The impacts of intertemporal income shifting on estimates of the behavioural response to a tax reform: Evidence from New Zealand

by

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Abstract

On 7 December 2020, the New Zealand Parliament added a new 39 percent top marginal tax rate on personal income over $180,000. The aim of the policy was to increase tax revenue gathered from the top two percent of income earners. The introduction of the new increased top marginal tax rate changed the labour-leisure trade-off for New Zealand's top earners. In this thesis I estimate the so-called Elasticity of Taxable Income (ETI). Using the standard specification, I find an elasticity of 0.227 which is in line with contemporary New Zealand estimates. The eve of a tax reform creates a two-period discontinuity with a clear tax preferred side. This creates a strong incentive for intertemporal manipulation of income towards the lower marginal tax rate period. I show evidence of income acceleration, likely in the form of bonus payments and other discretionary payments being paid in March 2021, the preferred tax period. I find evidence that approximately 4.2 percent of taxpayers engaged in accelerating behaviour. This has implications for estimation of the ETI. Using a specification that removes the months with the highest level of income acceleration I find an estimate of the ETI of 0.139. The results are based on full population monthly wage and salary data provided to the Statistics New Zealand Integrated Data Infrastructure (IDI) by Inland Revenue New Zealand.

Attestation of Authorship

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university of other institution of higher learning.

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Disclaimer

These results are not official statistics. They have been created for research purposes from the Integrated Data Infrastructure (IDI) and Longitudinal Business Database (LBD) which are carefully managed by Stats NZ. For more information about the IDI and LBD please visit https://www.stats.govt.nz/integrated-data/

The opinions, findings, recommendations, and conclusions expressed in this thesis are those of the author, not Statistics NZ.

The results are based in part on tax data supplied by Inland Revenue to Statistics New Zealand under the Tax Administration Act 1994 for statistical purposes. Any discussion of data limitations or weaknesses is in the context of using the IDI for statistical purposes and is not related to the data's ability to support Inland Revenue's core operational requirements.

All observation counts have randomly rounded to base 3 and all percentages rounded to one decimal place in accordance with Statistics New Zealand's confidentiality rules.

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Introduction

Individuals respond to incentives. When tax rates change, the incentives to work change, leading to a response from taxpayers as they adjust to the new tax regime. With a tax increase, work becomes less attractive when compared to leisure, and we expect the behavioural response will decrease taxable income. Behavioural responses can include changing hours worked, decreased effort, or decreased willingness to work unpleasant roles that pay more such as night shift.

The Elasticity of Taxable Income (ETI) is a measure that captures all these behavioural responses and is a sufficient statistic for evaluating the deadweight loss of taxation otherwise known as the excess burden of taxation (Feldstein, 1999). The ETI is defined as the percent change in reported income for a one percent change in the net-of-tax rate (that is, one minus the tax rate). The decision to define the ETI in terms of change in the net-of-tax rate is for interpretation purposes. An increase in the net-of-tax rate leads to an increase in reported taxable income which is more intuitive that an increase in the tax rate leading to decrease in reported taxable income. The long run ETI is a key statistic for evaluating size of the behavioural response and therefore the revenue impacts of a change in tax rate.

In September 2020, the prospective Labour government announced their intention to implement a new top marginal tax rate of 39 percent on personal income over $180,000 if elected in the October 2020 election. The expressed aim of this tax reform was to raise revenue from the top two percent of income earners. They estimated that the reform would generate an additional $550 million a year in tax revenue (New Zealand Labour Party, 2020). Upon being re-elected in October 2020, the government honoured this promise, and the new tax was passed into law as the Taxation (Income Tax Rate and Other Amendments) Act 2020 on 7 December. The new rate would be effective from 1 April 2021, the start of the next New Zealand tax year.

Prior to the reform there had been growing calls for increases in taxation on the very wealthy to combat inequality. The top two percent were targeted as the government wished to raise revenue without imposing further taxes on low- and middle-income earners. The passing of the new top tax rate was not without its detractors. The main opposition party in New Zealand, National, is currently campaigning on repealing the rate, claiming that increases in taxes and government spending leave all taxpayers worse off (New Zealand National Party, 2022). Should they succeed in being elected in the 2023 election, the findings of this thesis will

be relevant as a similar (but reversed in direction) incentive to respond will become available upon the repeal of the top marginal tax rate.

The 2020 New Zealand tax reform provides a good opportunity to assess this behavioural response for three reasons. First, prior to the reform there had been no changes in tax rates since National lowered the top marginal tax rate to 33 percent in 2010. Thus, the years prior to the reform are free from behavioural responses from prior tax reforms allowing for clear identification of trends in the wage data. Second, only one change was made to the tax regime, which was the addition of a new top tax bracket. By only changing one bracket, all variation surrounding the reform can be attributed to this change. Third, the reform only impacts the top of the income distribution who, in theory, have similar responsiveness to each other.

Understanding the size of this response is a key metric for governments attempting to evaluate the revenue impacts that a tax reform will have. This is particularly true for reforms targeting those at the top of the income distribution. Previous studies have shown that those at the top of the income distribution are the most responsive to changes in marginal tax rates (Saez, 2002; Slemrod, 1998). Getting accurate estimates for the size of this response is difficult due to factors that may distort the observed response in taxable income.

One such factor is intertemporal income shifting. When a tax reform occurs, a discontinuity occurs, with one period being a comparatively high tax period and the other comparatively low. Taxpayers impacted by the tax reform have an incentive to maximize their post-tax income by shifting income into the low tax period. Prior to the advent of monthly wage and salary data, detecting this movement of income was more difficult. Goolsbee (2000) found evidence of income shifting using annual data. More recently however, researchers have begun to utilize administrative level data from government sources which allows for monthly observations of wage and salary data. Using monthly data Kreiner et al. (2016) showed that almost all of the behavioural response surrounding a 2010 Danish tax reform that reduced tax rates could be attributed to income shifting.

The 2020 tax reform provides the opportunity to assess the level of income shifting that occurs in New Zealand. It also provides a chance to assess how a tax increase, rather than decrease impacts income shifting. This change in direction impacts the constraints for both taxpayers and employers looking to engage in income shifting. With a tax decrease, individuals wish to delay payment until the low tax period post reform. This requires individuals to have the liquidity to meet their financial obligations for a month or two without payment. Conversely, employers are able to maintain liquidity and defer payment at little cost to themselves. With a

tax increase the burdens of these constraints reverse. The taxpayer has no requirement for liquidity, as they are being paid early. The employer is now being asked to pay out ahead of schedule, possibly for work yet to be done. Intuition would seem to suggest that income shifting would be more prevalent with a tax decrease, where the liquidity burden lies on the individual who will directly benefit from the lowered tax rate. With a tax increase this burden lies on the employer who will see no direct benefit from paying employees early.

Therefore, the research question I seek to answer is: *what is the impact of intertemporal income shifting on estimates of the ETI following the 2020 New Zealand tax reform?* Using administrative level data provided by the Statistics New Zealand Integrated Data Infrastructure (IDI) I use monthly wage and salary data provided by Inland Revenue Department (IRD) to the IDI to identify individuals who accelerate income out of tax year 2022 and into tax year 2021. I do this by identifying individuals with abnormally high income growth rates immediately prior to the tax reform. I find that approximately 6 percent of taxpayers affected by the new top marginal tax rate accelerate income into tax year 2021.

Once I identify income accelerators, I assess the impact these individuals have on estimates of the ETI. Starting with a standard difference-in-differences approach as laid out in Feldstein (1995), I run a regression on the full population sample and find an ETI of 0.227. I then remove the months where acceleration has occurred from the sample and re-estimate the ETI. I find the estimate of the ETI dropped to 0.139. The difference in ETI estimates shows income acceleration may hide the true size of the behavioural response and represents an $86 million a year difference in tax revenue collected.

I contribute to the literature in two ways. First, I quantify the size of intertemporal wage shifting in the New Zealand context and the impacts it has on tax revenue. Second, I provide current short run estimates of the ETI for the top two percent of income earners in New Zealand, who are the most responsive to changes in tax rates. I account for the distortionary effects of income shifting on estimates of the ETI and provide a more accurate picture of the long run ETI.

The remainder of this thesis is structured as follows. Section 2 examines the extensive literature surrounding the elasticity of taxable income, from its beginnings in labour supply responses through the advent of the elasticity of taxable income all the way to analysis of income shifting behaviour; Section 3 lays out the New Zealand tax system and the 2020 tax reform; Section 4 examines the theoretical framework surrounding responses to changes in taxation; Section 5 describes the data and defines the population of interest; Section 6 details

the empirical estimation strategy; Section 7 presents the results and discusses the implications they have on tax policy; and Section 8 concludes.

Literature review

The first section shows the importance from a practical policy point-of-view of the ETI in evaluating the policy counter-factual to a tax reform. I then follow the literature chronologically from its start in the economics of labour supply through to the introduction of the elasticity of taxable income. The elasticity of taxable income literature is followed from its beginnings using panel data and the issues surrounding estimation that subsequent studies have attempted to mitigate. I then look at studies focussed on New Zealand estimates of the ETI, broken down by tax reform. Finally, I look at income shifting surrounding a tax reform, which is a short-term response that can confound estimates of the long-term response, and the impacts that this has on the estimation of the ETI.

Tax Policy and the ETI

In the last 35 years, there have been six tax reforms in New Zealand that have changed personal income tax rates. The first, in 1988, lowered the top marginal tax rate from 66 percent to 48 percent. The next year this was lowered again to 33 percent. In 2000 this top rate was raised to 39 percent. When the government changed in 2008 the top marginal rate was lowered to 38 percent in 2009 and then lowered again to 33 percent in 2010. The most recent tax change in 2020 created a new top bracket with a marginal tax rate of 39 percent.

Changes in tax rates cause changes in government revenue. For each reform the overall change in revenue dR can be broken into two parts. The first is the so-called mechanical response dM which is the change in revenue absent any behavioural response, which moves in the same direction as the tax change. The second is the behavioural response dB which encompasses all the behavioural responses to the tax change, for example, changing hours worked, which moves in the opposite direction to the tax change. By dividing the behavioural response by the mechanical response, the degree to which the behavioural response offsets the mechanical change in revenue can be seen. This value *s* can be defined as

$$s = -\frac{dB}{dM}$$

Utilizing the specification for dM and dB found in Saez et al. (2012),

$$s = \frac{\tau}{(1-\tau)} ea \qquad (1)$$

where τ is the marginal tax rate, e is the elasticity of taxable income (ETI) and a which is a measure of the thinness of the top tail of the income distribution. A value of s of one would be the case where the behavioural response exactly cancels out the mechanical response and so the change in revenue would be zero. How this degree of self-financing varies with differing estimates of e can be seen in the table below. In the benchmark scenario, the behavioural response is approximately half the size of the mechanical effect. In the low scenario it is only 14.78 percent of the mechanical response. In the high scenario however, the behavioural response is 77.28 percent larger than mechanical effect, meaning that by increasing the marginal tax rate, tax revenue would drop rather than increase.

Table 1. Comparison of degrees of self-financing dependent on estimates of the ETI

	τ	a	e	s
Benchmark	0.39	2.31	0.35	0.51
Low	0.39	2.31	0.1	0.14
High	0.39	2.31	1.2	1.77

Notes: The table show the impact of Elasticity of Taxable Income (ETI) estimates ***(e)*** on the degree of self-financing (***s***) using the formula described in (1). $\boldsymbol{\tau}$ represents the top marginal tax rate. $\boldsymbol{\alpha}$ is calculated using the formula $\frac{\bar{z}}{\bar{z}-180000}$ where $\bar{z}$ is the average annual income of those earning more than 180,000. The Benchmark scenario uses an ETI estimate from the midpoint of estimates in the literature. The Low scenario uses an ETI estimate from the low end of the estimates in the literature. The High scenario uses an ETI estimate from the high side of the literature.

Source: New Zealand Inland Revenue Department.

Misunderstanding the size of the behavioural response that a tax change would elicit would have strong policy implications, as tax changes designed to increase government revenue may not be as effective as predicted or in extreme cases, have the opposite effect and lead to a decrease in tax revenue.

Labour supply responses to changes in the marginal tax rate

Prior to the introduction of the elasticity of taxable income, elasticity of labour supply was the preferred measure to quantify the impact of tax changes on the working population. An individual would maximize a utility function $u(c,l)$ where c is disposable income, which equals consumption in a single period model, and l is labour supply. This labour supply was measured in hours of work. Hours spent working cannot be spent on leisure activities. As such labour supply models express the trade-off between work and leisure. When tax rates change, the incentives around each hour of work change, and so the chosen level of labour supply should change. The empirical literature on how labour supply responds to incentives is extensive.

An increase in taxation reduces the incentive to work by decreasing the return for each hour worked. Initial studies focussed on how taxation impacted labour supply at both the extensive margin, that is, whether to work at all, and the intensive margin, that is conditional on working, how many hours to work. These studies started by focussing on secondary earners, historically women, as they participate less in the labour market, and when they do participate, work fewer hours. The 1960's and 70's began to see more secondary earners join the labour market. It was thought that if these secondary earners could be drawn into the labour market at the same rate as primary earners, economic growth could be unlocked. There was also the belief that due to the more dispersed distribution of women's hours worked, that they would be more responsive to changes in tax rates. The studies then moved to primary earners, historically men, to assess the impact of tax changes on primary earner labour supply. Finally, these studies shifted to households, as evidence began to emerge that decisions regarding hours worked were being made as households rather than individuals.

Arellano and Meghir (1992); Blomquist and Hansson-Brusewitz (1990) and Blundell et al. (1998), amongst others, estimated elasticities for married women. Married rather than single women were used, as they were likely to be secondary earners A wide range of elasticities have been found, although they are all positive, and very few were greater than one. Elasticities of greater than one represents a greater than one percent change in hours worked for a one percent change in tax rate. Those using annual hours worked rather than monthly or weekly were higher and clustered around one. That annual hours worked yield a higher estimate of the elasticity than the shorter periods is expected as there are more avenues to adjust hours worked on an annual basis such as adjust weeks worked as well as hours, than adjusting on a weekly basis. The wide range in estimates indicate that estimation is very sensitive to the specification used. Mroz (1987) reviewed many of these early results by applying the methodologies used to a single dataset. Different approaches led to a range of estimated elasticities, highlighting the sensitivity of the estimates to the choice of specification.

Male labour supply elasticities, as a proxy for primary earners, have also seen extensive investigation. The Mirlees Review, commissioned by the British government prior to the 2011 tax reform, summarised these studies. With most working age males already working fulltime, adjustment on the extensive margin becomes less common than for females. Whilst there is some variability in hours worked, in countries such as the United Kingdom there is a distinct lack of individuals working below 35 hours a week. The United States also experiences concentrations of annual hours worked in full-time full year work. Despite this, most studies ignore the problems this poses empirically and treat hours worked as continuous. Unlike labour supply elasticities for women, estimates of the sensitivity of hours worked for males are

consistently very low. As such male hour adjustments can be ignored when considering the welfare impacts of a tax change. (Mirrlees, 2011)

Whilst these earlier studies focussed on the individual's choice of labour supply, there is plenty of evidence that this decision is made on a household basis. In the United States taxation is assessed on a household level and as such optimizations regarding optimal labour supply must be made by all tax paying members in a household. Eissa and Hoynes (2004) investigated the expansion of the earned income tax credit (EITC) in the United States which is a cash-transfer program for lower-income families with children. The EITC was increased to encourage greater participation in the workforce whilst providing additional support to lower income families. In response to the expansion of the EITC, both unmarried women and married men increased their participation in the labour force. Married women, however, reduced their labour supply. This reduction in hours worked was five times greater than the corresponding increase in married men. This means that in effect, the EITC was subsidizing the secondary earner in a family, often the woman, to stay at home rather than enter the workforce.

From hours worked responses to the Elasticity of Taxable Income

Lindsey (1987) was among the first to explore the possibility that marginal tax rates and tax revenue may be inversely related. The paper aimed to estimate the behavioural response of taxpayers to changes in personal tax rates and from that predict likely revenue maximizing rates for personal income taxation. Utilizing the 1981 tax recovery act that provided large tax cuts on personal income over three years and an immediate drop from 70 percent to 50 percent at the top bracket. Lindsey (1987) found elasticities between 0.728 for taxpayers earning $50,000 and 2.003 for those earning $1,000,000. From these elasticities Lindsey estimated a revenue maximising tax rate of around 35 percent for federal taxes and an overall rate of approximately 40 percent.

While Lindsey (1987) discussed revenue maximizing rates, he noted that the revenue maximizing rate was unlikely to be the socially optimal rate due to the presence of deadweight loss due to taxation. Feldstein (1995) showed that if a government's interest was the impact on government revenue of a tax change, or the deadweight loss associated with a change in taxes, then hours at the margin was only one of the responses that needed to be considered. Instead of estimating each response individually, he proposed a focus on taxable income, as this would capture all marginal responses required. Behavioural responses that could impact taxable income without

impacting hours worked include shifting from day shift to night shift or putting in more effort whilst at work. It was felt that the low elasticities did not accurately reflect the observed responses that changes in taxation had yielded. As such a measure that encompassed more than just labour supply responses was required. Individuals would now maximize a utility function $u(c,z)$, with c being disposable income or $(1-\tau)z$, which is still equal to consumption in the one period model, and z being taxable income. Under certain strong assumptions the ETI could be used to calculate the welfare impacts of a tax change.

Feldstein (1995) measured changes in taxable income in relation to changes in the net-of-tax rate, i.e., the amount remaining once tax has been removed. Utilizing the 1986 tax reform, which broadened the tax base whilst lowering high marginal tax rates in the United States, Feldstein investigated the observed changes in taxable income. A non-stratified random sample of tax returns provided by the US Treasury Department from 1985, which is before the tax reform could be anticipated, until 1988, two years after the reform had taken place, was used to form the sample population. Utilizing a difference-in-differences approach he estimated an elasticity of 1.1 for high income earners, and 3.05 for the highest income earners. This implies that given a 1 percentage point increase in net-of-tax rate (1-τ) taxable income increases by 1.1 percent.

Following his 1995 paper, Feldstein published another seminal paper in 1999. Feldstein (1999) showed that under certain assumptions, the ETI was able to be used to calculate the deadweight loss in welfare due to an increase in taxation. These assumptions are that there are no income effects, and that reductions in reported income have no other effect on tax revenue. This assessment would lead to the designation of ETI as a sufficient statistic when assessing the efficiency costs of a tax reform.

Auten and Carroll (1999) utilized an instrumental variable regression approach to assess the 1986 US tax reform. They use a panel of individual income tax returns that consist of the same taxpayers in both 1985, prior to the reform and 1989, following it. The panel data oversamples high income taxpayers and as such they weight their results accordingly. They regress the change in the logarithm of taxable income against the change in the logarithm of the net-of-tax rate as well as additional control variables such as geographic location and sector. Using a weighted least squares estimate, to account for the over sampling of high-income earners and to account for individuals who experienced income declines over the period they find an ETI estimate of 0.67.

Gruber and Saez (2002) improved upon Feldstein (1995) and (1999) in three ways. Firstly, rather than simply using a single year prior and post reform they use multiple years which allow them to control for the relationship between income changes and lagged income levels. Secondly their

empirical framework allowed for the decomposition of behavioural responses into substitution and income effects. And thirdly because they assessed a broad set of reforms that impacted more than just taxpayers at the top of the income distribution, they could assess variation in the ETI across the income distribution. They find an overall ETI of 0.4, far lower than the estimates found by Feldstein. High income earners are responsible for driving this estimate with an ETI of 0.57 for individuals earning more than $100,000, with other lower income groups having ETI's of less than one third of that. Controls for income effects are tested, however income effects are found to be very small and highly statistically insignificant and as such can be ignored.

Subsequent research using other tax reforms have found that the ETI is likely far smaller, typically between 0 and 0.3 (Saez, 2002; Slemrod, 1998) for most of the income distribution, but larger, between 0.5 and 1.5, for those in the top one percent of the income distribution. While some of the difference between the two groups can be attributed to responses in work hours, Slemrod (1995) argued that some of the sensitivity in elasticity caused by high incomes is due to tax avoidance and evasion. Many of the methods used to avoid or evade tax, such as the use of offshore accounts, or untaxed fringe benefits are unavailable except to high end income earners. This helps to explain some of the difference in elasticities in taxable income between high income earners and the rest.

Saez et al. (2012) provide a detailed overview of the large volume of ETI literature that had emerged by 2012. They clearly lay out a theoretical framework and the assumptions under which ETI can be used as a sufficient statistic for tax rate analysis with regards to efficiency and optimality. They break down changes in revenue incurred by a tax change into the mechanical effect, defined as the change in revenue due to a tax change absent any behavioural response, and the behavioural effect which captures changes in taxable income induced by the tax change. This allows for improved welfare analysis of tax changes as the exact marginal deadweight burden can be calculated under the standard Feldstein (1999) assumptions. The second assumption, that reductions in reported income have no other effect on tax revenue, is problematic as in reality reductions in taxable income are in part due to a shift from taxable personal income toward other taxable income sources such as deferred compensation or corporate income, rather than simply a change in labour supply. The standard model also does not account for the presence of deductions from taxable income which are particularly prevalent in the United States.

Saez et al. (2012) conclude that the use of the ETI as a sufficient statistic for welfare analysis, without enquiring into the nature of the behavioural response, is found wanting. This is for two major reasons. Firstly, that the extent of fiscal externalities occurring, e.g., shifting taxable income from one tax base to another, or the same tax base, but at a different time, impact the

welfare relevance of the ETI. Likewise, the use of common deductions, such as charitable donations require the ETI to be adjusted for use in welfare analysis. Secondly, whilst there has been compelling evidence that those at the top end of the income distribution demonstrate strong behavioural responses to tax changes, these responses have largely been driven by timing and avoidance. There is little evidence of long-term real changes in behaviour. For policy issues such as broadening of tax bases and eliminating avoidance opportunities, understanding the type of behavioural response becomes critical. They also find that the empirical methods are most convincing when used to estimate short-term responses to tax rate changes, although anticipated versus unanticipated tax changes should be carefully distinguished. They believe long term estimates suffer from difficult identification issues and as such there are no convincing long-term elasticities.

Mean reversion, which is the tendency for earnings at either high or low levels to return to the long run mean over time, is one of the long-standing issues in the ETI literature, particularly for studies focussed on the United States. Weber (2014) demonstrated that many of the standard controls used by instrumental variable approaches were not effective in the presence of mean reversion. Rather than attempt to simultaneously rectify mean reversion and heterogeneous income trends, Weber (2014) focusses on the issue of mean reversion. Most studies regress the log change of taxable income on the log change in the net-of-tax rate. Without use of an instrument the log change in net-of-tax rate is endogenous as it is a function of taxable income. Prior to Weber (2014) the preferred instrument was the value of the change in net-of-tax rate from the tax reform if individuals earned their base-year income. This was typically used as early tax return data sets did not have rich demographic data from which an alternative instrument could be provided. Instead of using a single lag, Weber (2014) shows that an instrument lagged three or four periods is more likely to be exogenous than the traditionally lagged single period, and that exogeneity increases as the instrument lags further from the initial period.

Another long-standing issue in the ETI literature is the difficulty in overcoming biases from nontax changes in inequality. Some countries have seen an increase in top income shares driven by globalization and skill-biased progress. When assessing the impact of tax reforms that target the top of the income distribution, these factors may result in an upward bias in elasticity estimates. Kleven and Schultz (2014) address this problem by using data from Denmark. Unlike elsewhere, the income distribution in Denmark has remained relatively stable over time. This stability over time eliminates bias from nontax changes in inequality. They show graphical evidence of taxable income responses. The panel regression evidence they provide is also robust to specification, unlike earlier studies based in the United States that were fragile to specification. They find an ETI of 0.2 for the full population. They conclude that a tax system with

a broad base and extensive use of information reporting can impose higher marginal tax rates with only modest behavioural responses, unlike earlier studies based in the United States who expected large behavioural responses on large marginal tax rates.

Recently Jakobsen and Søgaard (2022) have revisited the methodology for estimating the ETI. Traditional estimation of the ETI relies on the assumption that differences in income trends across the income distribution remain constant in the absence of tax reforms. They validate this assumption by comparing the changes in income over time in untreated parts of the income distribution. Instead of the standard difference-in-differences they utilize a difference-in-difference-in-differences approach. They run a difference-in-differences in a pre-reform period, to correct for underlying differences in income trends. They then subtract this from the reform difference-in-differences. They find average ETI's of around 0.2. Analysing both the 2004 and 2009-10 Danish tax reforms they conclude that only results from the 09-10 reform are likely to be causal, whilst ETI estimates from the 2004 reform are likely to be driven by changes in trend differentials within the control group, likely unrelated to the reform.

New Zealand tax reforms and ETI estimates

There are five papers investigating the ETI in New Zealand. One uses the 1986 New Zealand tax reform three use the 2001 New Zealand tax reform, with the final taking a broader approach looking at changes in income over time from 2001 to 2017.

The 1986 New Zealand tax reform converted five tax brackets into three brackets, with all taxpayers seeing lower tax rates. High income taxpayers experienced the largest reductions, with an 18-percentage point fall for all those earning over $38,000. Middle income earners also saw a large decrease, with those earning between $25,001 and $30,000 seeing a 15.1 percentage point decrease. Thomas (2012) utilized the methodology of Auten and Carroll (1999) to estimate the ETI and finds a significant behavioural response. The data used is a panel of tax returns created by matching taxpayers sampled in an IRD dataset in the 1986 and 1988 tax years. The dataset consists of stratified random samples of the tax returns from 1982-90.

Thomas (2012) finds a range of ETI estimates between 0.34 to 0.52, in line with estimates from the United States, Canada and Sweden at the time. The smaller variation in the newer estimates, when compared to the early ETI estimates such as those in Feldstein (1995), suggest that tax structure is likely to influence elasticities. This may be due to early estimates not accounting for non-tax factors on taxable income. Early estimates focussing on 1980's tax reforms looked at

periods where tax bases were narrow. This narrowness may have influenced the responsiveness of capital income. By broadening the tax base since 1988, the ETI in New Zealand is likely to have been moderated. Even so, the responsiveness found was well in excess of labour supply estimates, which would suggest that the welfare cost of tax changes in New Zealand were higher than previously thought.

Claus et al. (2012), Carey et al. (2015) and Creedy et al. (2018) all utilize the 2001 New Zealand tax reforms to estimate the ETI in New Zealand. The 2001 reform saw the introduction of a new top marginal tax rate of 39 percent on all income above $60,000. The reform contained both tax rate increases, 16.7 percentage points for the top tax rate, and decreases, 3.5 percentage points and 13.4 percentage points for lower tax brackets.

The database used by all three studies is an administrative IRD database covering the period 1994-2009. This dataset was constructed by the IRD using a random sample of tax returns over this period. Each return represents an individual's earnings and associated tax liability, so they include welfare benefits administered to individuals and family assistance provided to a nominated parent, but not assistance provided to both parents jointly. Only taxpayers aged between 25-64 for the full duration of the sample period are included.

Claus et al. (2012) focus on the introduction of the new top marginal tax rate of 39 percent in 2001. They estimate the ETI using the share of income in the affected group in the pre- and post-2001 tax reform periods. Using summary data from the database indicated above, they estimate the ETI across 4 different post reform years, 2001 to 2004. They find elasticities between 0.6 and 1 for the top decile, and between 0.9 and 2.2 for the top percentile. They note that taxable income fell sharply from 2000 to 2001, across the tax reform threshold. As such the elasticity is estimated to be higher using 2001 than later years. Negligible values for ETI were found for the 9^{th} and lower deciles which they attribute to fewer opportunities to shift or conceal income. Men are shown to have a higher ETI than women at the top decile and top percentile level. Rather than a difference in response rate between men and women, this is also likely driven by differences in income level, with the average income of top decile men around 1.63 times higher than top decile women. For this new top marginal tax rate, they concluded that the welfare cost associated with an extra dollar of tax revenue was well in excess of a dollar.

Carey et al. (2015) take an instrumental variables approach to estimating the ETI. Using the tax rate associated with expected income as the instrument they find an ETI of 0.575. Their use of an intercept shift dummy allows for observed income changes to differ for those taxpayers with income sources other than wage and salary, however it cannot capture the potential for different tax rate responsiveness by those with other income. Use of this dummy suggests that

the ETI for those without other income is smaller (0.414) and the interaction term coefficient is 0.495 and significant, which indicates that the ETI for those with only wage and salary income is approximately half of that for those with other income sources.

Creedy et al. (2018) investigate income effects and what impacts they have on ETI estimates. The 2001 tax reform was announced far in advance, and as such use of incomes from 2000 and immediately following the reform may generate misleading results. As such they use income data from 1999 and 2002.They utilize an instrumental variables approach and compare these with OLS estimates where expected tax rate is used as a proxy. Their methodology provides a point estimate of the ETI to be 0.375 and suggest that the magnitude of the taxable income response is sensitive to the methodology chosen even if parameter estimates for other variables are largely unaffected.

The final New Zealand based paper does not cover a single tax reform, but instead covers the period 2001 to 2017. Alinaghi et al. (2021) use a bunching methodology[1] to assess the ETI in New Zealand over this period. Using administrative data provided by the Statistics New Zealand Integrated Data Infrastructure, they find an overall ETI for the top threshold of between 0.2 and 0.3, in line with other contemporary estimates. They find evidence of large responses for self-employed taxpayers, with ETI estimates of around 0.8 and 1.0, which contrasts sharply with the estimates for wage earners of between 0 and 0.15. Those in the penultimate tax bracket show far lower ETI estimates, consistent with other studies who also find that taxpayer responsiveness, in terms of both income shifting and avoidance, decreases as you move down the income distribution.

A hierarchy of responses

Slemrod (1992) introduces a hierarchy of behavioural responses to tax changes. At the top of this hierarchy and thus most responsive to tax changes is the timing of economic transactions. These adjustments in timing are available when tax rates change by ensuring transactions fall in the period with the lower assessed tax rate. Below this in responsiveness is accounting and financial responses which is the repackaging and reshuffling of claims in response to tax changes. The lowest level of this hierarchy is the real decisions of firms and individuals, such as hours of labour supplied, which demonstrate the lowest level of responsiveness. Being able to separate

[1] The bunching methodology utilized tends to produce lower estimates of the ETI than standard difference-in-differences. For more information see Saez (2010) and Chetty et al. (2011)

out these various responses from each other allows researchers to better understand the impact of tax reforms.

Each time a reform occurs, there is an opportunity for an individual to maximize their income by responding to incoming change, by say changing the timing on when stock options are paid out, or by shifting income from the high tax period into the low tax period. Policy makers would benefit from the ability to separate the short-term, one-off responses that occur each time the tax policy changes, and the more persistent long-term shifts in labour supply. In the long run shifting is only a small issue compared to the size of the long-term response, but it is repeatable each time a reform occurs.

Auerbach and Slemrod (1997) in their assessment of the 1986 United States tax reform show evidence of extensive shifting in the timing of capital gains. With the reform widely anticipated prior to being implemented, taxpayers had plenty of time to plan and optimize their income. The 1986 Tax reform changed how capital gains were assessed, the impact of which effectively increased the tax paid on capital gains by a factor of two and a half. In response to this, realized long term capital gains increased sharply in 1986 increasing from $167 billion to $322.2 billion before returning down to $137.4 billion and $154 billion in 1987 and 1988 respectively. The opposite was seen to be true for short term capital gains, which were facing an effective tax rate decrease with the implementation of the reform. As such, short term gains fell markedly in the final few months of 1986, only to spike in early 1987. The surrounding literature concluded that for capital gains, timing effects are far larger than permanent ones in the face of a tax change.

Goolsbee (2000) focusses on high-income earners who had been shown to have high responsiveness to changes in tax rates when compared to the rest of the income distribution. Using compensation data for several thousand corporate executives in the United States, Goolsbee (2000) investigates the response to a 1993 tax reform that raised marginal tax rates for those earning more than $140,000 a year. These tax changes were announced well in advance of implementation and as such, taxpayers had plenty of time to structure their finances to best minimize their tax liability.

Goolsbee (2000) finds that that much of the short-run elasticity is concentrated at the very high end of the distribution, with the low group demonstrating an ETI of 0.39 and the top group an ETI of 2.21. The non-transitory elasticities are very similar for both groups, between 0.35 and 0.55 and not significantly different from each other or zero. What separates the groups then is the timing of compensation, such as stock options, especially as the long-run ETI estimates for the groups are approximately equal. When split into groups of executives who receive stock options as compensation versus those who do not, the only significant response was from those

receiving stock options, and what response there was appeared to be transitory. When stock option income was excluded, both groups had low short run elasticity indicating that taxes had little impact on income in the longer term.

With timing effects having such a large impact on ETI estimates, earlier studies may have overestimated the welfare impacts of increased progressivity in tax systems. Timing of stock option income can lead to dramatic shifts of income surrounding the boundary of a tax change; however, these do not indicate a permanent shift in taxable income. Once the shifting is done, taxable income experiences more limited changes and the deadweight loss incurred is likely to be less than initially estimated.

Kreiner et al. (2016) investigate intertemporal wage shifting in Denmark following a tax reform in 2010. They use full administrative level data, provided by the tax authority. The data provided was monthly in frequency, rather than yearly that had been used prior. They find an overall ETI of 0.1, which is in line with other contemporary estimates made using yearly samples. This increases to 0.25 for the top 1 percent of earners. Exploiting the monthly nature of the data Kreiner et al. (2016) provide additional insights into the ETI. By removing the months of December and January from the ETI estimation, the ETI falls to close to zero, indicating that almost all of the short term ETI comes from intertemporal wage shifting. Adjusting their analysis to a three-year window, one year income pre-reform, two after, the baseline ETI drops further. They also find evidence on income shifting amongst the highest income earners, with almost 8 percent of top income earners (99^{th} percentile) shifting income to the low tax period.

I contribute to the literature in both the New Zealand and international context. In the New Zealand context, I provide an estimate of the ETI using full New Zealand population data and modern difference-in-differences methodology while following advances in the modern literature surrounding income shifting. Internationally, I present further evidence of the impact of intertemporal movement of income on estimates of the ETI and build on Kreiner et al. (2016) by providing evidence in the form of standard growth rates, rather than their non-standard specification.

The New Zealand Tax System

The New Zealand tax system prior to the 2020 tax reform

New Zealand employs a progressive tax system for personal income which operates on a broad-base, low-rate framework. The broad base approach means that there are few exemptions and concessions on tax (Inland Revenue [IRD], 2017). The lack of exemptions and concessions make compliance costs lower when compared to narrow base approaches. There is no tax-free threshold.

Prior to the 2020 tax reform the New Zealand income tax system consisted of four tax brackets for personal income, each with a progressively higher marginal tax rate. The first $14,000 of income is taxed at 10.5 percent. Between $14,001 and $48,000 personal income is taxed at 17.5 percent. From $48,001 to $70,000 the marginal tax rate is 30 percent. The final bracket, which includes all personal income above $70,001 was taxed at 33 percent. These brackets are fixed and do not adjust with inflation. New Zealand also has no state or municipal income taxes; residents experience the same income tax rates regardless of where they live in the country.

Taxable income in New Zealand includes wage and salary earnings, self-employment income, dividends, interest and rental income. Whilst there are no capital gains taxes, certain specific items, such as sales of patents are classified as income rather than capital gain. Tax is assessed at the individual level; however social assistance payments are assessed on a household level.

Wage and salary payments for employees are taxed under a Pay As You Earn (PAYE) system. Under PAYE employers are responsible for remitting the income tax of their employees and this is deducted from each pay packet along with any other deductions, such as student loan payments. The remainder is then paid to the employee. The employer then pays this deduction to the IRD directly. Under current New Zealand law, PAYE returns must be filed electronically with the IRD within two working days of each payday.

Transfer payments such as pensions (including NZ superannuation[2] payments) and unemployment are taxable.

[2] Superannuation is a government pension paid fortnightly to all eligible recipients. To be eligible for Superannuation an individual must meet the following criteria. They must be aged 65 or over, either a New Zealand citizen, New Zealand permanent resident or hold a residence class visa and must have lived in New Zealand for at least 10 years since age 20, including at least five years since turning 50. Superannuation is paid at its full value regardless of employment status.

Trusts are taxed at a flat rate of 33 percent on all income earned by the trust. Income distributed to beneficiaries is taxed at their normal income tax rates. Trustees must pay tax on behalf of the beneficiary for income allocated to that beneficiary. The beneficiary can then claim a tax credit for the tax paid on their behalf. Unlike overseas where trusts are mainly used by charities, family trusts are a relatively common tax vehicle in New Zealand. A law commission report in 2010 suggested that New Zealand had one of the highest rates of personal trust use in the world. Conservative estimates put the number at one per every 18 people in New Zealand compared to one for every 294 in the United Kingdom (Law Commission, 2010). While there is no register of trusts in New Zealand, the Ministry of Justice in 2020 estimated that there were between 300,000 and 500,000 trusts in New Zealand (Ministry of Justice, 2020).

New Zealand resident companies are taxed on their worldwide income, and non-resident companies are taxed on their New Zealand based earnings. All company income is taxed at 28 percent. When transferring profits to shareholders, companies can provide imputation credits which mean that profits disbursed to shareholders are not taxed twice.

Most investment income is taxed at the associated rate the investor would pay on other earned income. Personal investors pay their relevant marginal tax rate, companies pay 28 percent and trusts pay 33 percent. However, for investments made into a certain type of investment entity known as a Portfolio investment entity (PIE), which are managed funds such as Kiwisaver[3], the tax rate paid on income varies. Depending on the combination of investment income and non-investment income earned, different tax rates are applied on the investment income. For people with taxable income of $14,000 or less from non-PIE sources and a total taxable income of less than $48,000 the tax rate is 10.5 percent. For non-PIE taxable income of $48,000 or less and total taxable income of $70,000 or less the rate on investment income is 17.5 percent. In all other cases the tax rate on PIE income is 28 percent.

Tax returns in New Zealand are due by the 7th of July for the tax year ending on the 31st of March of the same year. Return forms are issued and collected online, via the IRD website. Individuals complete an IR3 form, which is mostly prepopulated. If an individual wishes to claim specific expenses or deductions (such as charitable donations) they fill out the relevant sections. Once submitted, any tax return or tax bill is assessed soon after the forms are submitted. Tax returns

[3] Kiwisaver is a voluntary retirement savings scheme started on 1 July 2007. Members pay between 3 and 10 percent of their salary (with employers matching 3 percent) into a nominated Kiwisaver fund. These are then invested by the fund manager on behalf of the individual. Kiwisaver members cannot access these funds until age 65 except under specific circumstances, such as purchase of a first home, leaving the country with no intent to return, or financial hardship.

are paid out by the IRD immediately, whilst tax bills are due by the 7th of February the following year.

The 2020 New Zealand Tax Reform

The 2020 tax reform was passed into law on the 7th of December 2020. With the passing of the reform, a new top marginal tax rate of 39 percent on personal income over $180,000 would come into effect from the 1st of April 2021, the start of the 2022 tax year. This was the only tax rate added or changed. With this tax rate increase the New Zealand tax schedule was as follows:

Table 2. Comparison of New Zealand marginal tax rates in tax years 2021 and 2022

Income (z)	*Marginal Tax Rate (%) Tax Year 2021*	*Marginal Tax Rate (%) Tax Year 2022*
$z \leq 14{,}000$	10.5	10.5
$14{,}001 \leq z \leq 48{,}000$	17.5	17.5
$48{,}001 \leq z \leq 70{,}000$	30	30
$70{,}001 \leq z \leq 180{,}000$	33	33
$180{,}001 \leq z$	33	39
Company Tax	28	28
Trust Tax	33	33

Source: New Zealand Inland Revenue Department.

The stated aim for the 2020 tax reform was to increase tax revenue. The Government claimed that it would only impact the top two percent of taxpayers. According to IRD data released regarding tax year 2020, the change in tax rate would impact 88,602 taxpayers broken down as follows:

Table 3. Number of taxpayers impacted by the change in tax rate broken down by income

Income bracket	*Number of people*
180,000 - 190,000	11,019
190,000 - 200,000	9259
200,000 - 210,000	8344
210,000 - 220,000	6414
220,000 - 230,000	5365
230,000 - 240,000	4684
240,000 - 250,000	4019
250,000+	39,498
Total	88,602

Source: New Zealand Inland Revenue Department.

The Labour government claimed that the reform would generate $550,000,000 a year in tax revenue. Using the IRD provided numbers above, it is relatively easy to calculate the approximate mechanical increase in revenue that this reform would provide[4]. From the publicly available 2020 IRD data the increase in revenue would be $727,688,400. However, this value represents the mechanical effect absent the behavioural response that would be induced by the increase in tax rate.

With the tax change only impacting high income earners, the only transfer payments likely present in the affected population would be NZ superannuation. This becomes available to all NZ resident taxpayers who have lived in the country for at least 10 years since age 20, at age 65 even if they are still working.

With no social assistance payments present in the affected population, it is safe to assess each taxpayer individually, as they will each be optimizing income individually. This contrasts with tax systems such as the United States where tax is assessed on a household basis, which changes the optimization behaviour of taxpayers from an individual to a joint problem.

Expected behavioural responses

Prior to the change, the IRD released numerous statements indicating that they would be closely monitoring taxpayers impacted for evasion activities. Any activity where the "primary aim was to avoid the 39 percent" would be investigated, and those found to be engaging in evasive behaviour prosecuted (Pullar-Strecker, 2021). Movement of income into both trusts and companies was specifically called out as actions that would be carefully monitored. There was no mention of intertemporal shifting.

The IRD also noted that without effective integrity measures applied alongside the tax change, the new top marginal tax rate may become regressive. Those earning just over 180,000 would face the top rate of 39 percent whilst those earning very high incomes from business and investments would only face a top marginal tax rate of 33 percent. (IRD, 2020)

Under the New Zealand tax system, it is also relatively easy for income taxpayers to legally shift income between the personal tax code, the corporate income tax code, and trusts. This is of particular concern in the New Zealand tax regime. New Zealand has a high incidence of both

[4] The mechanical increase is given by the following equation $dM = \Delta\tau(\bar{z} - 180{,}000)N$ where $\Delta\tau$ is the change in marginal tax rate, $\bar{z}$ is the average wage of those effected by the tax reform and N is the number of taxpayers impacted by the tax reform.

trusts and small companies when compared to other jurisdictions worldwide. According to the Ministry of Business, Innovation and Employment (MBIE), there are approximately 546,000 small businesses - that is, businesses with less than 20 employees. This represents 97 percent of firms registered in New Zealand, accounting for 29.3 percent of employment (Ministry of Business Innovation and Employment [MBIE], 2022). MBIE notes that small and micro businesses make up a higher percentage of firms compared to other countries.

Similarly, trusts are also particularly common in New Zealand. There has been an effort by the New Zealand government over recent years to reduce the use of trusts as a vehicle to minimize tax exposure by increasing disclosure requirements for trusts, as well as being able to request income data for trusts back to tax year 2014. In 2020 the IRD recommended that the trustee tax rate should also be raised to 39 percent in order to reduce the incentive to employ trusts as a tax vehicle. They noted that trusts are the primary vehicle that high-income taxpayers are likely to use to divert income into when seeking to avoid the new 39 percent rate. They estimated that this would raise an additional $1.5 billion in revenue over the 5-year forecast period (IRD RIA 2020). They were unsuccessful in convincing the government to change the trust rate.

By not changing the tax rates associated with trusts or companies, the incentive to shift income into either of these entities was increased. PIE investment also becomes more appealing, with the difference between the top PIE tax rate and top personal income rate also increasing. Income flows from personal income to these sources are harder to detect than income shifting between periods.

Those wealthy earners who were either self-employed or derived a large income through investments were best positioned to reduce their tax exposure. Wage and salary earners in larger companies are the most poorly positioned. With PAYE being administered by employers rather than employees, any reduction in tax liability would require coordination by both employer and employee. This would include both legitimate avoidance behaviours such as timing of payments, and illegal evasion, such as misreporting of income. Behavioural responses are also more difficult for those employed by a firm. Responses such as reduction in labour supply by moving down to four working days instead of five, or other adjustments to a signed employment agreement would require assent from both parties.

Theory

This section lays out the theoretical framework surrounding the elasticity of taxable income as a function of net-of-tax rate. I start by looking at an individual's response to a change in taxation, before looking at how this translates into a population wide response.

Under the traditional labour supply model, each individual maximises some utility function $u_l(c,l)$ where c is disposable income which for a model that has a single period is equal to consumption, and l is labour supply, which is measured in hours of work. Labour earnings, wl are the combination of labour supply and the exogenous wage rate w. The New Zealand tax system is progressive which means that the standard budget constraint is piecewise linear as changing tax brackets changes the slope of the budget constraint. The nature of the tax reform, with only the top marginal tax rate changing, allows for the simplification of the budget constraint into a linear form. In a linearized model, all the post-tax income earned in tax brackets below the top marginal tax rate can be instead represented by a constant as only the income earned in the top bracket is variable. Simplifying the piecewise linear budget constraint, we get a linearized budget constraint $c = wl(1-\tau) + Y$,with τ being the (top) marginal tax rate, and Y is virtual income. Y comprises of transfer payments, alongside the income generated in the lower tax brackets.

Changes in taxation create a behavioural response. The Elasticity of Taxable Income literature notes that changes in hours worked are one of these possible responses (Saez et al., 2012). Other responses may include changes in intensity of work, and timing of bonus payments and other compensation. The wage rate w could depend on effort or respond to tax rates. Reported taxable income, z, then, may differ from wl with individuals splitting earnings between taxable cash compensation and other, non-taxable, benefits. It is also simple to measure via tax returns.

Instead let us consider a model that relies on reported income z rather than the combination of wages and labour supply. Reported income, z, is a proxy for leisure[5] and is negatively related to utility. Now individuals maximize some utility function $u(c, z)$ subject to a linearized budget constraint in the form $c = (1-\tau)z + Y$.

Let us assume individual taxpayers exhibit the following quasilinear utility function

$$u = c - \left(\frac{ba}{1+b}\right)\left(\frac{z}{a}\right)^{\frac{1+b}{b}}$$

[5] Leisure k is a function of z. $k = f(z)$ with fixed wages and honest reporting $f(z) = T - (\frac{z}{w})$ where T= total time available for work and leisure.

Where *c* is consumption, *z* is taxable income and *a* and *b* are positive parameters. This quasilinear function demonstrates no income effects with respect to *z*. The standard approach is to assume no income effects, which means the elasticity is equal to both the compensated and uncompensated elasticity. The presence of income effects is investigated in both Gruber and Saez (2002) and Creedy et al. (2018) and they find no significant effects. This means that the income function z only depends on the net-of-tax rate and does not depend on Y.

This gives a standard utility maximization problem where each individual is looking to maximize utility subject to the budget constraint $c = (1-\tau)z + Y$.

Substituting the budget constraint expression for c into the utility function we get

$$u = (1-\tau)z + Y - \frac{ba}{1+b}\left(\frac{z}{a}\right)^{\frac{1+b}{b}}$$

Using the chain rule and differentiating with respect to *z*

$$\frac{\partial u}{\partial z} = 1 - \tau - \left(\frac{1+b}{b}\right)\left(\frac{ba}{1+b}\right)\left(\frac{z}{a}\right)^{\frac{1+b}{b}-1}\frac{1}{a}$$

This simplifies to

$$\frac{\partial u}{\partial z} = 1 - \tau - \left(\frac{z}{a}\right)^{\frac{1}{b}}$$

Given individuals are interested in maximizing utility we set $\frac{\partial u}{\partial z} = 0$ as the first order condition. This leads to the expression

$$a(1-\tau)^b = z^* \qquad (2)$$

where z^* is the utility maximizing reported income.

Now recall that the Elasticity of Taxable Income is defined as the percentage change in reported income given a one percent change in the net-of-tax rate. This gives the following formula

$$ETI \equiv \left[\frac{\partial z}{\partial(1-\tau)}\right]\left[\frac{(1-\tau)}{z}\right] \qquad (3)$$

Using the expression for z derived in equation (2) first differentiate to find $\frac{\partial z}{\partial(1-\tau)}$ which gives

$$\partial z = ab(1-\tau)^{b-1}$$

Now substitute the expression for z into the ETI expression to get

$$ETI = ab(1-\tau)^{b-1}\left(\frac{(1-\tau)}{a(1-\tau)^b}\right)$$

This then simplifies to

$$ETI = b$$

We can use this to derive the impact that a tax change will have on an individual's reported income. Recall the definition of the ETI in equation a. Substituting in $ETI = b$ and rearranging for $\frac{\partial z}{\partial(1-\tau)}$:

$$\frac{\partial z}{\partial(1-\tau)} \equiv \left[\frac{1}{(1-\tau)}\right] zb$$

This shows for a given individual, if we can estimate b we can estimate their behavioural response to a tax change. Feldstein (1999) shows that this elasticity captures not only the hours of work response, but all other behavioural responses.

Now consider the full population. With only the top marginal tax rate changing, I focus my analysis on those that will be included in the new top marginal tax bracket. Let the threshold for this top marginal tax rate be $\underline{z}$, and the top marginal tax rate τ. For these individuals, I assume their incomes depend on the net-of-tax rate $(1-\tau)$. For simplicity, we assume there is only one tax bracket, and as such decreasing reported income will not change their tax rate. There are *N* individuals in the top tax bracket. The average income reported by these top *N* taxpayers, as a function of net-of-tax rate, is denoted by $(1-\tau)z^m$. Substituting z^m into the ETI definition given in (3) I define the aggregate elasticity of taxable income for the top tax bracket as

$$e = \left[\frac{\partial z^m}{\partial(1-\tau)}\right]\left[\frac{(1-\tau)}{z^m}\right] \qquad (4)$$

Now consider a small increase in the top marginal tax rate τ by $\partial\tau$ as estimates of the ETI can only be used for small changes in the tax rate. This increase has two effects on tax revenue. The first effect is the mechanical effect, where revenue increases due to the increased tax rate faced on incomes above $\underline{z}$. The extent of this mechanical effect is equal to

$$dM \equiv N(z^m - \bar{z})d\tau > 0.$$

This is the change in tax revenue that would occur if reported income did not change following the change in tax rate; that is, in the absence of any behavioural response. The behavioural response is the second effect triggered by the increased tax rate. The behavioural response is the drop in reported income that occurs in response to a tax increase. Using differentials, it is possible to rewrite equation (4) as:

$$e = \left[\frac{\partial z^m}{-\partial\tau}\right]\left[\frac{(1-\tau)}{z^m}\right]$$

which can be rearranged to show the behavioural response reduces the average reported income z^m by $dz^m = -ez^m \frac{d\tau}{(1-\tau)}$. The behavioural response always occurs in the opposite direction to the tax change. Changing reported income by dz^m changes average tax revenue over taxpayers in the top bracket by τdz^m. This leads to a change in tax revenue due to the behavioural response of

$$dB \equiv -Nez^m \frac{\tau}{(1-\tau)} d\tau < 0 \qquad (5)$$

Combining the mechanical effect and the behavioural effect, the total effect on revenue due to the tax change is

$$dR = dM + dB$$

$$= N(z^m - \bar{z})d\tau + \left(-Nez^m \frac{\tau}{(1-\tau)} d\tau\right)$$

$$= N\left(z^m - \underline{z}\right)\left[1 - e\left(\frac{z^m}{z^m - \bar{z}}\right)\left(\frac{\tau}{(1-\tau)}\right)\right] d\tau$$

Let $a = \frac{z^m}{z^m - \bar{z}}$. The parameter a measures the thinness of the top tail of the income distribution, the larger that z^m is compared to $\bar{z}$, the smaller a is. Generally, $a \geq 1$ with $a = 1$ when a single flat tax is applied to the whole income distribution, so that $\underline{z} = 0$.

Using a I rewrite

$$dR = dM\left[1 - \frac{\tau}{(1-\tau)} ea\right]$$

The fraction of tax revenue lost through behavioural responses is an increasing function of the tax rate τ, the elasticity of taxable income, e, and the parameter a. In the case where $e = 0$, there is no behavioural effect and so $dR = dM$. The expression that represents the exact marginal deadweight loss generated by the increase in tax rate is

$$DWL = \frac{\tau e a}{(1-\tau)}$$

When $e > 0$ there will always be a deadweight loss associated with an increase in taxes. The expression $\left[1 - \frac{\tau}{(1-\tau)} ea\right]$ can also be used to find the revenue maximizing tax rate or Laffer rate. Let τ^* be this revenue maximizing tax rate. To maximise revenue, $dR = 0$. So $\tau = \tau^*$ when $dM\left[1 - \frac{\tau}{(1-\tau)} ea\right] = 0$. Rearranging for τ^* :

$$\tau^* = \frac{1}{1 + e * a} \qquad (6)$$

Therefore, any tax rate above τ^* is inefficient, as above τ^* decreasing the tax rate would see both an increase in revenue for the government, and an increase in utility experienced by the taxpayer.

With τ fixed by the tax regime and a being relatively straightforward to measure, accurate estimates of e therefore become important for the analysis of both the welfare impacts of a tax change, and for estimation of revenue maximising tax rates.

Data

The Integrated Data Infrastructure and Longitudinal Business Database

The data used for this thesis was obtained through the Statistics New Zealand Integrated Data Infrastructure (IDI) and the Longitudinal Business Database (LBD). The IDI contains individual and household level administrative datum collected by government agencies through the course of their operations, across a range of characteristics including education, work and income and population. Upon collection by each individual agency, this data is then provided to Statistics New Zealand, who upload it to the IDI where it can be accessed by researchers.

Each individual in the IDI is given a unique identifier, which is then shared across all data sets in which they appear. This identifier is assigned to each entity upon entry into the IDI. Through this identifier, an individual's characteristics can be collated from multiple datasets. A similar identifier is used for individual businesses in the LBD and is included in tax data in the IDI. To match individuals across datasets, basic characteristics, such as age, name ethnicity and gender are used to ensure that each individual is linked to the same identifier in all data sets in which they appear. To create these links, Statistics New Zealand uses probabilistic linkages to connect tax data to birth records, birth records to visa data and then visa data to tax records. Statistics New Zealand estimates that less than one percent of these identifiers are incorrect.

The primary dataset is the Inland Revenue Employee Monthly Schedule (EMS). From 1999 the EMS has contained a range of monthly tax and income data such as: gross income broken down by source (wage and salary, benefit, investment earnings), tax liability, implied tax rate, tax code and an employer identifier. Data are collated each month by the IRD from datum generated from PAYE returns submitted by employers. As PAYE returns are filed within two days of wage payments, they are submitted more frequently than monthly. The IRD then collates these so that for each individual there is a single entry per employer, per month. This means for individuals with multiple employers, a separate entry is generated for each. Returns are dated the final day of each month. This dataset is updated each month; however, these updates are only uploaded to the IDI during data refreshes which occur three times each year.

Two other datasets are linked to this EMS data to provide other characteristics of interest. First, 2018 Census data is linked to provide age details. The 2018 Census data is used over birth records from the Internal Affairs births deaths marriages database as a higher proportion of the

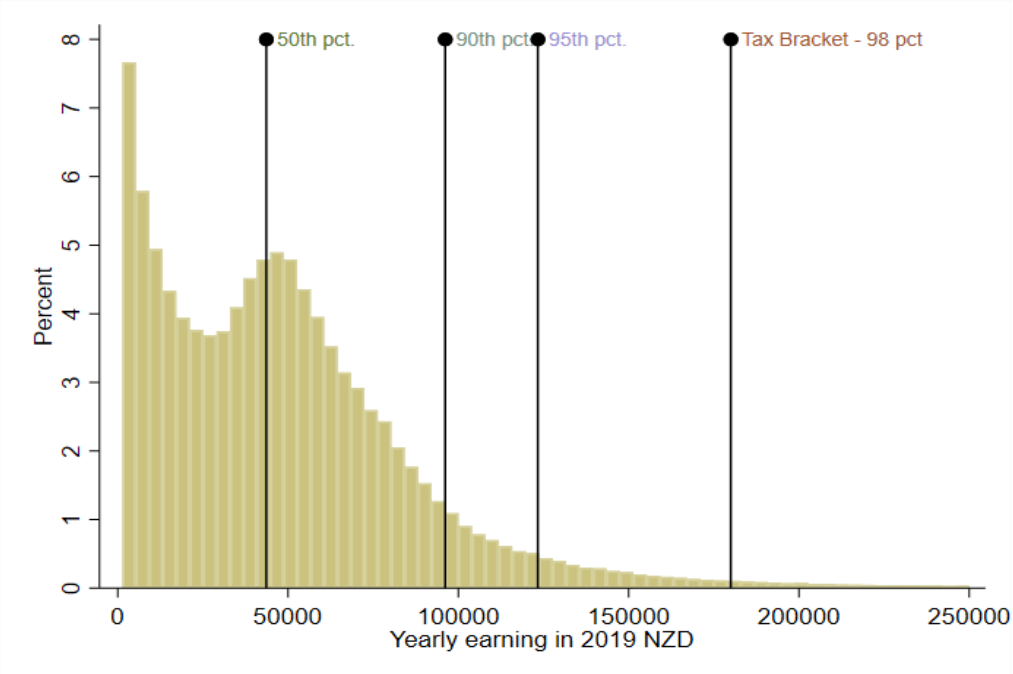
population of interest have Census records indicating age rather than a registered birth certificate. From the census data I obtain an individual's age in 2018.

The second dataset linked is the Business Register. The Business Register data is accessed through the LBD. The LBD provides de-identified microdata on businesses. This data is gathered via various government agencies and Statistics NZ surveys. The data in the LBD is updated yearly. From the Inland Revenue database in the IDI an employee is linked to an employer in the Business Register dataset. The Business Register information, provided by the companies' office, contains relevant information regarding each individual's employer in 2019. The Business Register data includes a range of firm information such as number of employees, location, sector and number of branches. From the Business Register I obtain each employer's number of employees and sector classification via its Australian and New Zealand Standard Industrial Classification (ANZSIC) code. The ANZSIC code classifies each employer into one of 19 sectors.

Population of Interest

The population of interest are all individual employees whose combined personal wage and salary income in tax year 2019 was at least $110,000. According to IRD statistics there were 266,570 individuals who earnt more than $110,000 from all sources in 2019. Figure 1 provides a breakdown of the 2019 wage distribution.

Figure 1. Wage distribution of New Zealand taxpayers 2019



Notes: Figure 1. shows the distribution of yearly earnings for all New Zealand taxpayers in 2019. The new top tax bracket starts at around the income of the ninety eighth percentile.

Source: The employee monthly schedule provided by the Inland Revenue Department to the Statistics New Zealand IDI.

To arrive at a population sample that can be used to estimate the revenue loss due to shifting behaviour I impose six conditions.

- First, the individual must have at least $110,000 in wage and salary earnings in tax year 2019. By conditioning on tax year 2019 earnings, I ensure that the selected sample is not impacted by individuals who changed their earnings behaviour upon the announcement of the tax reform in September 2020. Wage and Salary data is used as this data is all submitted to the IRD with no input from the employee which reduces the ability to under- or over- report wage and salary income for tax purposes. Income derived from investments or other self-reported sources is not included as this is far more open to manipulation particularly with respect to timing of earnings. This means I start with a sample of 170054 individuals.

- Second, individuals who do not have linked census or employer information are excluded as the other conditions imposed require this information. This removes 6554 individuals from the sample.

- Third, each individual in the sample must have non-zero wage and salary earnings in each of the 12 months in tax year 2019. This is to ensure that any monthly growth rates calculated using 2019 data are not excessively volatile due to zero income months. This removes 11,607 individuals from the sample.

- Fourth, wage earners aged below 25 and above 60 are excluded. Wage earners above the age of 60 are excluded as the New Zealand retirement age, and the age that superannuation becomes available is 65. Those close to the end of their working life have a different set of incentives than those who are likely to continue to work for an extended period. They are also likely to share a different wage growth rate trend to the general working population. It is for a similar reason that those below 25 are excluded. To be earning more than $110,000 before the age of 25 indicates an extreme difference in lifetime growth rate trends compared to population and as such are excluded. These limits also remove obviously inaccurate data records such as three-year-olds earning a wage or salary. This removes 15,270 individuals from the sample.

- Fifth, any individual who does not earn at least $10,000 in each of the tax years 2020, 2021 and 2022 is dropped. This acts as a proxy for continued engagement in the

workforce and helps ensure that only those still working in tax year 2022 are counted. This removes 13,368 individuals from the sample.

- Finally, individuals who are employed in a firm with less than five employees are excluded. This is to ensure that self-employed individuals or sole proprietors are excluded. These individuals have many more tools available to minimize tax liability when compared to those employed by a firm. Due to their ability to self-report income accurately assessing their monthly income is difficult. This removes 5,979 individuals from the sample.

After these restrictions are imposed, I am left with a total population sample of 117,276 individuals.

To identify intertemporal shifting behaviour the individuals in the population sample are split into two groups. Those earning between $110,000 and $160,000 in tax year 2019 form the comparison group and comprises of 78,699 individuals. These individuals have no incentive to shift income due to the tax reform as it will have no impact on their income. Those individuals earning more than $160,000 in tax year 2019 form the treatment group. This gives a treatment group of 38,577 individuals. I use $160,000 rather than $180,000 as the cut-off for the treatment group as I am using 2019 wage data. Given two years of wage growth, many of those earning $160,000 in 2019 will now be earning $180,000 and as such will be impacted by the tax reform. These are the individuals with a strong incentive to shift income due to the tax reform. Robustness checking of other cut-offs, such as $170,000 and $180,000 was undertaken, with all showing evidence of shifting. The treatment group represents wage earners in the 97th percentile of wage and salary earners. I am left with a control group of 78,699 individuals and a treatment group of 38,577 individuals.

Generated variables

For each individual I take their monthly wage and salary data for every month between the dates of 1 April 2018, the start of tax year 2019, and 28 February 2022, which is the latest date for which IDI data is available. When pulled from the IDI individuals may have more than one income entry per month. This occurs when an individual holds two or more jobs. Income is summed at the monthly level, leaving each individual with one income entry per month. An individual's employer is assigned based on their 2019 employer. For individuals with more than one

employer in 2019 I sum up their total earnings in 2019 by employer. The employer responsible for the largest percentage of 2019 income is then assigned as the employer. As months with zero income are not recorded in the IDI, for those months where an individual does not have an entry, we generate an entry with zero income. This means that for each individual in the data set we have 47 monthly observations.

Using these monthly observations, we compute a wage growth rate. This wage growth rate is defined as follows:

$$w_{y,m,i} = \frac{z_{y,m,i} - z_{2019,m,i}}{z_{2019,m,i}} \quad (7)$$

Where y denotes the tax year, m denotes the month, and i the individual. This growth rate is the percentage change in monthly wage relative to that month in 2019. Percentage change is used rather than log-transformation as earnings may be zero, or close to zero in some months, for example via income shifting, or a month of unemployment. I depart from the Kreiner et al. (2016) methodology by using a standard growth rate. Whilst Kreiner et al. (2016) use a specification that includes average monthly income in the base year, the New Zealand data allows for use of specific monthly data. By using a standard growth rate, interpretation of the growth rate becomes easier, as it is a simple percentage change.

From this growth rate, I generate a dummy indicator for monthly growth rates of at least 100 percent. This excessive growth rate dummy will be used to investigate the presence of shifting or accelerating behaviour in the months surrounding the tax reform.

Empirical estimation

The objective of this thesis is to identify the impact of income shifting on estimates of the Elasticity of Taxable Income (ETI). To identify this impact, I must first verify the existence of income shifters and estimate the ETI before I will be able to identify any impact that income shifting has on estimates of the ETI.

The treatment effect is the causal effect of a treatment or intervention on an outcome variable of interest. This effect is of interest to policymakers as it allows for evaluation of the effectiveness of a given tax policy. The treatment is the change in the net-of-tax rate (1 – marginal tax rate) caused by the 2020 tax reform, and the outcome variable of interest is the change in taxable income. This causal effect can be thought of as the difference between two outcomes, the outcome where treatment is administered and the outcome where it is not.

We cannot estimate this effect on an individual level because an individual is changed by treatment. Once they are treated, we can only observe them in a treated state. We are unable to observe them in an untreated state and vice versa. Given that the desired outcome is to observe the treatment effect, we must use alternative methods. These methods utilize the average treatment effect on the treated. Using the average treatment effect means that each individual in the treatment group does not have to match a specific individual in the comparison group. Instead, the treatment group and comparison group average needs to match. A match would be parallel trends in average pre-treatment earnings. I am interested in the average treatment effect of the treated, that is, those earning $180,000+ a year in individual income and so subject to the new top marginal tax rate. This can be framed by the following equation

$$ATT = E(Yi\,(1)|\,Di = 1) - E(Yi\,(0)|\,Di = 1), \qquad (8)$$

where the ATT is the average treatment effect on the treated, the first component of the equation is the is the average wage growth rate for taxpayers who earn more than $180,000 a year who were impacted by the new top 39 percent marginal tax rate and the second component is the is counterfactual average wage growth rate for taxpayers earning more than $180,000 a year if they were not treated. This second component is unobservable and therefore to recover the ATT I will need a credible comparison group.

Randomised trials are seen as the ‘gold standard’ to provide a credible comparison group. In a randomised trial individuals are randomly assigned to either the treatment group where they receive treatment or the control group (where they do not receive treatment). Given enough individuals the characteristics of the two groups will not be statistically different on average, due

to the law of large numbers. This allows the control group to be used as a valid counterfactual to the treatment group, and the average treatment effect can be recovered. This is known as the SATE or sample average treatment effect.

Fully randomized trials are difficult to set up in order to study policy changes. In the case of tax reforms, a randomised trial would require taxpayers who would otherwise have been assessed under a new tax rate to continue to be assessed under pre-reform rates. Depending on the direction of the tax reform assignment into the control group would either be desirable or undesirable for the taxpayer and likely to cause a public outcry. Randomly controlled trials would also impact tax revenue. With randomized trials unavailable to assess the ATT other methods to recover the ATT are required. Most of the literature has followed Feldstein (1995) and used various versions of difference-in-differences (DD) estimation designs. I will follow in their footsteps and utilize a DD approach.

Difference-in-differences methodology

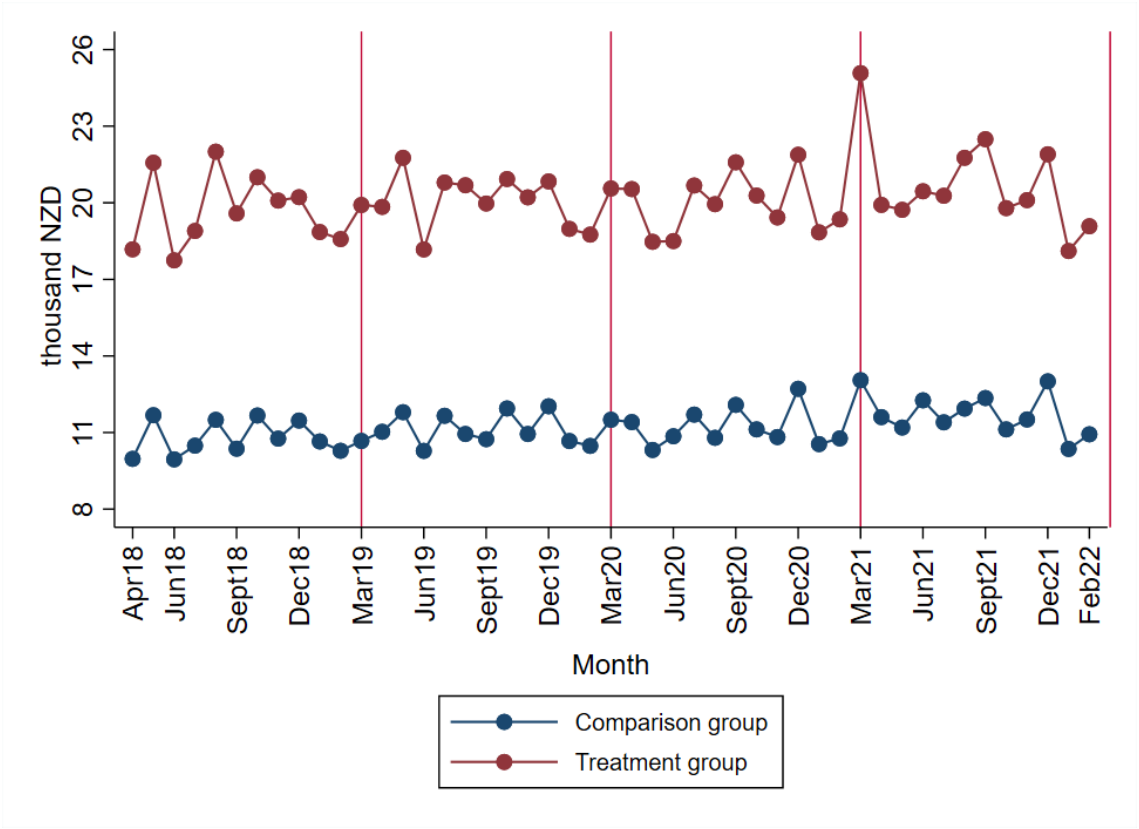
DD methods use panel data to assess the average change over time of the outcome variable in the treatment group when compared to the average change in the outcome variable in the comparison group. Under a DD methodology, because the variable of interest for this thesis is a percentage change, the ATT can be defined as follows

$$ATT = \underbrace{[G_2 - F_2]}_{Post\ Treatment\ Period} - \underbrace{[G_1 - F_1]}_{Pre\ Treatment\ Period}, \quad (9)$$

where G_2 is wage growth rate of the treatment group in the post treatment period, F_2 is the wage growth rate of the comparison group in the post treatment period, G_1 is the wage growth rate of the treatment group in the pre-treatment period and F_1 is the wage growth rate of the comparison group in the pre-treatment period.

The DD methodology relies on the parallel trends assumption to allow for recovery of the ATT. The parallel trends assumption is the assumption that, absent any outside change, the treatment and comparison groups exhibit the same trends over time. In the case of this thesis, for the parallel trends assumption to hold, the treatment group and the comparison group must demonstrate parallel wage growth rates. Using wage data prior to the reform, seen in figure 2, we can see graphically that from April 1st, 2018, through till December 31st, 2020, both the treatment and comparison group demonstrate parallel wage growth rates prior to treatment.

Figure 2. Average monthly wages of treatment and comparison group



Notes: Figure 2. shows the monthly wage income of the treatment group and the comparison group. The treatment group consists of all employees with an annual wage and salary income of above $160,000 a year in tax year 2019 and more than $10,000 a year in income in tax years 2020, 2021 and 2022. The comparison group consists of all employees with an annual wage and salary income of between $110,000 and $160,000 in tax year 2019 and more than $10,000 a year in income in tax years 2020, 2021 and 2022. The treatment group comprises of 38,577 individuals, and the comparison group consists of 78,699 individuals.

Source: The employee monthly schedule provided by the Inland Revenue Department to the Statistics New Zealand IDI.

Shifting or accelerating behaviour would be characterized by an unusually high growth rate immediately preceding the implementation of the tax reform and lower growth rates following the reform. These effects can be detected via a DD approach, comparing the growth rates in the months surrounding the implementation of the reform, and comparing the growth patterns between the treatment group and comparison group.

$$w_{y,m} = \frac{1}{n^T}\sum_{i\epsilon T} w_{y,m,i} - \frac{1}{n^C}\sum_{i\epsilon C} w_{y,m,i},$$

Where T indicates treatment group, C indicates comparison group and n indicates the number of individuals in each group. Direct income shifting would involve an increase in income in March 2021, the month immediately preceding the reform and a corresponding drop in income in April 2021. Income acceleration would still demonstrate a similar increase in income in March, however the drop in income following the reform may be harder to detect if spread across multiple months.

To estimate the ETI I use a traditional DD estimate of the ETI. I start with the following regression

$$w_{y,m,i} = \beta_0 + \beta_1 d_{y,i}^{2022} + \beta_2 d_i^T + \beta_3 \frac{1-\tau_{2022,i}}{1-\tau_{2021,i}} + \varepsilon_{y,m,i}, \quad (10)$$

where $w_{y,m,i}$ is defined in (7), $d_{y,i}^{2022}$ is a dummy variable that equals one in tax year 2022, d_i^T is a treatment dummy, $\tau_{y,i}$ is the tax rate that applies to individual i in tax year y and $\varepsilon_{y,m,i}$ is the error term. Under this specification β_3 is the parameter of interest and equal to the ETI under the parallel trends assumption.

Substituting (7) into (10) we can show that:

$$ETI = \frac{E\left[\frac{\bar{z}_{2022,i}-\bar{z}_{2021,i}}{\bar{z}_{2019,i}}\middle| i \in T\right] - \left[\frac{\bar{z}_{2022,i}-\bar{z}_{2021,i}}{\bar{z}_{2019,i}}\middle| i \in C\right]}{\left(\frac{1-\tau_{2022}^T}{1-\tau_{2021}^T}-1\right)-\left(\frac{1-\tau_{2022}^C}{1-\tau_{2021}^C}-1\right)} = \beta_3, \quad (11)$$

where the numerator is the percentage change in monthly income from the base year of the treatment group from the year prior to the implementation of the tax reform to the year after implementation, and measured relative to the comparison group, while the denominator is the percentage change in the net-of-tax rate of the treatment group due to the reform (9 percent) minus the same change in the comparison group (0 percent).

Mean reversion has been an issue when DD methods have been used to assess the ETI. Mean reversion is the tendency for individuals that experience unusually high or low incomes in one period compared to their mean level of income to return towards the long run mean in the following period. This can cause issues with autocorrelation in the error term. Weber (2014) showed that the underlying income process should guide the choice of comparison group. She suggests that choice of treatment and comparison group should come from income at least two years prior to treatment. Both the treatment group and the comparison group were selected on 2019 wage data. This reduces the impact of mean reversion on the estimation. It also ensures that any individuals who changed their behaviour in the seven months between announcement of the tax reform and its implementation are unable to impact their selection into treatment or comparison group. However, it does mean that there will be some number of individuals in the treatment group who are not treated, and some number in the comparison group who are treated.

Results

In this section, I answer my research question: *what is the effect of income shifting on estimates of the ETI in New Zealand following the 2020 New Zealand tax reform*. Using the workhorse DD model in the literature, I find an ETI of 0.227. I show that income acceleration is significant and has large implications for ETI estimates with an ETI of 0.139 when excluding 4 months where acceleration is prevalent.

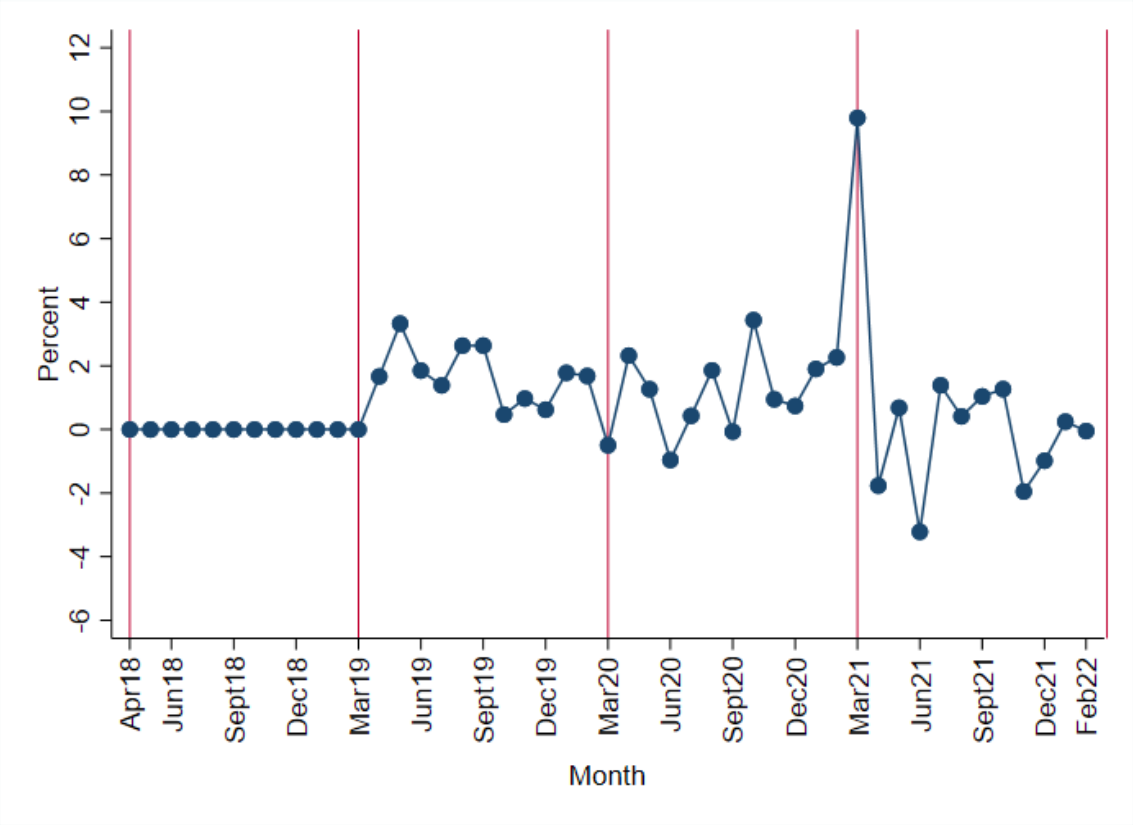
Income Shifting

I begin by assessing potential income shifting surrounding the 2020 Tax reform. Figure 2 in the empirical estimation section shows the average monthly wage for both the treatment and comparison groups from April 2018 through till February 2022. From 2018 until just prior to the reform both groups exhibit some variation in monthly wages each month but remain stable with a slight upward trend. Both groups track in generally the same direction with no clear differences in wage growth rates between the two. This changes in March 2021. While the comparison group exhibits a slightly increased average wage compared to months prior, the treatment group exhibits a far higher average wage than in any other month.

The differing growth rate in March 2021 becomes more apparent in Figure 3. Figure 3 shows the difference in percentage change in wage growth compared to the same month in tax year 2019 of the treatment group relative to the comparison group. Here the increase in wages in March 2021 becomes even more apparent. In the months prior to the reform the treatment group displays between -0.5 and 4 percent higher wage growth rates relative to the comparison group. There are no months with clear spikes in income. Just prior to the reform however a clear indicator emerges. In March 2021, the month before the tax reform went into effect the treatment group displays an 9.8 percent higher wage growth rate relative to the comparison group. The relative growth rate is almost three times the difference in relative growth rates when compared to any other month prior to the reform. In April 2021, the treatment group displays a growth rate of minus two percent relative to the comparison group. Although lower than any month prior to March 2021, the April 2021 growth rate is more in line with the growth rates prior to the reform. In the months following the tax reform the difference in wage growth rates returns to a lower level. It is more volatile post reform with the treatment group having multiple months with negative growth compared to the comparison group. In only two months

prior to the reform did the treatment group demonstrate negative growth relative to the comparison group. Following the reform this occurs in five months.

Figure 3. Change in wages of treatment group relative to comparison group



Notes: Figure 3. shows the difference between the wages in a given month and the same month in tax year 2019 (as a percentage of the monthly wage in 2019) for the treatment group and measured relative to the comparison group (in percentage points).

Source: The employee monthly schedule provided by the Inland Revenue Department to the Statistics New Zealand IDI.

Shifting versus Acceleration

Direct wage shifting from April 2021 into March 2021 would generate a spike in income in the March 2021 followed by a corresponding drop in income in April 2021, following the reform. The data shows a clear increase in income in March 2021 for the treatment group. However, the corresponding drop in income in April 2021 does not occur in the New Zealand data. This would indicate that income shifting, as defined in Kreiner et al. (2016), is not occurring in New Zealand. The lack of income shifting may be because, with a tax increase, firms are required to pay

employees early should the employee wish to take advantage of the lower tax rates. That leaves the large increase in wages immediately prior to the reform unexplained.

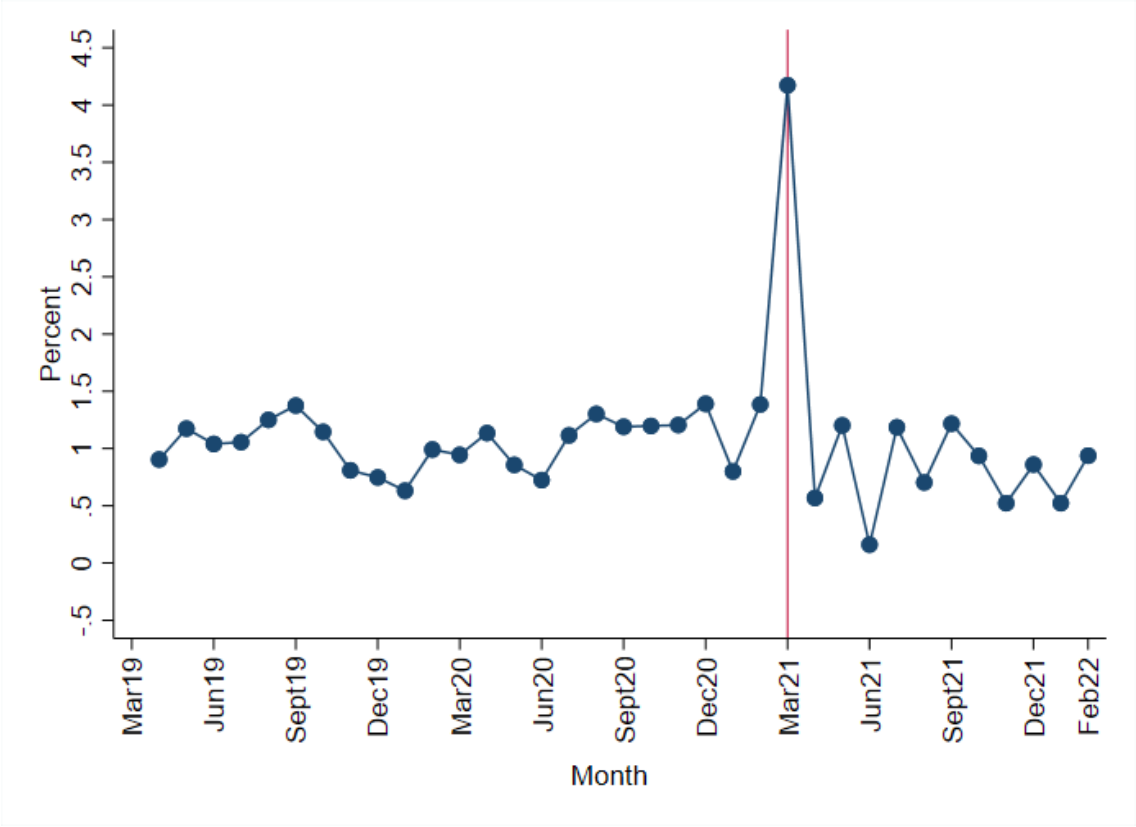
In the months following the reform there are multiple months where the comparison group displays growth rates higher than the treatment groups. In three of these the comparison group grows at greater than two percent faster than the treatment group. This only occurs in three months prior to the reform and the comparison group never grows faster than one percent. This would indicate that there is some movement of payments from post reform months into March 2021. The income that was paid in March 2021 to generate the sharp increase in growth rates therefore did not come from standard wage and salary paychecks, but from some other shiftable income.

Discretionary bonus payments may explain the lack of corresponding clear downward spike in income growth. Employers in New Zealand are free to pay a discretionary bonus payment to employees at will. In many cases these are linked to individual or business performance. Businesses in New Zealand may pay bonuses at differing times throughout the year depending on firm. A common time for these bonuses is the end of the financial year, which is observed differently by different firms (Edmunds, 2011). The spread on when firms choose to make their payments make detection of clear drops in income difficult. These bonus payments fall under PAYE for tax purposes, and as such are included in monthly EMS records in the month they are paid.

In years without a tax reform there is no incentive to time these payments as the marginal tax rate paid on the income is the same regardless on when the bonus is paid. However, in the presence of the tax reform, an individual who would typically receive a bonus payment in the months following the reform and has an income that would put them in the new top marginal tax rate has an incentive to encourage their employer to accelerate this payment to prior to the reform.

The relative difference in number of accelerators can be shown by using a DD graph to compare the treatment and comparison groups. Figure 4 shows the difference in exceptionally high (100 percent or greater) growth rates each month between the two groups. In the months leading up to the tax reform the difference between the two groups in number of people experiencing exceptionally high growth rates is steady at around one percent. In the month immediately prior to the tax reform, March 2021, this difference increases to 4.2 percent.

Figure 4. Share of employees accelerating income



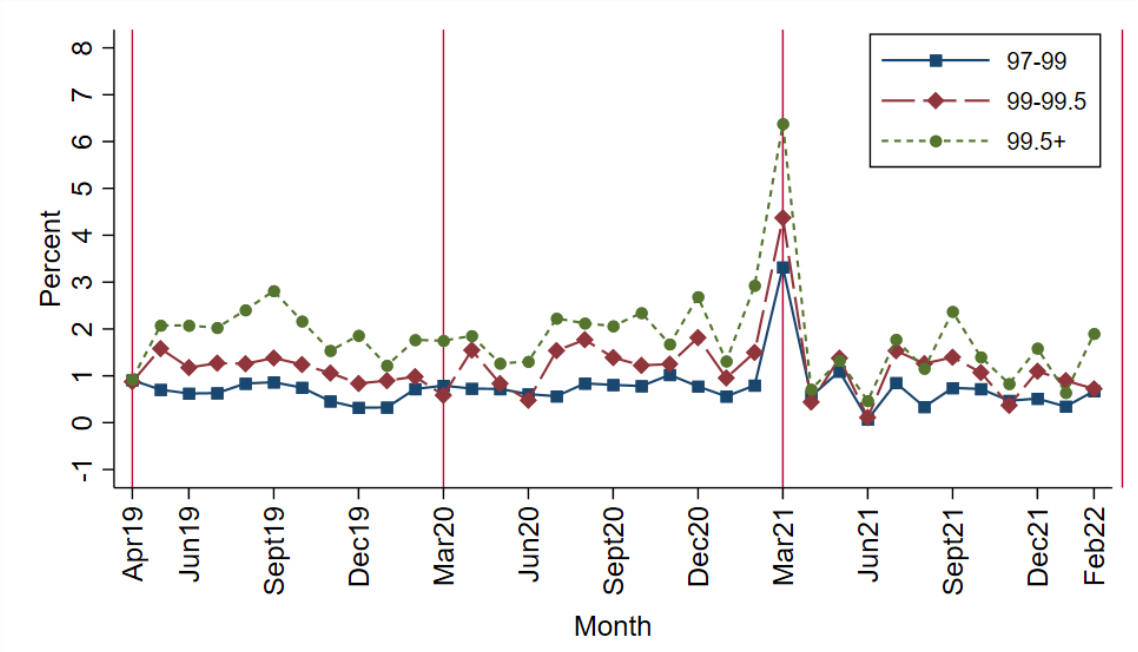
Notes: The acceleration indicator is a dummy constructed separately for all months and equals 1 if the income of the employee in that month is at least 100 percent above the wage of the same month in tax year 2019. Figure 4. shows the difference in the share of employees with an acceleration indicator equal to one between the treatment and the comparison groups, where the size of this difference in March 2021 is taken as an approximation of the share of income accelerators. The construction of the treatment group and the comparison group is described in the data section.

Source: The employee monthly schedule provided by the Inland Revenue Department to the Statistics New Zealand IDI.

Acceleration by percentile

One of the consistent observations in the literature estimating the ETI is that income responses to changes in taxation increase as income increases (Saez et al., 2012). Figure 5 shows the acceleration broken down into three groups. The 97th to 99th percentile group represents the lowest income earners in the treatment group. The second group is the 99th to 99.5th percentile and the final group the 99.5+. All three groups demonstrate acceleration rather than shifting behaviour.

Figure 5. Share of employees accelerating income by income percentile



Note: The figure shows the share of income accelerators within different income segments of the treatment group. The blue solid curve represents employees with average monthly earnings within the ninety seventh and ninety ninth percentile of the wage distribution and so on. Each graph is constructed by computing the differences in the share of income accelerators, according to the definition of accelerators defined in Figure 4., between the relevant income segment of the treatment group and the comparison group for each month.

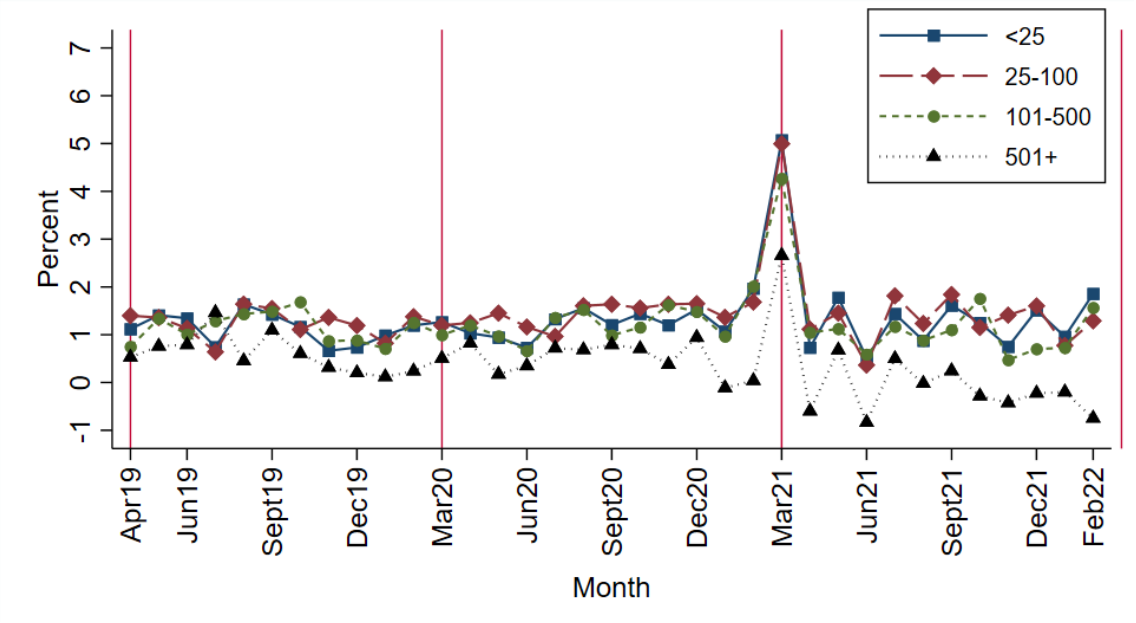
Source: The employee monthly schedule provided by the Inland Revenue Department to the Statistics New Zealand IDI.

Group 1 are 3.3 percent more likely than the comparison group to demonstrate accelerating behaviour. This increases to 4.4 percent for the second group. Those at the very top of the income distribution are the most likely to accelerate with 6.4 percent accelerating. If this acceleration does come from bonuses, it should be noted that those at the top of the income distribution may also receive compensation in the form of stock options or other capital income which would not be observed in the wage and salary data.

Impact of firm size on income acceleration

Firm size also plays a part in the ability to shift income. Top income earners in smaller firms are likely to have more influence over timing and size of bonus payments. Smaller companies are also more likely to be entirely New Zealand based, and therefore reactive to changes in New Zealand tax reforms and the impact said reform would have on employees. Another consideration for larger firms is the potential for negative publicity should their assistance in tax avoidance become public.

Figure 6. Share of employees accelerating income by firm size



Note: Figure 6. shows the share of income accelerators by firm size. The figure corresponds to Figure 4. and is constructed by splitting the full sample used in Figure 4. into four subsamples according to the number of employees. The blue solid line is based on individuals working in companies with 1-24 employees, the red line is based on individuals working in firms with 25-100 employees and so on.

Source: The employee monthly schedule provided by the Inland Revenue Department to the Statistics New Zealand IDI.

Figure 6 shows the percentage of income accelerators broken down by firm size. Firms were split into 4 categories based on the number of New Zealand employees. These brackets were less than 25, 25-100, 101-500 and 501+. All four categories show an increase of accelerators in March 2021 compared to the previous months. However, there is a link between firm size and percentage of income accelerators. For the first two categories approximately five percent of employees show unusually high income growth rates in March 2021, up from a baseline of approximately one percent. The percentage of accelerators drops as firm size increases but becomes particularly apparent for the largest firms where only 2.7 percent of employees show accelerating income profiles.

Elasticity of Taxable Income estimation in the presence of income acceleration

As noted by Saez et al. (2012) and shown by Kreiner et al. (2016) estimation of the ETI by exploiting variation in tax rates brought on by tax reforms is impacted by transitory income movement caused by income shifting. Income acceleration is likely to have the same effect. By accelerating payment into the low tax period from income that would have been earned in the

high tax period, the empirical estimate of the short run ETI is an upwardly biased version of the long run elasticity.

In the top left corner of the following table is the standard Feldstein ETI estimate for the full sample obtained from running the regression detailed in equation (10). The ETI equals 0.227 with a 95 percent confidence interval of plus or minus 0.03. The value obtained is in line with ETI's estimated by other New Zealand based studies, which used yearly data. The remaining rows of column 1 represent the ETI estimate for the points in the income distribution laid out in figure 5. It shows that the ETI increases with income, with the top 0.5 percent having an ETI of 0.495. This has been found in other studies both overseas as in Slemrod (1998) and in New Zealand such as Claus et al. (2012). The size of the disparity in estimates between those earning in the 97th to 99th percentile when compared to those in the 99.5+ percentile is dramatic. The very top of the income distribution displays an ETI five times higher than those in the 97th to 99th percentile. The results are statistically significant at the one percent level.

Table 4. Impacts of income acceleration on estimates of the Elasticity of Taxable Income

Income Group	*All Months All individuals (1)*	*All Months Non-accelerators (2)*	*Only M21 & A21 All individuals (3)*	*Excl. M21 & A21 All individuals (4)*	*Excl. M21, A21, Ma21 & J21 All individuals (5)*
Full Sample	0.227 (0.191, 0.264)	0.167 (0.134, 0.200)	1.291 (1.140, 1.443)	0.172 (0.133, 0.211)	0.139 (0.097, 0.182)
P97 ≤ income < P99	0.166 (0.072, 0.160)	0.093 (0.053, 0.133)	0.807 (0.630, 0.984)	0.081 (0.034, 0.128)	0.060 (0.008, 0.112)
P99 ≤ income < P99.5	0.273 (0.201, 0.345)	0.217 (0.153, 0.282)	1.594 (1.278, 1.911)	0.200 (0.124, 0.276)	0.150 (0.065, 0.234)
P99.5 ≤ income	0.495 (0.422, 0.568)	0.361 (0.293, 0.428)	2.341 (1.996, 2.686)	0.398 (0.322, 0.474)	0.353 (0.368, 0.439)

Notes: The table reports ETI estimates using the specification defined in (10) and 95 percent confidence intervals in brackets. The construction of the treatment group (38,577 individuals) and comparison group (78,699 individuals) is described in the data section. The column label "Non-accelerators" refers to estimations where employees accelerating income into March 2021, according to the acceleration criteria described in the data section, are excluded from the sample. This excludes 57,065 from the total sample of 117,276 taxpayers. The ETI estimates under the label "Only M21 & A21" are based on estimation of (10) on the subsample of wage observations from March 2021 and April 2021. The ETI estimates under the column label "Excl. M21 & A21" are based on an estimate of (10) on a subsample where wage observations in March 2021 and April 2021 are excluded from estimation. The ETI estimates under the column label "Excl. M21, A21, Ma21 & J21" are based on an estimate of (10) on a subsample where wage observations in March 2021, April 2021, May 2021 and June 2021 are excluded from estimation.

Source: The employee monthly schedule provided by the Inland Revenue Department to the Statistics New Zealand IDI.

To analyse the impact that income acceleration has on estimates of the ETI, I recalculate the ETI using a subset of the data where individuals who were identified as accelerators in the Treatment group and the Comparison group are excluded. This process removes 57065 out of 117,276. By doing this the ETI estimate drops from 0.227 to 0.167. An ETI of 0.167 means that for a one percent increase in the net-of-tax rate, taxable income would increase by 0.167 percent. For an individual with a taxable income of $200,000 this would be an increase of $334. This is reported in column 2 of table 4. This has the largest effect on the estimates for the highest income earners. The results are statistically significant at the one percent level.

Monthly data allows me to decompose the ETI further. Column 3 is the ETI estimation, but only for the months of March 2021 and April 2021, across the boundary of the Tax reform, where acceleration is most common. The ETI estimates for these two months are, not surprisingly, far higher than for the full period estimates. The ETI estimate for the full sample is 1.291 and once again increases with income in absolute terms all the way to 2.341 for the very top of the income distribution. An ETI of 1.291 means that for a one percent increase in the net-of-tax rate, taxable income would increase by 1.291 percent. For an individual with a taxable income of $200,000 this would be an increase of $2582. Somewhat surprisingly, in percentage terms those in the ninety seventh to ninety ninth percentile show the greatest increase with ETI estimates almost 8 times higher than the full sample. The results are statistically significant at the one percent level.

With income acceleration most likely to impact growth rates in March 2021 and April 2021, we can remove most of the effect of acceleration from the estimates of the ETI by running the standard regression on the remaining 21 months. The estimates from this specification can be seen in column 4 and for the full sample gives an ETI estimate of 0.172. This estimate is smaller than the full period estimates for all income groupings. The difference between the estimates increases as income increases. These results are all significant to greater than 99 percent.

While income acceleration would shift income into March 2021, it could have come from any of the months following the tax reform as there is some variety in when bonus payments are paid to employees. Income is less likely to have been accelerated out the months further from the reform, such as December, as uncertainty regarding both continued employment as well as economic conditions increases the further into the future the money is accelerated from. As such the final column shows estimates where the months of March 2021, April 2021, May 2021 and June 2021 are excluded. These estimates show an even further drop in the ETI for all income groups, with the main sample ETI of 0.139 representing an almost 40 percent drop in the ETI estimate when compared to the original full Feldstein (1995) estimate. In percentage terms the ETI estimates of those at the top of the income distribution are least impacted, but still see a 20 percent reduction overall. These results are all significant to greater than 99 percent except for the 97-99 percentile decomposition which is significant to greater than 95 percent.

The literature has historically looked at three-year income differences, using annual income for the year prior to the reform and for two years post reform (Auten & Carroll, 1999; Gruber & Saez, 2002). The reasoning behind this is that the longer period reduces the impact of short-term responses such as income shifting on the estimates of the long run ETI. At the time of writing, the standard three-year window of data is not yet available. The expectation would be for the ETI estimates to decrease and the impact of acceleration to drop with only the year

before the reform now impacted by accelerating behaviour. This was seen in Kreiner et al. (2016) who saw decreases in both the ETI estimate and the impact of income shifting on the ETI.

Implications for tax policy

The assessed size of the behavioural response varies greatly due to the variation in the estimates of the ETI. ETI estimates are also used to help determine the revenue maximizing tax rate or "Laffer rate" for a given income distribution. Understanding what the revenue maximizing rate is allows governments to understand which side of the "Laffer curve" the tax regime currently sits on and therefore whether increasing tax rates still generates desired increases in revenue.

First, I consider the size of the behavioural response. The size of the behavioral response was defined in equation (5). With the standard Feldstein estimate of the ETI the behavioural response is $226 million. Using the ETI estimate that accounts for income acceleration, the behavioural response drops to $140 million. The difference between the two behavioural response estimates represents $86 million a year in tax revenue collected. With the New Zealand government claiming that the new top marginal tax rate would bring in an additional $550 million a year in revenue, the difference in behavioural responses represents 15.6 percent of the additional revenue.

The increase in average wage for the Treatment group relative to the comparison group represents approximately $43,500,000 in taxable income. If we attribute all of this increase in wages to income accelerated into tax year 2021 from tax year 2022, this represents approximately $2,600,000 in tax revenue not collected due to income acceleration. With wage and salary income the most difficult to shift, and this income only coming from income that is reported by a third party (the employer), this value represents the lower bound of tax loss due to income acceleration.

The tax revenue directly lost to income acceleration is low in the context of the tax reform. It represents approximately three percent of the difference in tax revenue represented by the two ETI estimates. This indicates the outsized effect that income acceleration can have on estimates of the ETI. This reenforces the necessity to try and identify short-term, one-off responses that may distort estimates of the ETI. Thankfully administrative level data sets are becoming more available to researchers, and they are increasingly linked to non-tax data such as employer information. This allows for identification of subsections of taxpayers who may have greater or lessened access to these responses.

Turning to the revenue maximizing tax rate, the standard ETI estimate gives a revenue maximizing top marginal tax rate of 65.6 percent. When income acceleration is taken into account, which lowers the ETI, the revenue maximizing rate increases to 75.7 percent. With the ETI estimates not taking into account self-employed data the true value of the Laffer rate is likely lower. Even so, these values are far higher than the current marginal tax rate indicating that the New Zealand tax regime currently lies on the left-hand side of the Laffer curve. This means that increasing tax rates will continue to raise revenue. Raising tax rates to this level would not come without political cost. Getting the public at large on board without a large change in current sentiment would prove difficult. Raising the tax rates without bringing the public along would lead to political backlash at the next election which makes increasing rates to the Laffer rate politically untenable. Raising tax rates this high would also mean New Zealand was taxing income at a far higher rate than many other countries round the world. With a large difference between income tax rates, worker relocation to countries with a lower tax burden becomes increasingly attractive.

The results above show that even at the very high end of the income distribution there are differing levels of responsiveness to tax changes. The very top (99.5+) of the income distribution have a revenue maximizing rate of 55.2 percent. As tax rates rise towards the overall revenue maximizing rate of 65.6 percent, this rate will be passed. When this happens, the revenue collected from the very top of the income distribution will decrease. This makes the tax rate increasingly regressive as the revenue gathered from those with comparatively high ETI's will begin to decrease. This leaves those with comparatively low ETI's carrying more of the tax burden.

As discussed in the tax section, New Zealand has a high proportion of personal trusts when compared to the rest of the world. According to the IRD the trust is the "primary vehicle that high-income taxpayers are most likely to use to divert income that would otherwise be taxed at their 39 percent personal rate" (IRD, 2020). Following the election of the Labour government in October 2020 the IRD detected a 28 percent increase in the number of trusts and companies registered prior to the start of tax year 2022 (Bond, 2022). With the ETI capturing all behavioural responses, it will capture the shifting of personal income in to trust income. Trust income is then taxed at 33 percent rather than the top marginal tax rate of 39 percent. This will have revenue effects for the government but does not represent a 'real' response. The taxpayer will still work the same amount as prior to the tax reform in the same job, but their income will be redirected into a trust.

In the hierarchy of responses described in Slemrod (1992), these tax base adjustments are easier to implement than 'real' behavioural responses such as changes in hours worked and so

responses that include base shifting will exhibit higher elasticities. If the government chose tax personal trusts at the same rate as they tax wage and salary income, the observed behavioural response would be lower as shifting tax bases to trusts would no longer provide a reduction in tax paid. An increase in the trust tax rate was suggested by the IRD in the lead up to the reform as their method for reducing the behavioural effect of the tax change and to improve the integrity of the tax system (IRD, 2020)

Tax policy changes are usually designed to have long term revenue implications and as such policy analysts are interested in both the short run and long run behavioural responses to changes in the tax rate. The estimates of the ETI provided by the DD approach are short run estimates and capture short run behavioural responses. These short run estimates can help identify the impact on tax revenue for the period immediately post reform. As seen, using short run estimates that do not account for transitory income will dramatically overestimate the size of the behavioural response. Using these estimates for long run responses to tax reforms may also inaccurately quantify the size of the response. Long run ETI estimates will include further responses such as changing jobs which may take longer than a year to become apparent. Long run ETI effects are more elusive as they require a different, more structural approach to identify accurately as seen in Kreiner et al. (2015). Kreiner et al. (2015) find long term ETI's for Denmark between 0.15 and 0.35. These are higher than the short-term results found in Kreiner et al. (2016) which used the standard DD evaluation and far higher than the results found once income shifting was accounted for. If long term ETI estimates are higher than short term ETI estimates, using short term ETI estimates for calculating the long-term revenue impacts of a tax change will underestimate the size of the behavioural effect.

Conclusion

I sought to answer the question, what is the impact of intertemporal income shifting on estimates of the ETI following the 2020 New Zealand tax reform. While I find no evidence of income shifting, defined as an increase in income in one period followed by a corresponding decrease in the next, I find clear evidence of income acceleration. This income acceleration exhibited many of the same properties as the income shifting uncovered in Kreiner et al. (2016). Whilst prevalent in all groups affected by the tax reform, income acceleration was most prevalent in those at the very top of the income distribution, and those in firms with less than 25 employees.

Income acceleration had a clear impact on estimates of the ETI. When not accounting for the income acceleration, I find an ETI estimate of 0.227. Under my preferred specification of income acceleration, when the ETI is re-estimated the estimate drops to 0.139, indicating that transitory income movement can account for approximately 40 percent of estimates of the ETI. In line with the literature, estimates of the ETI increase as income increases, even when income acceleration is excluded.

It should be noted, that because these estimates were generated from wage and salary data, which should be the most difficult to manipulate to avoid taxation, these values represent lower bounds for the true behavioural response. If we were to include the self-employed, the true ETI is likely somewhat higher. For those not already taking advantage of the lower 28 percent company tax rate or the 33 percent trust rate, the new top marginal tax rate may provide enough incentive to change tax codes. The self-employed are also likely to have greater access to timing responses, such as ensuring outstanding bills were paid prior to the new tax rate. This means that the income acceleration detected is also a lower bound.

In the context of the New Zealand 2020 tax reform the standard ETI estimate represents a behavioural response of $226 million in tax revenue. Using the estimate with income acceleration removed this behavioural response becomes $140 million in tax revenue. This is a difference of $86 million a year in tax revenue. This represents almost 15 percent of the yearly revenue that the government expected the tax reform to generate. From a lost revenue standpoint, the timing response as a one off is relatively small. However, it is available every time a tax rate changes and so should be accounted for when considering a change in tax rate.

I contribute to the New Zealand literature in two ways. Firstly, I quantify the impact that timing responses have on short run estimates of the ETI. Secondly, I provide recent estimates of the ETI

for those at the top of the income distribution for New Zealand. Further research would include the income of the self-employed, if reliable monthly data could be found. Without monthly data, the magnitude of the timing response becomes difficult to detect.

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