes reduced the UCC for over half the population of firms under corporate taxation, but led to further increases in the UCC^s for domestic firms under shareholder-level taxation.

Consider, for example, the value of the tax component that has been the focus of some previous studies, $\{1-mZ'\}/(1-m)$ or $\{1-\tau Z'\}/(1-\tau)$, though recall that this only captures the complete tax effect where $r^* = r$. Nevertheless, it provides some insight into how far the required pre-tax rate of return is amplified by the tax system (to deliver a given post-tax rate of return) and is reported by, for example, Bond and Xing (2010) for different

[29] See Victoria University of Wellington Tax Working Group (2010, p.11).

[30] The 5% drop in the personal tax rate in October 2010 followed a 1% reduction in the previous year.

asset types. It represents a form of tax multiplier of the gross-of-depreciation return component, ($r^* + \delta$).

Figure 8 reports the value of this tax multiplier for 1999/20 to 2011/12. In general, despite the depreciation reform in 2005/06, it has remained remarkably constant over 2000/01 to at least 2007/08, and is similar again in 2011/12. In 2008/09 there is a noticeable fall in the tax component, from 1.131 to 1.116, based on corporate-level taxation and a somewhat smaller fall in 2009/10 and 2010/11, from 1.145 to 1.140, when shareholder-level taxation is used. These largely reflect the respective cuts in the corporate statutory rate from 33% to 30% in 2008/09, and the top personal tax rate cut from 39% in 2009/10 to 33% in 2011/12 (via 38% and 35.5% in the intervening years).

The ambiguous reform to corporate taxes (in terms of the expected direction of UCC impacts) over the 2009/10-2011/12 period can be seen to have increased the tax multiplier effect quite markedly under corporate-level taxation after 2009/10, rising from 1.116 in 2009/10 to 1.128 in 2011/12. The overall effect is smaller for shareholder-level taxation, but with the decrease in the tax multiplier between 2008/09 and 2010/11 being more than offset by the increase in 2011/12. As a result the overall effect appears very small or negligible on average, though clearly will differ across firms according to their debt/equity structures and asset compositions.[31] Interestingly both tax component measures rise in 2011/12 despite the fall in both the relevant tax rates (to 28% and 33%), emphasising the dominant role of the depreciation changes, and the effect of lower tax rates to reduce the tax deductions value of pre-tax capital costs.

These values for New Zealand, can be compared with those found by Bond and Xing (2010) for the UK. This indicates that the tax multiplier effects on the UCC in New Zealand in figure 8 are similar but somewhat smaller to the UK values estimated by Bond and Xing (2010). They ignore shareholder-level taxation and report UK values for $\{1-\tau Z'\}/(1-\tau)$ separately for 'structures' (buildings etc) and 'equipment' (similar to PME here), from 1982 to 2007. They find values falling steadily from1.2 and 1.6 for structures and equipment respectively in 1982, to 1.1 and 1.3 respectively by 2007. This compares with an 'all-assets' average of 1.12 for New Zealand in the late-2000s in figure 8.

Finally figure 8 reveals that the shareholder-level tax component, at 1.119, was especially low in 1999/2000 compared to later years, and lower than the corporate-level equivalent at 1.134. This reflects the 33% top personal rate prior to the increase in 2000/01. The corporate-level tax component is higher (despite the same statutory corporate tax rate of 33%) because of the assumed debt-equity split in financing, such that the relevant value of i*, used to calculate Z', differs between the shareholder/corporate cases. When the top personal rate is reduced to 33% again in 2011/12 (and a weighted average 35.5% in 2010/11), figure 8 shows that the tax component does not drop back to its 1999/2000 level. This is because of the subsequent changes in the depreciation regime, such as the elimination of the 20% loading and the removal of fiscal depreciation on buildings. Both of these served to raise the tax component of the user cost, counteracting the statutory rate change.

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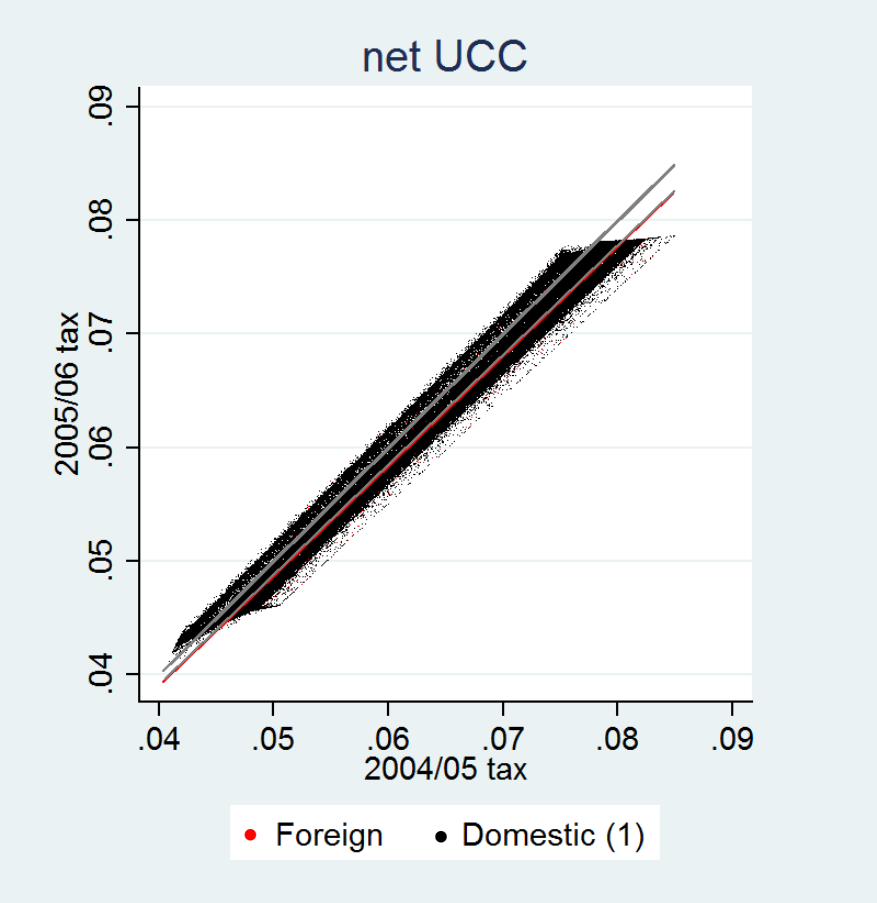
[31] These tax components can be compared with the EMTRs reported below using equation (15) above. For example, a tax component of T = 1.1, a depreciation rate δ = 0.25 (the average in 2010, including loading, across our LBD firms) and r* = 5%, gives an EMTR from (15) of 37.5%.

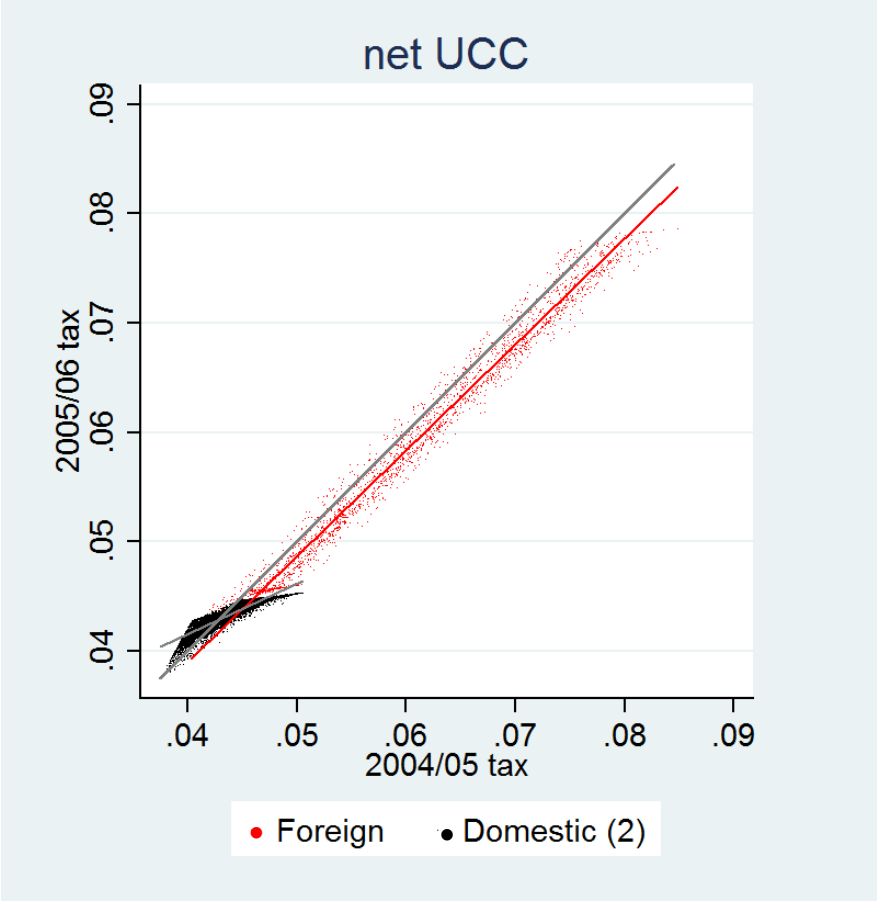
Figure 7 - UCC Responses to Tax Reforms

Figure 7A – Responses to the 2005/06 Reforms

2005/06 Depreciation Reforms: C_{net}



2005/06 Depreciation Reforms: C^{S}_{net}

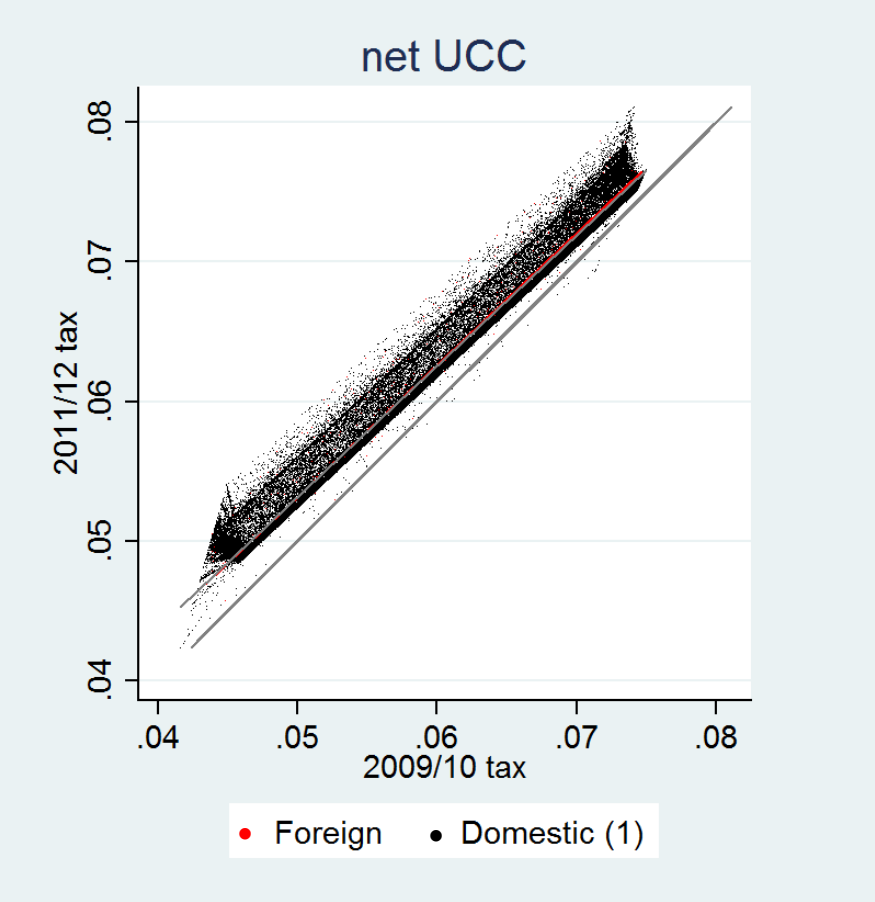


Counterfactual UCCs calculated by applying 2004/05 and 2005/06 tax treatments to firm characteristics at the end of the 2004/05 year. Thick grey line is at 45 degrees (ie, represents no change in UCC due to tax changes). Thin red and grey lines are fitted values reflecting the relationship between 2004/05 and 2005/06 UCCs for foreign and domestically-owned firms respectively.

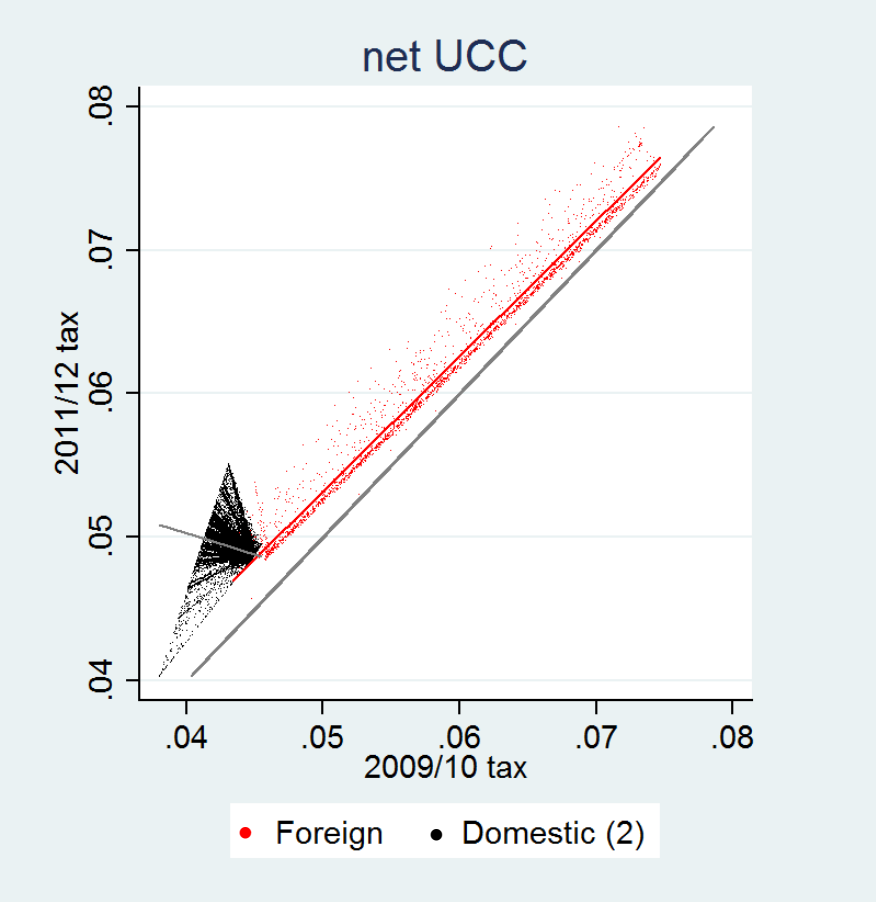
Figure 7B – Responses to the 2010/11 and 2011/12 Reforms

Figure 7B.1 Combined tax reforms, 2010/11-2011/12

C_{net}



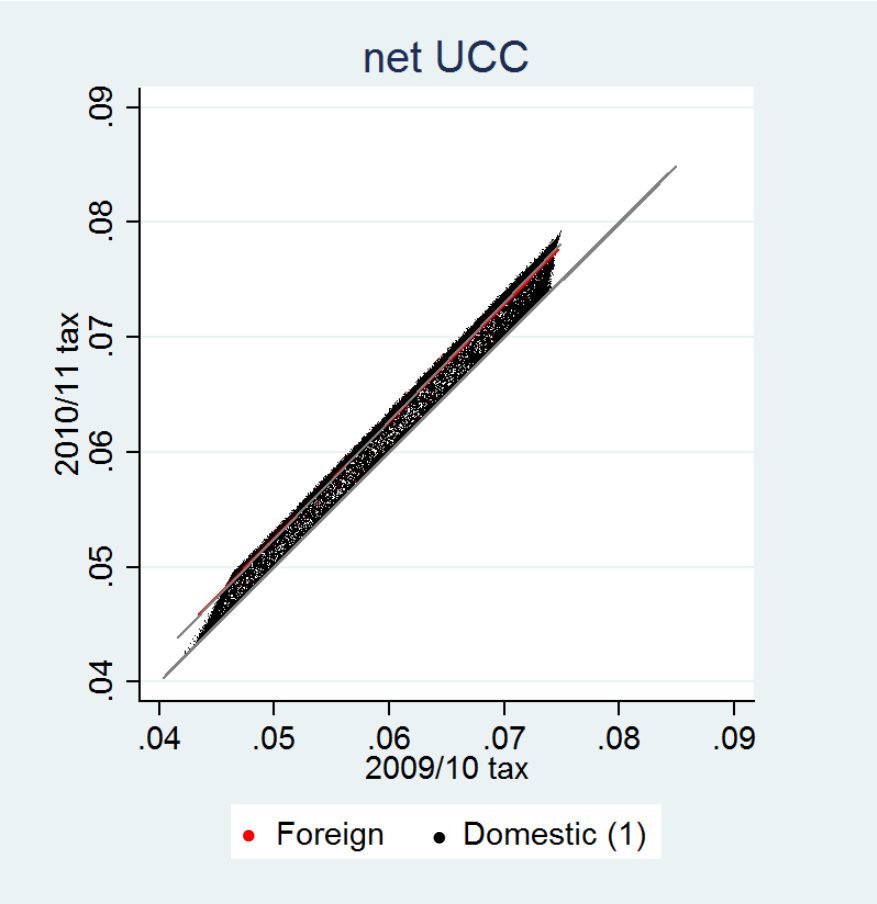
C^{S}_{net}



Counterfactual UCCs calculated by applying 2009/10 and 2011/12 tax treatments to 2009/10 firm characteristics. Thick grey line is at 45 degrees (ie, represents no change in UCC due to tax changes). Thin red and grey lines are fitted values reflecting the relationship between 2009/10 and 2011/12 UCCs for foreign and domestically-owned firms respectively.

Figure 7B.2 2010/11 Depreciation and Personal Tax Reforms

C_{net}



C^{S}_{net}

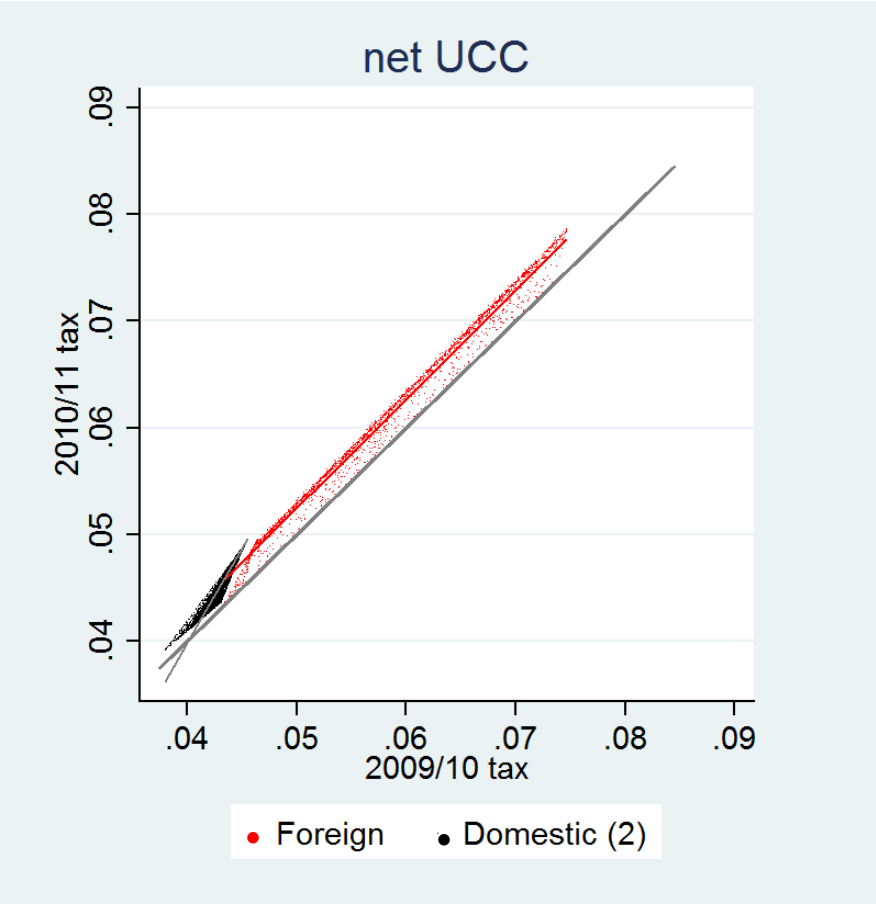
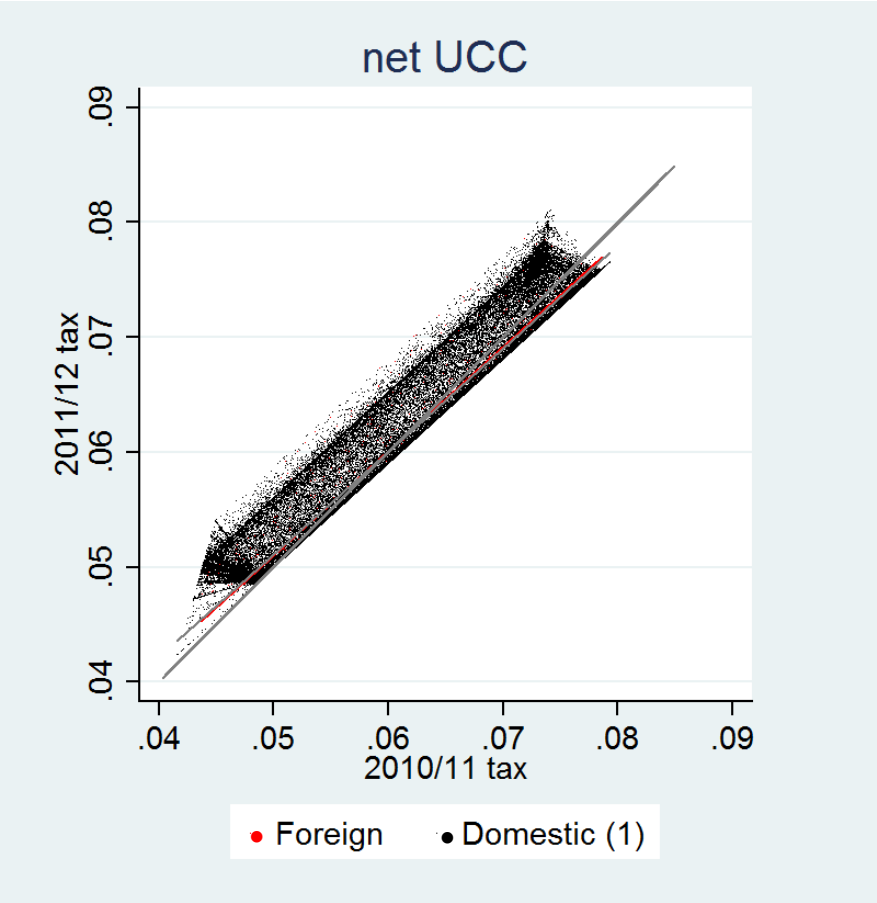


Figure 7B.3 2011/12 Corporate Tax Reforms

C_{net}



C^{S}_{net}

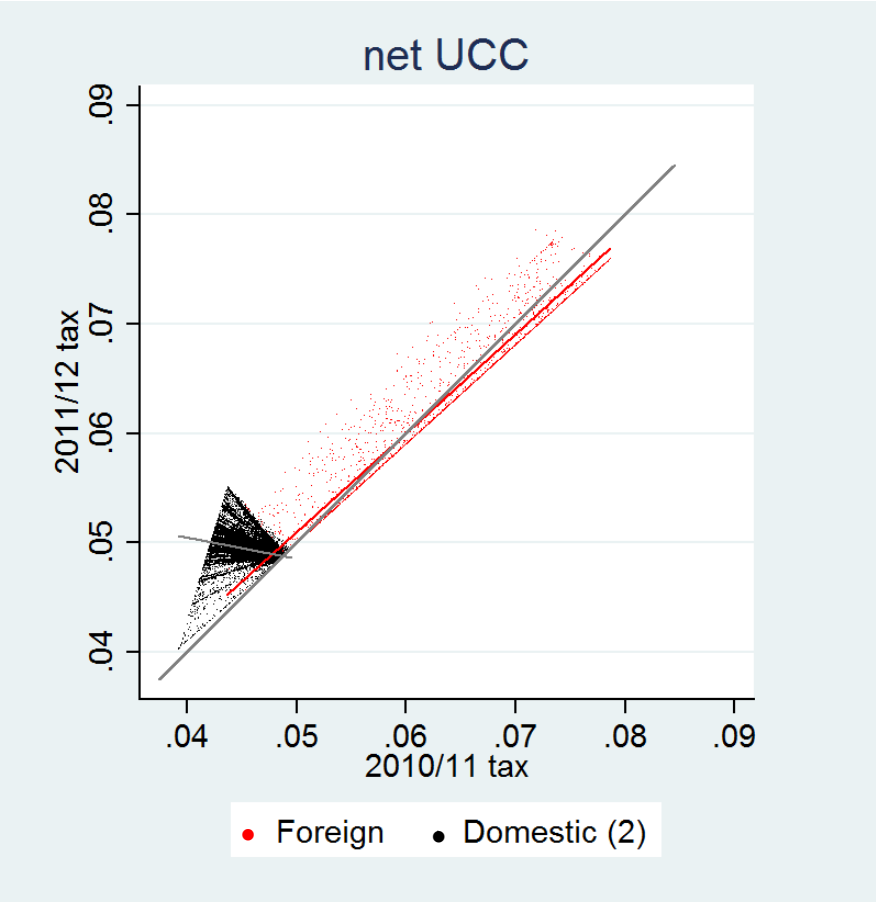
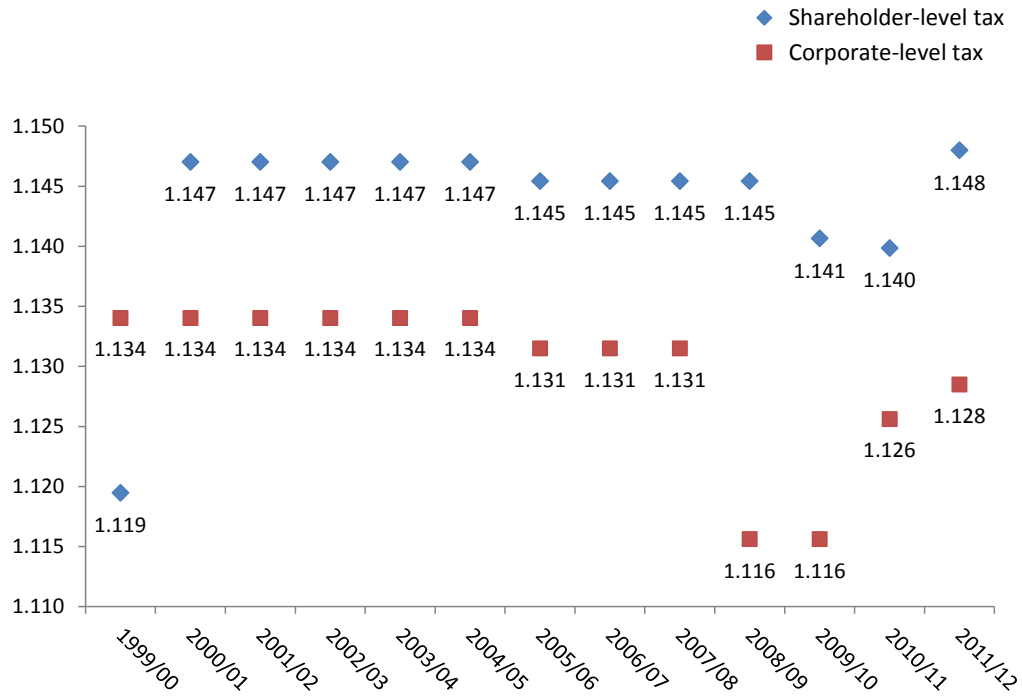


Figure 8 - The UCC Tax Component, 1999/00 – 2011/12



Effective Marginal Tax Rates

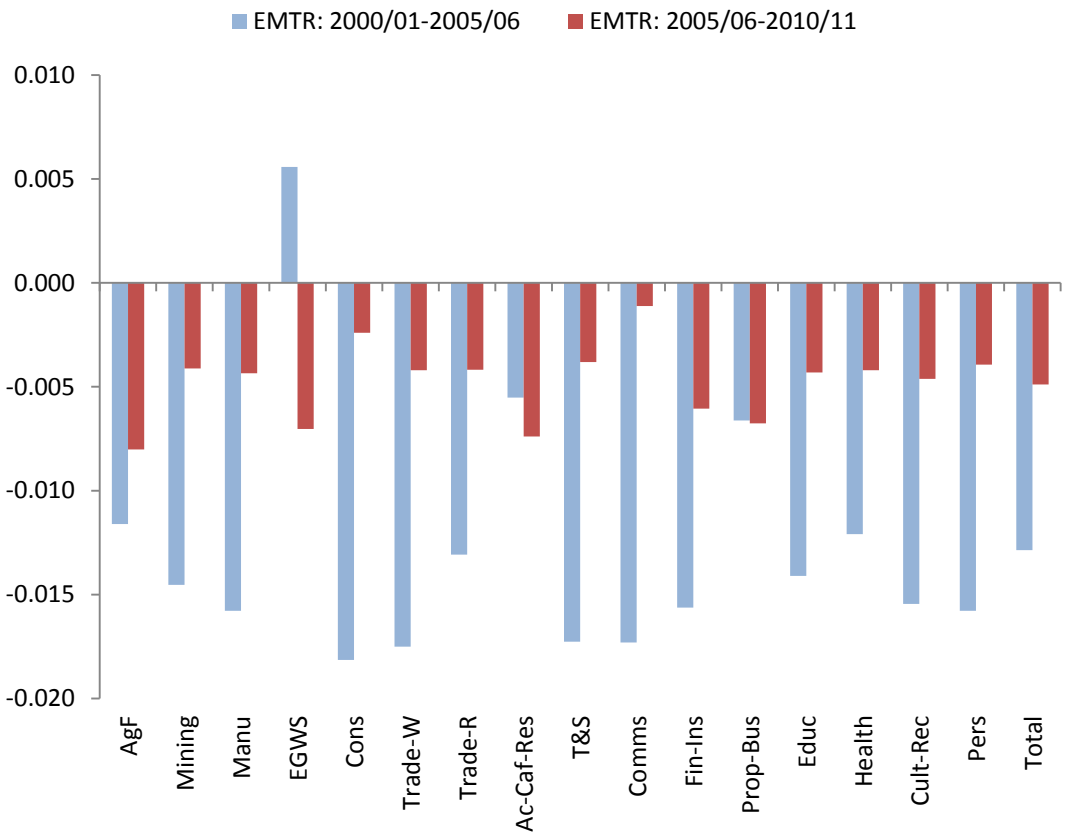
As a measure of the impact of tax reforms on firms' costs of new investment, EMTRs are often preferred to user costs because of their intuitive interpretation and ease of comparison with headline statutory tax rates. They have the disadvantage however that, since $\text{EMTR} = (C_{net} - r^*)/C_{net}$, a constant difference between the pre-tax C_{net} and post-tax rates of return, r^*, can translate into large numbers when C_{net} and r^* are both smaller. Nevertheless, effective tax rates are perhaps more commonly quoted tax measures of investment (dis)incentives.

Figure 9 shows changes in EMTRs by industry over 1999/00-2004/05 and 2004/05-2009/10. The results shown are based on C_{net} but comparable results are obtained using C^S_{net}. With the exception of EGWS during 1999/00-2004/05, there are across-the-board reductions in EMTRs through tax and other changes in both periods.[32]

However it is also clear that average EMTR reductions were variable across industries, especially during the first five-year period. Those industries which saw relatively small EMTR reductions (Accommodation/Restaurants; Property/Business Services), or even increasing EMTRs (EGWS) over this period, were those with relatively high shares of buildings in their asset structures for which fiscal depreciation rates were reduced in the 2005/06 reforms where asset depreciation rates generally rose. There is evidence of more uniform cross-industry reductions in EMTRs over 2005/06-2009/10, as might be expected in association with the statutory corporate rate cuts.

[32] Appendix Figures 2.1 and 2.2 depict firm-level changes in EMTRs across the two tax reforms, comparable to figures 7A and 7B for UCCs.

Figure 9 - Changes in EMTRs by Industry, 2000/01, 2005/06 & 2010/11



6 Conclusions

Recent literature has stressed the importance of estimating user costs of capital and effective marginal tax rates *at the firm level*, and has begun to find evidence of significant effects of these on firms' investment in some OECD countries. Motivated by this, we have constructed similar forward-looking measures of the user cost of capital for New Zealand, based on firm-specific information on the composition of assets, equity/debt financing, and foreign/domestic equity ownership. This yielded firm-specific user costs (UCCs) and effective marginal tax rates (EMTRs) for a given marginal investment by each firm under alternative assumptions including the tax status of the marginal investor (facing either company-level or shareholder-level taxation).

Using a variety of descriptive statistics, including kernel density functions to characterise the distribution of UCCs across firms, we identified a number of features of New Zealand firms' user costs of capital.

Firstly, the particular measure chosen – gross versus net of depreciation, with or without the inclusion of shareholder-level taxation – can make a substantial difference to the size of estimated user costs and their distribution among firms and industries. This suggests that identifying the relevant measure that enters into firm's investment decisions could be important for assessing the impact of capital costs on those decisions.

Secondly, we found that allowing for shareholder-level taxation produced a much more concentrated distribution of UCC values across domestic firms, compared to when only corporate-level taxes are considered. In part this is caused by evaluating the user cost using the top personal marginal tax rate. Nevertheless, the results suggest that whether investment decisions are effectively determined at the corporate level, ignoring subsequent taxation of final shareholders, or are influenced by the tax faced by those personal shareholders, is vital in identifying the 'true' user costs faced by firms.

Thirdly, we found systematic differences between the user costs (and EMTRs) of foreign-owned and domestically-owned firms. This reflects both differences in debt-equity financing choices by foreign-owned and domestic firms, and the fact that foreign firms are generally free from domestic resident shareholder-level taxation.

Importantly, it does *not* follow that the user costs or EMTRs of foreign firms are systematically lower or higher than those of domestic firms. Conclusions on this depend on whether foreign firms are using debt or equity financing. Importantly, conclusions can also differ between the user cost and EMTR measures. Because EMTRs are based on a pre- and post-tax return difference, *as a proportion* of the user cost, the ranking of firms by the two measures – UCCs and EMTRs – can be different (see table 4 and figure 5).

Fourthly, differences in asset composition across firms appear to be relatively unimportant in explaining differences in user costs and EMTRs across firms, and especially across industries. Though asset composition itself can vary substantially, the data suggest that the mix of high, medium and low depreciation rate assets are such that the overall average depreciation rates across firms do not substantively impact on capital user costs.

Fifthly, we observed systematic changes in user cost measures between 2000/01 and 2011/12 due to changes in the tax treatment of corporate profits, and personal tax rates. The tax component of the UCC and EMTRs both fell between 2000 and 2010 but rose slightly in 2011. Overall, the New Zealand corporate or personal tax system appears to have a modest impact on pre-tax rates of return (to achieve a given post-tax return) such that, on average, EMTRs are only modestly higher than statutory corporate or personal rates.

Finally, our analysis has been focused on *forward-looking* user cost or EMTR measures, mainly to avoid the well-known endogeneity problems associated with *backward-looking* measures – because the latter are based on *ex post* tax base and revenue *outcomes*. Nevertheless, the unique nature of the LBD data, incorporating official data on companies' tax payments (as opposed to company account based data), potentially allows a more accurate comparison between forward- and backward-looking measures than has been possible for other countries. This is the subject of on-going research.

Appendices

Appendix 1 – Derivation of Firm-Level Variables

Industry

Industries are defined according to the Australian and New Zealand Standard Industrial Classification 1996 (ANZSIC96). Firms are allocated to a permanent 2-digit industry based on predominant employment over the 11 year period.

Asset composition

Firm-level asset composition variables are derived from AES and IR10 asset schedules. Where firms have both data sources available, precedence is given to AES responses, as these provide a more detailed breakdown of fixed assets. In the final dataset, 6.1 percent of observations are sourced from AES with the remainder from IR10.

We distinguish seven asset classes: land; buildings; vehicles; computer hardware and software; furniture and fittings; plant, machinery and equipment (PME) and other fixed assets; and intangibles. In IR10s, land and buildings are reported as a single asset class, while computer hardware and software are included in the broader classes of plant and machinery and other fixed assets. We therefore impute the relative shares of each of these classes based on observed AES responses of firms in the same 2-digit industry and size class.[33]

Debt/Equity Ratio

Debt equity ratios are defined as the closing book values of total liabilities/total assets, sourced from IR10 and AES forms and truncated at one.

Foreign Ownership

Foreign ownership indicators are derived from the Longitudinal Business Frame (LBF) and IR4 Company Tax returns. Firms are classified as foreign owned if (a) they are recorded as having 50% or more foreign ownership in the LBF, or (b) they indicate being "controlled or owned by non-residents" in the IR4.

[33] A small number of 2-digit industries are combined due to low observation counts. Firm size classes are distinguished by having above or below the industry-year median employment for AES respondents.

Appendix Table A1.1 Debt-Asset Ratio by Industry & Ownership, year ending March 2010

Debt-to-asset ratio	Domestic			Foreign owned			Total
2010	Mean	S.D.	Nos.	Mean	S.D.	Nos.	Numbers
Services to Agriculture, and Fishing	0.523	0.378	5,619	c	c	12	5,628
Mining	0.530	0.353	213	0.591	0.325	39	252
Manufacturing	0.555	0.365	15,075	0.574	0.311	447	15,519
Electricity, Gas and Water Supply	0.518	0.324	96	c	c	3	99
Construction	0.575	0.372	31,278	0.659	0.276	69	31,347
Wholesale Trade	0.586	0.356	9,012	0.596	0.321	756	9,765
Retail Trade	0.564	0.377	26,103	0.671	0.355	156	26,262
Accommodation, Cafes, Restaurants	0.591	0.389	8,574	0.628	0.343	111	8,682
Transport and Storage	0.573	0.376	7,719	0.629	0.312	168	7,884
Communication Services	0.582	0.386	2,088	0.692	0.262	18	2,106
Finance and Insurance	0.529	0.381	3,255	0.667	0.321	177	3,432
Property and Business Services	0.500	0.384	47,952	0.609	0.334	642	48,594
Education	0.537	0.376	2,019	0.691	0.264	33	2,055
Health and Community Services	0.501	0.369	10,461	0.713	0.303	78	10,539
Cultural and Recreational Services	0.507	0.403	5,400	0.616	0.343	54	5,454
Personal & Other Services	0.531	0.391	7,995	0.716	0.316	33	8,031
Total	0.542	0.379	182,856	0.616	0.324	2,796	185,649

Firm counts random rounded base three in accordance with Statistics New Zealand confidentiality protocols. Mean debt-asset ratios not reported for foreign firms in Services to Agriculture, and Fishing, and Electricity, Gas and Water Supply due to low firm counts.

Appendix Table A1.2 Mean Debt-Asset Ratio by Industry & Ownership, years ending March 2000 and 2005

Debt-to-asset ratios	2000				2005			
	Domestic	Foreign	Total	% foreign	Domestic	Foreign	Total	% foreign
Services to Agriculture, and Fishing	0.481	0.726	4,974	0.2%	0.508	c	5,637	0.2%
Mining	0.503	0.382	243	7.0%	0.490	0.462	240	7.5%
Manufacturing	0.541	0.572	16,284	2.5%	0.543	0.545	16,905	2.6%
Electricity, Gas and Water Supply	0.379	0.670	75	6.8%	0.445	c	78	3.8%
Construction	0.554	0.665	26,220	0.2%	0.554	0.670	30,282	0.2%
Wholesale Trade	0.592	0.639	10,062	7.2%	0.572	0.611	10,854	7.0%
Retail Trade	0.550	0.650	26,697	0.5%	0.540	0.677	27,678	0.5%
Accommodation, Cafes and Restaurants	0.523	0.611	7,236	1.0%	0.545	0.683	8,544	1.0%
Transport and Storage	0.564	0.679	7,659	1.6%	0.578	0.693	8,028	1.9%
Communication Services	0.533	0.624	2,112	0.9%	0.554	0.610	2,058	1.2%
Finance and Insurance	0.549	0.687	2,628	6.3%	0.549	0.676	3,507	5.0%
Property and Business Services	0.462	0.655	41,571	1.0%	0.487	0.624	46,704	1.1%
Education	0.510	0.664	1,509	1.4%	0.501	0.688	2,022	1.9%
Health and Community Services	0.487	0.624	8,481	0.2%	0.487	0.518	9,546	0.2%
Cultural and Recreational Services	0.483	0.700	4,071	0.9%	0.486	0.498	4,974	0.7%
Personal and Other Services	0.517	0.680	6,705	0.4%	0.514	0.716	7,587	0.4%
Total	0.521	0.636	166,527	1.4%	0.526	0.618	184,641	1.4%

Firm counts random rounded base three in accordance with Statistics New Zealand confidentiality protocols. Foreign ownership percentages not reported for Services to Agriculture, and Fishing, and Electricity, Gas and Water Supply due to low firm counts.

Appendix Table A1.3 Asset Composition by Industry, year ending March 2010

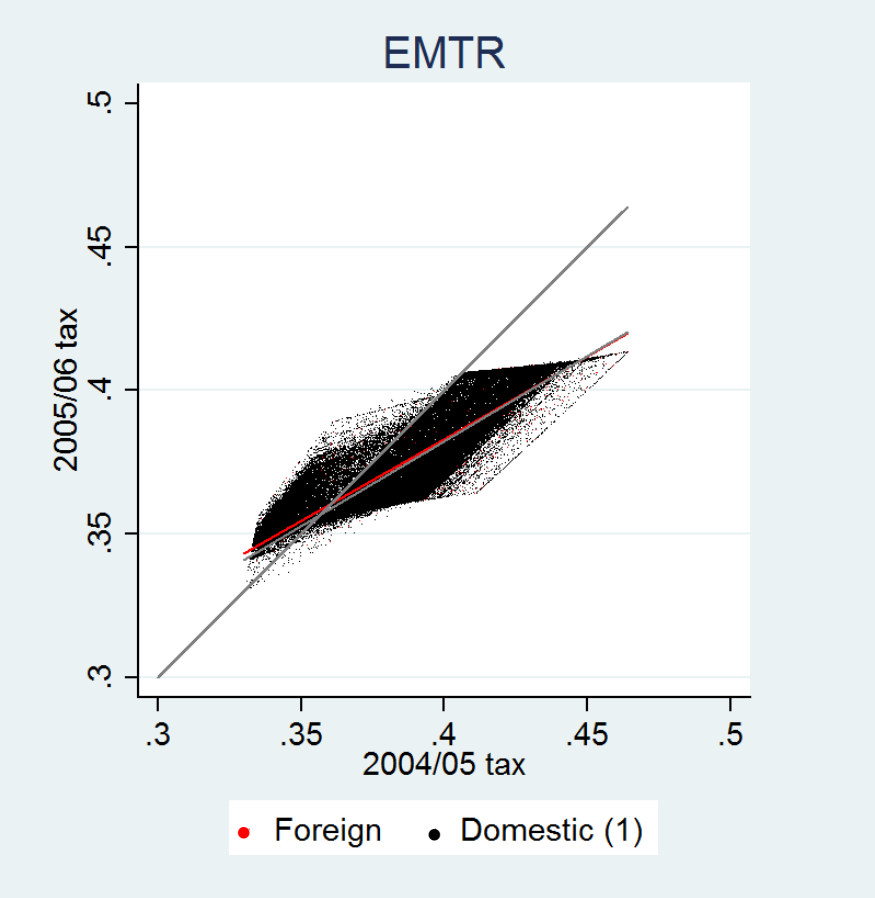
Asset shares	Means:							Standard Deviations:							Nos.
2010	land	build	furn	pme	comp	vehic	intang	land	build	furn	pme	comp	vehic	intang	
AgF	0.137	0.127	0.016	0.285	0.005	0.377	0.053	0.214	0.190	0.097	0.322	0.029	0.358	0.175	5,628
Mining	0.070	0.162	0.016	0.429	0.026	0.236	0.060	0.155	0.274	0.074	0.371	0.125	0.327	0.172	252
Manu	0.041	0.099	0.049	0.430	0.019	0.235	0.128	0.092	0.197	0.147	0.334	0.040	0.291	0.260	15,519
EGWS	0.032	0.290	0.051	0.295	0.083	0.185	0.064	0.105	0.411	0.150	0.370	0.227	0.321	0.163	99
Cons	0.027	0.066	0.027	0.251	0.014	0.536	0.078	0.076	0.178	0.100	0.279	0.025	0.348	0.218	31,347
Trade-W	0.040	0.078	0.117	0.242	0.052	0.319	0.151	0.104	0.179	0.238	0.284	0.088	0.347	0.293	9,765
Trade-R	0.049	0.092	0.095	0.291	0.032	0.203	0.238	0.109	0.191	0.216	0.299	0.050	0.294	0.328	26,262
Ac-Caf-Res	0.093	0.172	0.111	0.308	0.010	0.089	0.219	0.140	0.243	0.217	0.320	0.018	0.210	0.304	8,682
T&S	0.030	0.057	0.047	0.143	0.014	0.601	0.108	0.092	0.160	0.168	0.270	0.054	0.403	0.244	7,884
Comms	0.007	0.049	0.026	0.110	0.012	0.636	0.160	0.031	0.176	0.117	0.226	0.052	0.390	0.302	2,106
Fin-Ins	0.040	0.083	0.167	0.147	0.104	0.229	0.231	0.108	0.206	0.311	0.251	0.193	0.356	0.382	3,432
Prop-Bus	0.072	0.147	0.139	0.195	0.071	0.275	0.101	0.129	0.264	0.287	0.279	0.119	0.370	0.262	48,594
Educ	0.032	0.142	0.144	0.217	0.095	0.241	0.128	0.085	0.262	0.264	0.272	0.152	0.338	0.280	2,055
Health	0.033	0.100	0.138	0.257	0.040	0.244	0.189	0.081	0.220	0.266	0.309	0.065	0.349	0.329	10,539
Cult-Rec	0.039	0.125	0.100	0.332	0.079	0.260	0.065	0.106	0.257	0.238	0.341	0.164	0.339	0.203	5,454
Pers	0.034	0.082	0.099	0.321	0.032	0.241	0.190	0.083	0.192	0.223	0.316	0.071	0.316	0.304	8,031
Total	0.051	0.106	0.092	0.258	0.040	0.315	0.137	0.114	0.219	0.226	0.303	0.089	0.366	0.281	185,649

Firm counts random rounded base three in accordance with Statistics New Zealand confidentiality protocols.

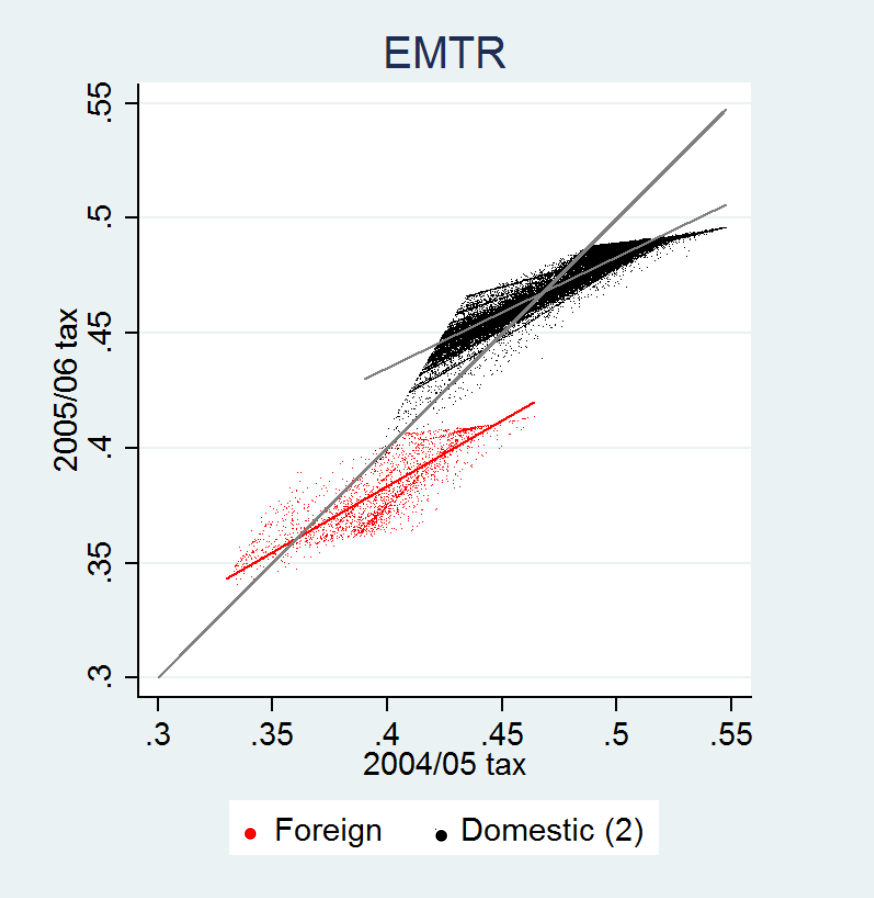
Appendix 2 – EMTR Changes in Association with 2005/06, 2010/11 and 2011/12 Tax Reforms

Appendix Figure 2.1 EMTR Responses to the 2005/06 Reforms

2005/06 Depreciation Reforms: EMTR



2005/06 Depreciation Reforms: EMTR^{S}

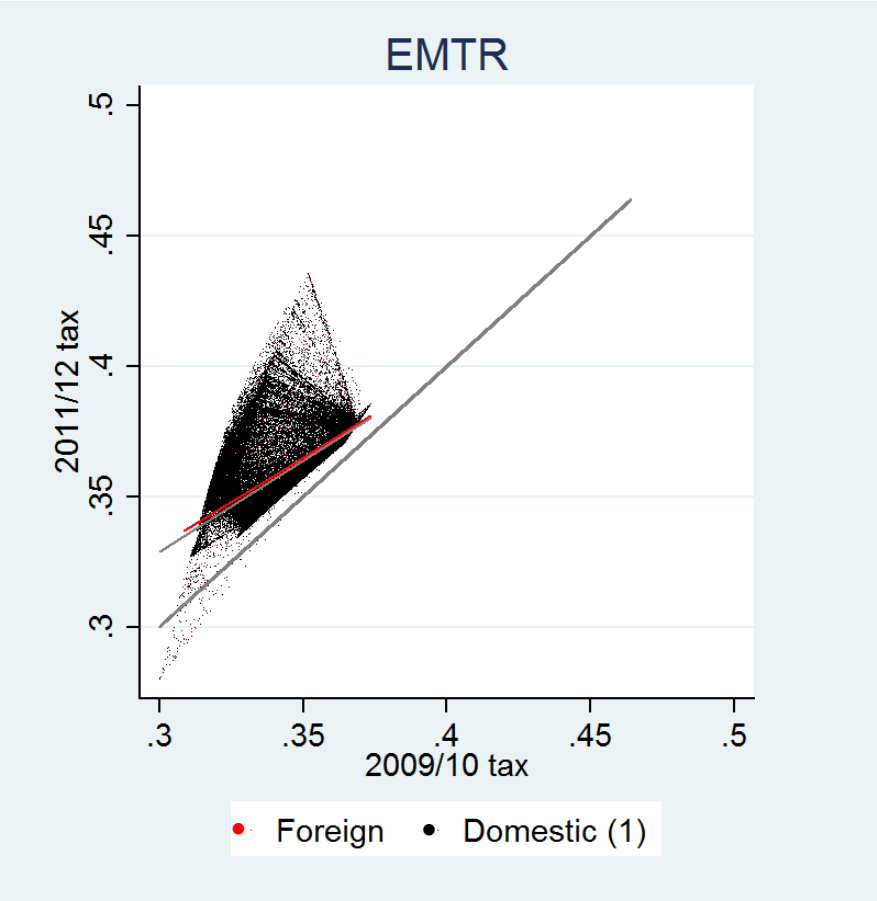


Counterfactual EMTRs calculated by applying 2004 and 2005 tax treatments to 2004 firm characteristics. Thick grey line is at 45 degrees (ie, represents no change in EMTR due to tax changes). Thin red and grey lines are fitted values reflecting the relationship between 2004 and 2005 EMTRs for foreign and domestically-owned firms respectively.

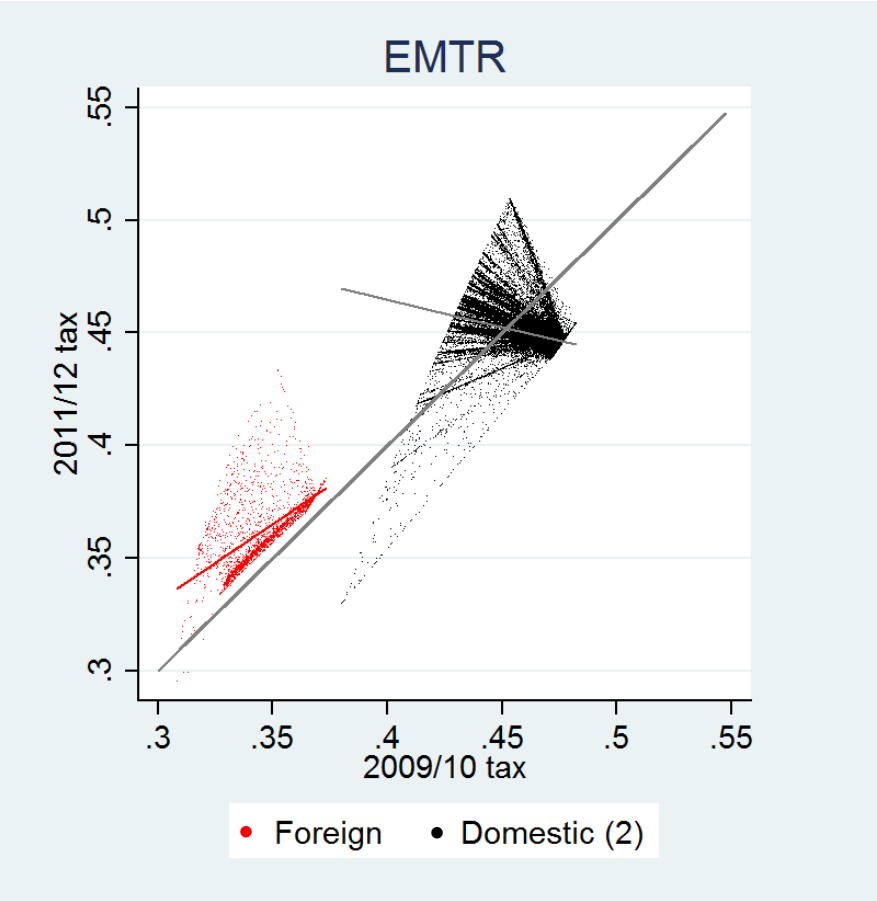
Appendix Figure 2.2 EMTR Responses to the 2010/11 and 2011/12 Reforms

2010/11 and 2011/12 Tax Reforms

EMTR



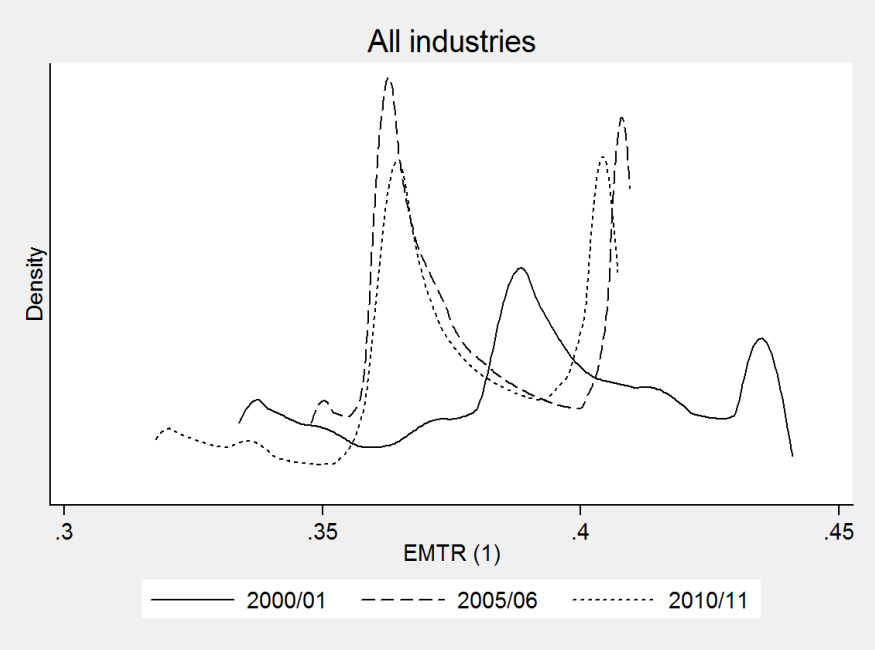
EMTR^{S}



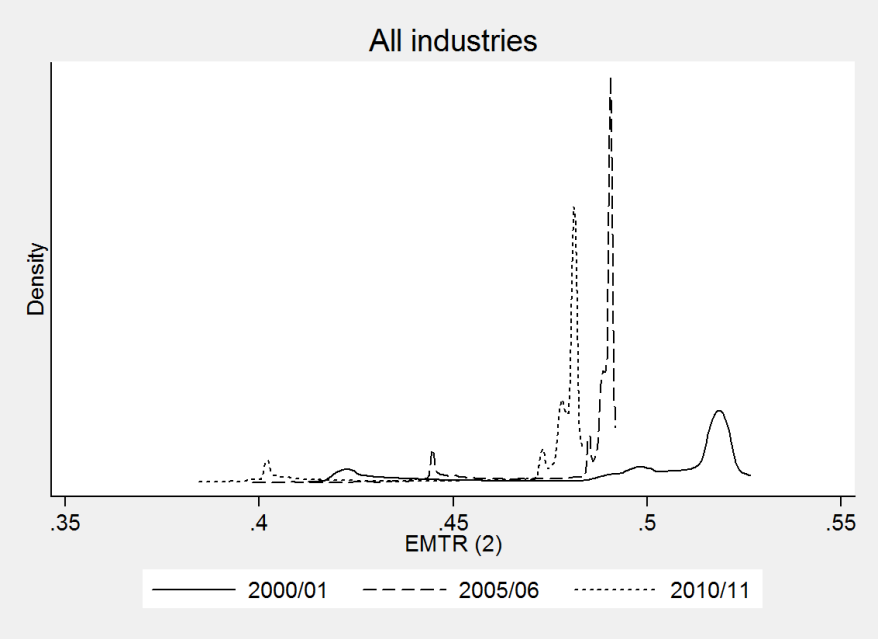
Counterfactual EMTRs calculated by applying 2010 and 2012 tax treatments to 2010 firm characteristics. Thick grey line is at 45 degrees (ie, represents no change in EMTR due to tax changes). Thin red and grey lines are fitted values reflecting the relationship between 2010 and 2012 EMTRs for foreign and domestically-owned firms respectively.

Appendix Figure 2.3 Shifts in EMTR Densities, 2000/01 to 2010/11

EMTR

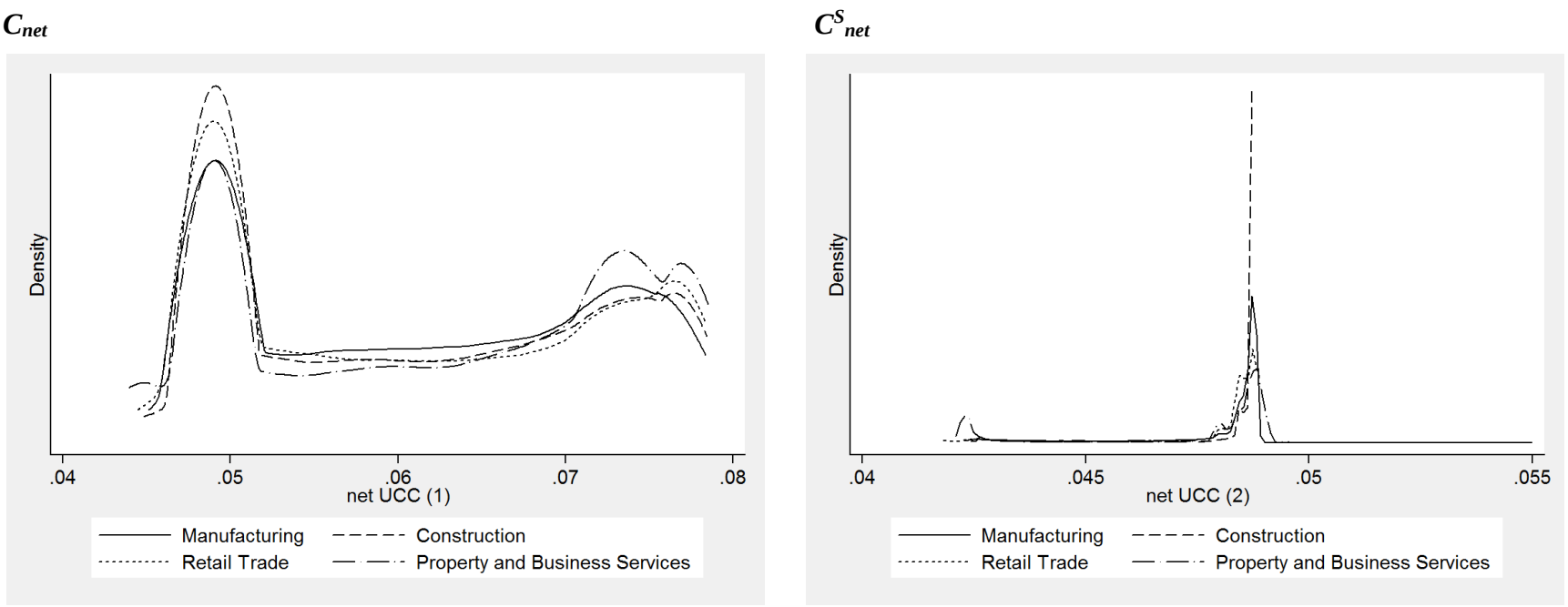


EMTR^{S}



Top and bottom 1 % trimmed in accordance with Statistics New Zealand confidentiality protocols.

Appendix Figure 2.4 Kernel Density Functions for C_{net} and C^S_{net}: Four Industries, 2010/11



Top and bottom 1% trimmed in accordance with Statistics New Zealand confidentiality protocols. Upper tail of C^S_{net} trimmed to allow distribution to be identifiable.

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