Taxable income elasticities and the deadweight cost of taxation in New Zealand

by

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Abstract

This paper investigates the behavioural response to income taxation in New Zealand and its consequent welfare implications. Using the 1986 New Zealand tax reform as a 'natural experiment' the elasticity of taxable income is estimated. Adopting the methodology of Auten and Carroll (1999), elasticity estimates ranging from 0.36 to 1.10 are obtained, with a preferred estimate of 0.52. Following Feldstein (1999), these estimates are then used to measure the deadweight loss due to income taxation in New Zealand. The main results are that the 1986 tax cuts reduced deadweight costs by 27% to $2,138 million, or 23% of income tax revenue. In contrast, the increase in tax rates in 2000 raised deadweight costs by 36% to $2,653 million, though this is now only 15% of tax revenue. The marginal welfare cost of taxation is estimated at $1.01 for every extra dollar of tax revenue. When allowing for the effect of behavioural responses on tax revenue this figure increases markedly to $7 per extra dollar of revenue. These results have strong implications for public policy. In particular, the marginal welfare cost is significantly greater than previous (labour supply based) estimates for New Zealand, suggesting that the welfare costs of taxation in New Zealand are considerably higher than may generally be perceived.

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1. Introduction[1]

An income tax imposes welfare costs on society. This is the inevitable result of any form of taxation that alters the relative prices of goods. The magnitude of these costs depends on both the size of the tax, and on the size of the behavioural response induced by the tax. In other words, how people respond to being taxed matters.

This paper investigates the behavioural response to income taxation in New Zealand and its consequent welfare implications. This is achieved in two distinct, but related parts. First, I take advantage of the significant tax reform that occurred in New Zealand in 1986 to estimate the elasticity of taxable income with respect to a change in the 'net-of-tax-rate' (one minus the marginal tax rate). This parameter has received significant attention in the recent literature and has major implications for public policy.[2]

Placing this parameter within a more traditional framework, however, may help emphasise the significance of the elasticity estimates for public policy. As such, a framework is then adopted that allows taxable income elasticities to be used to derive estimates of the familiar welfare concept of deadweight loss.[3]

There is a vast empirical literature measuring behavioural responses to tax rate changes that dates back to the work of Harberger (1964). This analysis, and much of what followed, was focussed on labour supply decisions, in particular on hours worked. The typically low compensated labour supply elasticity estimates (and similarly low elasticities for savings) resulted in the general view that welfare costs

[1] I would like to thank Frank Cowell, Jonathan Leape, Sandra Watson and Sri Farley for their help. The views expressed in this paper are those of the author and do not necessarily reflect those of the New Zealand Inland Revenue Department.

[2] Not only do taxable income elasticities have obvious implications for revenue raising and the efficiency costs of taxation, but they have also been applied in relation to the optimal size of government [Feldstein (1997)] and optimal tax rates [Saez (2001)].

[3] See Auerbach and Hines (2002) for a detailed discussion of the theory and measurement of deadweight loss.

due to income taxation were relatively low. For example, Harberger's deadweight loss estimate was roughly 2.5% of tax revenue raised from labour.

While perhaps the most obvious distortion is to hours worked, an income tax also influences work effort, and longer term labour supply decisions such as participation, choice of occupation, and whether to undertake further education. A tax will also influence the form in which compensation is taken (biasing towards tax-favoured forms such as pensions, or other fringe benefits, including less obvious forms such as improved working conditions), and create a bias towards tax-favoured forms of consumption (for example, charitable giving and housing). Capital income will also be influenced by the income tax, with bias again towards tax-favoured forms, such as capital gains (untaxed in New Zealand) rather than dividends. The decision to evade tax, of course, is clearly tax influenced.

The conceptual benefit of the elasticity of taxable income is that it provides a means of summarising many of these behavioural responses in a single parameter.[4] Slemrod (1998, p777) concludes that "the compensated elasticity of taxable income accounts for all of the tax-induced responses that have a social cost and, for this reason, is superior to a narrow focus on the labour supply elasticity". Feldstein (1999) argues that the traditional (labour supply) method of analysing the income tax greatly underestimates the true deadweight costs of the tax, and suggests that Harberger's original estimate may be less than one-tenth of the true cost of the income tax.

Empirical work has utilised tax changes, particularly the US changes of 1981, 1986 and 1993, as 'natural experiments' to estimate this parameter. The 1986 New Zealand tax reform resulted in significant variation in tax rate reductions, and allows a similar approach to be taken. I follow the methodology of Auten and Carroll (1999)

[4] Elasticity estimates may not fully capture the longer term labour supply effects on taxable income.

who use an instrumental variable based regression approach that accounts for the influence of both tax rates and other non-tax factors on taxable income.

While the elasticity is an important parameter in its own right, Feldstein (1999) provides a framework for using taxable income elasticities to estimate the deadweight losses due to income taxation. While this framework is not without limitations, it allows corresponding estimates to be derived of the deadweight cost of the New Zealand income tax.

This analysis is extended to examine the welfare costs of the most recent tax rate reform in New Zealand in 2000. Some analysis on the likely costs of future taxation policies is also provided.

The paper proceeds as follows: in section two I review the empirical literature on taxable income elasticities. Sections three and four outline the empirical approach, while section five discusses the results. Section six summarises and provides some concluding comments.

2. The empirical literature on taxable income elasticities

Empirical estimation of the responsiveness of taxable income to changes in marginal tax rates began as far back as Lindsay (1987), but it has been in the last ten years that interest in the parameter has markedly grown, to the extent that Goolsbee (2000a) suggests it has become the most central empirical issue in public finance.

As noted in the introduction, the common feature of the empirical work has been the use of tax reforms as 'natural experiments'. Essentially, this involves comparing groups of taxpayers affected differently by tax changes, using less affected groups as 'controls' to identify the true 'treatment' effect of the tax changes.

Lindsay compared two different cross-sections of taxpayers either side of the 1981 US tax rate reductions. Taxpayers were grouped by income and the change in average taxable income of individuals in each group was compared to the corresponding change in net-of-tax-rate to obtain estimates of the elasticity of taxable income. His results suggested an elasticity of between 1.6 and 1.8, although some estimates were substantially higher.

However, a major concern with this approach is how comparable the two income distributions actually are, as they do not necessarily correspond to the same taxpayers. Furthermore, all variation between years is assumed to be a response to the tax changes, whereas the distribution may have skewed towards high incomes for some other reason.[5]

The first of these problems can be solved through the use of panel data, and essentially following the same taxpayers over time. Feldstein (1995) does just this in analysing the response of close to 4,000 middle- and upper-income married taxpayers to the 1986 US tax reforms. These reforms had a varying effect on marginal rates, but resulted in a large decrease in rates for high-income taxpayers. He groups taxpayers by their pre-reform marginal tax rate and calculates percentage changes in the average income and net-of-tax-rate for each group between 1985 and 1988, adjusting 1985 income for wage growth. Elasticity estimates are calculated based on the 'differences-in-differences' of these percentage changes.

The 'differences-in-differences' approach relies on two assumptions: that the constituents of the groups do not change over time, and second, that changes in the macroeconomic environment have the same effect on each group. If these hold, both groups will respond identically to any common macroeconomic shocks, so

[5] This concern is noted by Navratel (1995) and by Gruber and Saez (2002).

differencing will remove the effect of such shocks from the data leaving only the 'treatment' effect – the response of taxable income to tax rate changes.

Feldstein compares three groups: a medium-, high-, and highest-income group, to obtain elasticity estimates ranging from 1.04 to 3.05. These results, while initiating considerable further research, have been criticised. In particular, Goolsbee (2000a) has argued that increasing inequality coinciding with tax reforms in the 1980s may have created a spurious correlation between tax cuts and rising top-end incomes. Goolsbee (2000b) questions whether tax reforms really are 'natural experiments'. He argues the very rich differ from other taxpayers in more ways than simply their tax rate, and that this may bias results.

Perhaps a clearer concern is that Feldstein's sample only included 57 observations for taxpayers in the top two pre-reform tax brackets. As Slemrod (1998) notes, generalising from such a small sample is, at the very least, problematic.

While Feldstein only had access to a limited publicly available tax return sample, US Treasury officials Gerald Auten and Robert Carroll (1999, henceforth AC) were able to analyse the 1986 reform using the far larger (non-public) Treasury sample. This sample is stratified, providing even more high-income taxpayers (though this comes at the empirical disadvantage of having to use a weighting procedure to avoid sample selection bias). Their final sample consisted of over 15,000 observations with over 4,000 relating to taxpayers in the top two pre-reform tax brackets.

AC were particularly interested in whether tax rates or non-tax factors explain the increase in inequality observed in the US during the 1980s. As such, they adopt an instrumental variable regression approach and explicitly control for the influence of several non-tax factors including age, education, region and wealth. Unlike Feldstein's approach, a regression also details the precision of estimates.

Their unweighted estimates are similar to Feldstein's, but after their weighting procedure reduces the influence of the over-sampled high-income taxpayers, their estimate settles around 0.6. They conclude that both tax and non-tax factors played a role in increasing inequality in 1980's America.

Sillamaa and Veall (2001) follow AC's empirical approach, applying it to the Canadian reforms of 1988. The significant advantage of this study is the large sample size (up to 474,040 observations) available to them. They find a smaller elasticity for Canada of around 0.25. When adjusting for various tax credits this falls further to 0.14. They also break their income variable into both employment and self-employment income, unsurprisingly obtaining low (0.08) and high (1.32) elasticities, respectively.

Thanks to their large sample, Sillamaa and Veall are also able to extend their analysis to particular age and income groups.[6] They conclude that taxpayers aged 65 or over are slightly more responsive to tax changes (0.29) overall, and that high-income taxpayers are significantly more responsive to tax rate changes than lower-income taxpayers. In particular, working age taxpayers earning over $100,000 had an elasticity of 1.67, while their older (65+) counterparts had an elasticity of 3.17.

Hansson (2004) incorporates the approaches of both Feldstein and AC in a study of the 1990 Swedish reforms. By using an instrumental variable approach, where the instrument is a dummy variable that groups observations by pre-reform marginal tax rate, she adapts Feldstein's 'differences-in-differences' approach into a regression setting. This enables the inclusion of similar non-tax explanatory variables to AC and Sillamaa and Veall. She finds an elasticity of 0.82 under this approach, falling to 0.57

[6] Most other studies, including Feldstein (1995) and AC, exclude younger and older taxpayers to avoid the non-tax related jumps in taxable income caused by first employment and by retirement. Sillamaa and Veall do the same for their initial estimates.

when controlling for the effects of income shifting due to the introduction of separate rates for 'earned' and 'unearned' income.

When following AC's approach, her general estimate is substantially lower at 0.37, and rises slightly to 0.43 when adding the same controls for income shifting. Aarbu and Thoresen (2001) apply a very similar approach for Norway obtaining lower estimates of between 0 and 0.2.

Gruber and Saez (2002) take a different approach, developing a framework that separates out income and substitution effects, and estimating these effects for the US using a far longer panel than previous work. They take the differences in incomes and marginal tax rates of the same taxpayers between nine pairs of years (each three years apart) throughout the 1980s. These differences are combined to produce a data set of around 100,000 observations. Their identification comes from the 1981 and 1986 reforms, various state reforms, as well as 'bracket creep'.[7]

Without controlling for income effects their preferred elasticity estimate is 0.4. When they do control for income effects they obtain a slightly higher (0.43) elasticity estimate and a negative (-0.135), but statistically insignificant, income effect. They consider the difference between compensated and uncompensated elasticities to be small relative to the magnitude of the elasticities, and proceed to examine different income groups on the assumption that compensated and uncompensated elasticities are identical.

In this regard, their elasticity estimates are far larger for taxpayers earning over $100,000, than lesser amounts. However, these are all statistically insignificant at the five percent level, although the greater than $100,000 estimate is significant at the ten

[7] 'Bracket creep' refers to inflation pushing taxpayers into higher tax brackets, and therefore higher rates, when brackets are not indexed for inflation. Saez (2003) uses 'bracket creep' as the sole source of identification for 1979-81 US data, reporting elasticities of around 0.4.

percent level. Nevertheless, they conclude there is strong evidence that the responsiveness to taxable income is driven by the highest income taxpayers, albeit conceding it is 'not definitely conclusive'.

Goolsbee (2000a) looks specifically at the responsiveness of high-income taxpayers to the 1993 US reform that increased rates for such taxpayers. He uses panel data detailing the level and forms of corporate executive compensation, in a regression setting that separates out short-run and longer-run elasticities. He estimates the short-run elasticity to be greater than one, but that after a year the elasticity becomes 0.4 or lower, with the vast majority of the short-run response coming from a large increase in the exercise of stock options in anticipation of the increase in tax rates. He concludes that, due to the predominance of timing rather than permanent effects, the costs of progressivity appear to be less than previous work has suggested.

3. Estimating taxable income elasticities

3.1 The 1986 New Zealand tax reform

The 1986 tax reform in New Zealand provides an excellent opportunity to examine the effects of changes in tax rates on taxable income. As table one in Appendix A shows, statutory rates were reduced by varying degrees for all taxpayers. High-income taxpayers experienced the largest reductions, with an 18 percentage point fall for those earning over $38,000, but taxpayers in the upper-middle of the income distribution also experienced a large reduction, with a 15.1 percentage point fall for those earning between $25,001 and $30,000. This variation in tax rate reductions across income groups makes it possible to identify the response of taxable income to tax rate changes.

3.2 An empirical model for taxable income

Taxable income is determined by various factors. While tax rates are likely to have a significant influence, other non-tax factors will also play a role. Following AC, I

adopt a model that incorporates both tax rates and various non-tax factors in explaining a taxpayer's income. The model is as follows:

$$\ln Y_{it} = \mu_i + \gamma_t + \alpha X_i + \beta \ln(1 - \tau_{it}) + \varepsilon_{it} \quad (1)$$

where Y is taxable income[8], μ is a fixed individual specific effect that controls for individual characteristics such as skills, tastes, and geographic location, while γ is a time effect controlling for factors that affect all individuals in the same way. With τ the marginal tax rate, $(1 - \tau)$ is the net-of-tax-rate. The vector 'X' contains variables that are unchanging over time, but may have a time-varying influence on income. These are discussed in more detail in the following section.

By differencing equation (1) we can remove the individual effect to get:

$$\Delta \ln Y_i = \Delta\gamma + \alpha X_i + \beta \, \Delta \ln(1 - \tau_i) + \Delta\varepsilon_i \quad (2)$$

where Δ signifies the first difference. Given the log-difference form, β can be interpreted as the elasticity of taxable income with respect to a change in the net-of-tax-rate.

3.3 Variable selection

In estimating equation (2) the following explanatory variables are included in the 'X' vector: 1986 taxable income, 1986 capital income, age, age-squared, and an 'entrepreneurship' dummy variable.

[8] AC use two income concepts: 'taxable income' and the broader 'adjusted gross income'. Due to several small tax base changes, they make some further adjustments to their income definitions to ensure more compatibility between the years considered. Such adjustments are beyond the scope of this paper. While no major alterations were made to the definition of taxable income in 1986-88, smaller base broadening changes were being continuously made throughout the 1980s, and may lead to some bias in the results.

1986 taxable income is included to control for 'reversion-to-the-mean' effects. This refers to the likely presence in the data of some transitory (high or low) income and the tendency to revert back to a far higher, or lower, 'mean'. This can bias estimates up or down by producing large swings in taxable income between the years considered. As Kopczuk (2003) points out, by including initial income, the transitory component of income is effectively being treated as a missing variable, with initial income acting as a proxy to indirectly control for its effect. The sample restrictions imposed are also designed to reduce the effect of transitory income.

1986 capital income is included as a proxy for wealth. Wealth may affect a taxpayer's ability to alter both their labour supply and the structure of their investments in response to tax changes. Also, capital income is likely to be more easily manipulated into tax-favoured forms. Capital income is calculated as the sum of interest, dividend and rental income.

Age and age-squared are included to allow for life-cycle effects. The entrepreneurship dummy variable indicates whether a taxpayer had self-employment, or partnership income of more than $1,000 in 1986. AC argue that such a variable may reflect business ownership and entrepreneurial skills and the propensity for risk-taking. More simply, the self-employed tend to have more opportunity to both avoid and evade tax.

AC include a number of other variables that data limitations prevent from being used here. Most significantly, they include occupational dummies to account for potential changes in the returns to education. Sillamaa and Veall (2001) note, however, that the inclusion of these dummies does not significantly alter the coefficients of other variables in their regressions.

3.4 Data

To estimate equation (2), a panel of tax return data is created by matching taxpayers sampled in the Inland Revenue Department's IR7X dataset in both the 1986 and 1988 tax years.[9] The IR7X dataset consists of stratified (more high-income taxpayers) random samples of tax returns for 1982-90.

Preferably, 1989 rather than 1988 data would have been used to allow more time for the effects of the reform to fully 'bed-in'. This would be consistent with Feldstein (1995), Sillamaa and Veall (2001) and Gruber and Saez (2002) who use a three year gap. However, this was not possible due to a further reduction in tax rates in October 1988, leaving the 1989 year incomparable. AC use data four years apart, but this is to account for the delayed implementation of parts of the US Tax Reform Act of 1986.

Using 1988 data may lead to bias in either direction. The long-term effects of the reform may not be fully captured, biasing the response of income down. Another possibility is that temporary effects, such as the altered timing of income and/or losses, may be caught and bias the response of income upwards. The significant timing effects found by Goolsbee (2000a) amongst high-income taxpayers, suggest that this is perhaps the greater concern.

Only taxpayers aged between 25 in 1986 and 59 in 1988 are included in the panel. This is to avoid the non-tax related jumps in income caused by first employment and retirement. For similar reasons AC restrict their sample to ages 25-55. Sillamaa and Veall (2001) restrict their sample to ages 25-61, but then consider separately the responsiveness of individuals over age 64. Taxpayers in the lowest tax bracket (or returning a loss) in either year are also excluded.[10] This is to minimise the influence

[9] The 1986 tax year is 1 April 1985 to 31 March 1986. Likewise, the 1988 tax year is 1 April 1987 to 31 March 1988. The (1 October) 1986 reform occurred six months after the end of the 1986 tax year and six months before the beginning of the 1988 tax year.

[10] This excludes taxpayers earning less than $6,000 in 1986 or $9,500 in 1988.

of 'reversion-to-the-mean' effects, and also to limit the effects of high effective marginal tax rates at the bottom of the income distribution created by the withdrawal of welfare payments. After imposing these restrictions the final panel consists of 21,533 taxpayers, including 5,165 taxpayers in the top tax bracket in both 1986 and 1988.

3.5 Estimation

Equation (2) is estimated using a weighted two-stage least squares procedure. This is designed to correct for both sample selection bias, and the endogeneity of the net-of-tax-rate. Both these problems were faced by AC, and I employ their solutions.

As mentioned above, the stratification process used for the IR7X dataset over-samples high-income taxpayers, which avoids the small sample problems faced by Feldstein (1995). However, as noted by Hausman and Wise (1981), stratification using an endogenous variable (such as income is here) may lead to biased parameter estimates. To correct for this each observation is weighted by the inverse of the sampling rate of their respective strata, thus extrapolating the sample to represent the population.[11]

The second problem results from the marginal tax rate depending on a taxpayer's own behaviour. That is, due to the progressive structure of the income tax, an increase in taxable income can result in a taxpayer moving to a higher marginal tax rate (even if marginal rates have declined). As a consequence, the net-of-tax-rate is likely to be correlated with the error term in the regression, and an ordinary least squares regression will produce biased and inconsistent parameter estimates.

[11] The stratification process took a 'full collection' of taxpayers with income over $70,000. Stratification for lower incomes was based on the type of return filed. The weighting procedure corrects for any possible bias here also. AC faced further problems due to sampling probabilities varying between years for the same taxpayers. In contrast, once a taxpayer was included in the IR7X sample in one year they continued to be sampled in following years. As such, the weighting can be based on the sampling rate for 1986 alone.

An instrumental variable approach (two-stage least squares) is adopted to solve this problem. While such an approach is still biased in small samples, it will provide consistent parameter estimates. The instrument used is a modified net-of-tax-rate calculated using the post-reform marginal tax rate that would have applied if the taxpayer's real income had not changed, rather than using their actual post-reform rate.[12] As a result, this instrument should be correlated with the change in marginal tax rate, but not with any change in income.

The estimation process is completed in two steps. First, weighted least squares is used to regress the endogenous net-of-tax-rate on the instrument and the other independent variables in *'X'*, from which predicted values for the net-of-tax-rate are generated. This removes the influence of income on the net-of-tax-rate. Taxable income is then regressed on this 'predicted' net-of-tax-rate and the other independent variables (again using weighted least squares).

For comparison I also provide unweighted results. Additionally, I duplicate the approach for a restricted version of the model including only one additional explanatory variable, the log of 1986 income. AC argue that this provides a comparison with earlier work.

4. Calculating the deadweight loss of an income tax

4.1 Feldstein's (1999) framework

Traditional measurement of the deadweight loss of a labour income tax is based on the taxpayer's trade-off between leisure and consumption (of all other goods). The taxpayer maximises utility (a function of leisure, L, and consumption, C) subject to the following budget constraint:

$$C = (1-t)w(1-L) \tag{3}$$

[12] Sillamaa and Veall (2001) and Gruber and Saez (2002) also follow this approach.

where t is the tax rate, and w the wage. Feldstein (1999) argues that this is not the true problem faced by taxpayers as some forms of compensation are generally excluded, while some forms of consumption are (at least partially) deductible in calculating tax liability. Incorporating these, the taxpayer's budget constraint becomes:

$$C = (1-t)[w(1-L) - E - D] \tag{4}$$

where E and D represent exclusions and deductions.[13] This can be rewritten as:

$$(1+\tau)C = w(1-L) - E - D \tag{5}$$

where $(1+\tau) = 1/(1-t)$. Feldstein points out that if you treat leisure, excludable compensation and deductible consumption as one composite good, then this is equivalent to analysing an excise tax on ordinary consumption. He goes on to show that the deadweight loss of such an excise tax, and hence of the income tax, is:

$$DWL = 0.5t^2(1-t)^{-1}\varepsilon\ TI \tag{6}$$

This is the traditional Harberger (1964) formula [as amended by Browning (1987)] with taxable income replacing labour income, and the compensated taxable income elasticity replacing the compensated labour supply elasticity.

Although this framework incorporates more behavioural responses than the basic leisure-consumption framework, Slemrod (2000), and Slemrod and Yitzhaki (2002) note that it is based on real substitution responses, as opposed to types of avoidance

[13] Auerbach and Hines (2002) extend this to where some consumption is only partially deductible. This does not alter the result.

and evasion that do not actually alter consumption decisions, such as paying a tax professional to advise on the deductibility of activities already undertaken, or changing the timing of income or losses. They argue that the framework will only apply to this broader avoidance and evasion if taxable income is defined broadly to take account of shifts across bases and time periods.

An important limitation of Feldstein's framework is its applicability to labour income only. In contrast, the major benefit of the elasticity of taxable income is its coverage of various decision margins, including those relating to capital income. Within Feldstein's framework, however, 'taxable income' is a labour concept.

Empirically, this implies that to estimate deadweight costs, one must distinguish labour and capital income, excluding the latter. Of note, however, Feldstein does not do this when applying his own framework to US data.[14] He uses elasticities from his 1995 paper that are based on a definition of taxable income that includes capital income, and uses taxable income levels that again include capital income. He estimates the deadweight loss associated with the US income tax at $181 billion, or 32% of income tax revenue.

4.2 Applying the framework

In order to properly apply Feldstein's framework, I re-estimate equation (2) with labour income as the dependant variable. This is defined as taxable income less interest, dividend and rental income.

Equation (6) is then used to estimate deadweight losses.

5. Results

5.1 Estimation of elasticities

[14] Hansson (2004) also includes capital income when following Feldstein's (1999) approach.

The two-stage least squares regression results are presented in tables three and four in Appendix B.[15] Table three shows the second-stage results with taxable income as the dependant variable, for both ordinary and weighted least squares. The unweighted results suggest a taxable income elasticity of 0.82. The weighted regression drops this estimate significantly to 0.36. Estimates for the restricted model are very similar.

These results are significantly lower than those of the earlier studies by Lindsay (1987) and Feldstein (1995) that did not explicitly account for non-tax factors, but the weighted estimate is comparable to the recent work of Gruber and Saez (2002) and Hansson (2004) who suggest elasticities around 0.4.

The weighted estimate fits roughly in the middle of the two most similar studies: AC, whose weighted estimates were approximately 0.6 for both adjusted gross income and taxable income, and Sillamaa and Veall (2001) whose preferred estimate is 0.25. This variation does not necessarily point to a failing in any of the studies. As Slemrod (1998) notes (and Sillamaa and Veall emphasise), different countries, with differing tax systems and tax bases, are likely to have different elasticities.

The lower weighted estimate implies that higher-income taxpayers are more responsive to tax changes than lower-income taxpayers. AC had the same result, while Sillamaa and Veall, and Gruber and Saez explicitly test for and conclude that responsiveness does vary with income level. Feldstein (1999) argues that, if true elasticities do differ by income, then using weighted estimates will underestimate the true response to a proportional tax change.

With labour income as the dependant variable (table four), the estimates change to 1.10 and 0.52 for unweighted and weighted regressions respectively. The drop from

[15] For brevity, the first-stage regression results are not presented. I note, however, that all the instrument coefficients from these regressions are large, positive, and highly significant, suggesting a strong correlation between the endogenous net-of-tax-rate and the instrument.

unweighted to weighted estimate is similarly large, but what is surprising is that the estimates themselves are larger than the corresponding taxable income estimates.

The difference between the two income measures is capital income (measured as interest, dividend, and rental income). As such, this result implies that labour income is more responsive to tax changes than capital income.[16] One would expect capital income to be more responsive to tax rate changes than labour income, given the greater scope for tax avoidance and manipulation such forms afford.[17] However, a possible explanation follows.

The 1980's were characterised by high tax rates and narrow bases. As a result, avoidance (and evasion) opportunities were far more prevalent than today. Further, they were less complicated and hence accessible to a greater range of taxpayers. For example, income was commonly retained in corporate form, or within a trust, while large exemptions were present for saving through life insurance and superannuation schemes.[18] At the time, New Zealand had a classical tax system that could produce a combined tax rate on dividends of 78%, creating strong avoidance incentives. The 2001 New Zealand Tax Review summed up the dividend problem:

> "[A]lthough dividends were generally fully taxable in shareholders' hands, with no credit for any tax paid at the company level, there were a number of ways that dividend taxation could be avoided. One was simply to pay no dividends. There was an excess retention tax to prevent this, but this was

[16] This definition of labour income includes unincorporated business income, a part of which should rightly be attributed to capital. Re-estimating the model with 'salary and wage' income as the dependant variable produces a smaller (and statistically insignificant) weighted elasticity of 0.25. This implies that most of the responsiveness measured in labour income comes from these unincorporated businesses. This appears inconsistent with the (surprisingly) negative coefficient on the 'entrepreneurship' dummy.

[17] Indeed Sillamaa and Veall (2001) find evidence of this with a slightly higher elasticity for gross income than for 'work' income, defined as combined regular employment and self-employment income.

[18] The 2001 New Zealand Tax Review notes that concessions provided to superannuation and life insurance, including the income tax exemption for pension superannuation schemes, cost the government $800 million in foregone revenue.

> complex and often easy to avoid. Other ways to avoid dividend taxation were to pay dividends out of capital gains or to issue bonus shares. Subject to certain rules, neither approach resulted in dividend taxation." (p15)

In such an environment, it is likely that a large proportion of capital income would have already been in tax-preferred vehicles before the 1986 tax change occurred. This being the case, a fall in personal tax rates would not have affected this capital income (to the extent that it was already taxed at a lower rate than the post-reform top personal rate).

This lack of variation in the 'true' tax rate on capital income means that the responsiveness of capital income will not be captured by the taxable income elasticity estimates. As a result, I conclude that a better estimate of the taxable income elasticity is, instead, the labour income estimate of 0.52.

As noted earlier, the effects of short-term income shifting, and tax base changes remain a concern. It is also possible that some income changes were simply movements between bases, rather than outright increases in income. As a result of the 1986 reforms, taxpayers that earned between $6,000 and $30,000 went from having an incentive to receive income in the form of fringe benefits to being better off receiving income as salary or wages. This may have lead to an increase in reported taxable income, biasing upwards the responsiveness of labour income relative to capital income. Also, Gordon and Slemrod (2000) note that some changes in taxable income may simply be taxpayers moving between incorporated and un-incorporated forms as a result of tax rate changes.

That said, all the elasticity estimates imply a large responsiveness to tax rate changes well in excess of standard labour supply elasticities. Accordingly, the welfare loss from an increase in tax rates will be large.

5.2 Deadweight loss calculations

As previously emphasised, the framework outlined in section four for calculating deadweight loss relates to a labour income tax. As such, I use equation (6) with labour income data and the estimated labour income elasticity.[19] The results are presented in tables five and six, and cover the 1986 reform as well as extensions to more recent data. For comparison, results using weighted and unweighted elasticities are included for both labour and taxable income. Preferred estimates are in the far right columns.

1986 reform

The deadweight loss of the income tax on labour in 1986 is estimated at $2,340 million. Given that the income tax generated total revenue of $8,070 million, this is a total deadweight loss of approximately 29 cents per dollar of revenue raised.[20] Post-reform, this figure falls to $2,138 million, or 23% of income tax revenue. Comparing the two (measured in 1988 dollars) points to a welfare increase of $810 million – a 27% reduction in deadweight costs. Estimates using taxable income are similar, but slightly higher in each year.

2000 reform

The most recent tax rate reform in New Zealand, in 2000, saw an end to the trend of lowering tax rates begun by the 1986 reform. As table two details, the top tax rate was increased from 33% (its level since October 1988) to 39% for income over $60,000. Given this reversal, it would be interesting to determine the costs associated with the change. As taxpayer responsiveness is not necessarily constant across time, it is preferable to re-estimate elasticities for 2000. This was attempted, however due

[19] I apply equation (6) to individual data then aggregate up to the population using sample weights. This avoids the downward bias created by using aggregate data and average marginal tax rates, an approach taken by Harberger (1964) and Browning (1987). Browning (1987) acknowledges this bias. Feldstein (1999) discusses the issue in more detail.

[20] Note the revenue figure includes tax on both labour and capital income.

to various difficulties surrounding this reform reliable elasticity estimates are not attainable. Instead, I apply the 1986 estimates to 1999 and 2002 data.

These estimates suggest that deadweight costs have increased from $1,801 to $2,653 million. While in real terms this is a 36% increase, due to the flatter rate structure overall, and a broader base than in the 1980s, the total deadweight loss is now only 15% of income tax revenue. Using taxable income the estimates are, again, slightly higher in each year.

Implications for future tax policy

Given that we live in a world with pre-existing taxes, a measure of marginal deadweight loss is desirable for policy development. As such, I estimate Browning's (1976, 1987) concept of 'marginal welfare cost', defined as the ratio of the change in total welfare cost to the change in tax revenue produced by a specified variation in tax rates.

Using 2004 data (the latest available) I estimate the current deadweight cost of labour income taxation at $3,099 million, or 16% of income tax revenue. Raising the top tax rate by one percentage point (from 39% to 40%) would result in an additional welfare loss of $112 million. Ignoring behavioural responses this would increase income tax revenue by $111 million, resulting in a marginal welfare cost of $1.01 for every additional dollar of tax revenue. This implies that, for future government expenditure policies (funded through increased progressivity) to be welfare improving, their benefit must be greater than $2.01 for every dollar of revenue required.

Allowing for behavioural responses increases this figure substantially. Raising the top rate to 40% corresponds to a 1.67% decrease in the net-of-tax-rate. An (uncompensated) elasticity estimate of 0.52 suggests that taxable income will then fall by 0.87%. This implies a revenue loss of $95 million. The overall revenue effect is

then only $16 million, implying a marginal welfare cost of $7 per additional dollar of tax revenue.[21]

As with Feldstein's (1999) estimates, these deadweight cost figures are far greater than those generally obtained from standard labour supply analysis. Perhaps most interestingly, the estimates of marginal welfare cost are significantly higher than the previous estimates on New Zealand data by Diewert and Lawerence (1994). Using a general equilibrium approach they estimated the marginal welfare cost of taxation of labour income to be only 18% in 1991, and averaging 9.5% for the previous 20 years.

Of note, the partial equilibrium approach I follow does not account for how a government spends the revenue collected. This could potentially reinforce or offset the initial distortions imposed by the tax, altering taxable income further.

Another limitation is the use of uncompensated rather than compensated elasticity estimates. However, given Gruber and Saez's (2002) finding of insignificant income effects for US data, the uncompensated estimates are likely to be good proxies for compensated elasticities. The introduction of a value added tax[22] at the same time as the 1986 tax rate reductions is also likely to have minimised income effects.

Feldstein concludes that both the overall revenue effect and deadweight loss of a proportional tax change depends almost entirely on the responsiveness of high-income taxpayers. This, combined with evidence of greater responsiveness to tax rate changes amongst high-income taxpayers, suggests the deadweight loss figures may be biased downward. Even so, they are significant enough to demand caution in the

[21] Note that no distinction has been made between labour and capital income. Revenue estimates were calculated for individual taxpayers, then aggregated to the population using sample weights. Data for 1999, 2002 and 2004 is from the New Zealand Inland Revenue Department's annual simple random samples of tax returns.

[22] The Goods and Services Tax (GST) was introduced at a flat rate of 10% at the same time as the 1986 income tax reforms, replacing numerous complicated and varying sales taxes. This partially offset the revenue loss from lowering income tax rates.

development of future government policies. The marginal welfare cost estimates suggest the costs of increased progressivity are extremely high.

6. Summary and conclusions

This paper has used the 1986 tax reform in New Zealand as a 'natural experiment' to investigate the behavioural responses caused by income taxation and the resulting welfare implications. It has progressed in two parts. The first was to estimate the elasticity of taxable income, while the second was to use these estimates to calculate the deadweight cost of the income tax.

Estimates of the elasticity of taxable income ranged from 0.35 to 1.10, with a preferred estimate of 0.52. This is within the range of recent empirical estimates for the US, Canada and Sweden. Earlier estimates for the US are far larger. However, these studies did not account specifically for the influence of non-tax factors on taxable income. Smaller variation in recent estimates using similar methodologies for different countries suggests that tax structure may influence elasticities. This may restrict the external validity of these studies, emphasising the value of country-specific analysis.

Some caution must be taken with these estimates as income figures were not adjusted for tax base changes. Furthermore, the narrow tax base that existed in the 1980s appears to have influenced the responsiveness of capital income. Another concern is the impact of the withdrawal of welfare payments on effective marginal tax rates for lower-income earners. Extension of this work to adjust for these concerns seems worthwhile. Nevertheless, the results imply a significant responsiveness to tax rates well in excess of standard labour supply approaches, suggesting that welfare costs are large.

Following Feldstein (1999), the elasticity results are adapted to estimate the total deadweight loss due to the taxation of labour income. The main results are that the 1986 tax reforms reduced deadweight costs by 27% to $2,138 million or 23% of income tax revenue. In contrast the 2000 reform increased deadweight costs by 36% to $2,653 million. Of note though, this is now only 15% of tax revenue – far lower than for 1988 thanks to a flatter rate structure, and broader tax base.

Absent the effect of behavioural responses on income tax revenue, the marginal welfare cost is estimated at $1.01 for every extra dollar of revenue raised. Including behavioural responses increases this figure markedly to $7, emphasising the significance of the elasticity estimate of 0.52. This measure is based on an increase in the top personal tax rate and thus demonstrates the cost of increased progressivity.

These results are only as strong as the elasticity estimate on which they are based. Due to continued base broadening, substitutability of tax-advantaged for non- tax-advantaged income is now likely to be lower. Consequently, the current elasticity, and these results, may be overstated. That said, evidence of larger elasticities amongst high-income taxpayers, and of the greater influence of high-income taxpayers on deadweight costs, points to a possible underestimation of the true costs of income taxation.

Overall though, the strong conclusion of this paper is that the welfare costs of income taxation in New Zealand are far greater than may generally be perceived. As such, a cautious approach needs to be taken regarding the implementation of future public expenditure policies. The benefits that these provide must not only outweigh their basic revenue costs but also the significant costs that coercive revenue collection imposes on society. In particular, a program financed by increasing the top marginal tax rate may need to generate a social benefit as high as nine times the necessary revenue.

Appendix A: Tax rates

Table One – New Zealand statutory tax rates: 1986-1988

1986		1988	
Taxable income	%	Taxable income	%
0 - 6,000	20	0 - 9,500	15
6,001 - 25,000	33	9,501 - 30,000	30
25,001 - 30,000	45.1	30,001 +	48
30,001 - 38,000	56.1		
38,001 +	66		

Table Two – New Zealand statutory tax rates: 1999-2002

1999				2002	
April – June		July – March			
Taxable income	%	Taxable income	%	Taxable income	%
0 – 34,200	21.5	0 – 38,000	19.5	0 – 38,000	19.5
34,201 +	33	38,001 +	33	38,001 – 60,000	33
				60,001 +	39

Appendix B: Econometric results

Table Three - Regression results: 1986-88. Dependant variable: Change in log of taxable income

	Restricted model		Full model	
Variable	Two-Stage Least Squares	Weighted Two-Stage Least Squares	Two-Stage Least Squares	Weighted Two-Stage Least Squares
Intercept	3.250879*	3.029569*	3.123306*	2.763608*
	(0.068407)	(0.055936)	(0.086831)	(0.069086)
$\Delta \ln(1-\tau)$	0.768891*	0.337695*	0.816009*	0.355593*
	(0.029052)	(0.023523)	(0.030198)	(0.024126)
Log of 1986 income	-0.32376*	-0.30041*	-0.32992*	-0.30193*
	(0.007018)	(0.005694)	(0.007161)	(0.005727)
Log of 1986 wealth			0.001956*	0.001956*
			(0.00086)	(0.000709)
Age in 1986			0.013397*	0.013397*
			(0.002804)	(0.002220)
Age in 1986 squared			-0.0002*	-0.0002*
			(0.000035)	(0.000028)
Entrepreneurship dummy			-0.05997*	-0.02044*
			(0.006407)	(0.007646)

Note: standard errors appear in parenthesis. *, #, and † indicate variable is significant at the 5, 10, and 20% level respectively.

Table Four - Regression results: 1986-88. Dependant variable: Change in log of labour income

	Restricted model		Full model	
Variable	Two-Stage Least Squares	Weighted Two-Stage Least Squares	Two-Stage Least Squares	Weighted Two-Stage Least Squares
Intercept	4.106203*	3.756128*	3.926875*	3.293568*
	(0.194958)	(0.155383)	(0.245411)	(0.191562)
$\Delta \ln(1-\tau)$	0.980351*	0.459245*	1.099663*	0.519260*
	(0.082796)	(0.065342)	(0.085349)	(0.066896)
Log of 1986 income	-0.41368*	-0.37690*	-0.45607*	-0.38938*
	(0.020001)	(0.015817)	(0.020239)	(0.015880)
Log of 1986 wealth			0.022768*	0.007712*
			(0.00243)	(0.001966)
Age in 1986			0.038897*	0.036630*
			(0.007925)	(0.006155)
Age in 1986 squared			-0.00055*	-0.00052*
			(0.000099)	(0.000077)
Entrepreneurship dummy			-0.27503*	-0.18034*
			(0.018108)	(0.021202)

Note: standard errors appear in parenthesis. *, #, and † indicate variable is significant at the 5, 10, and 20% level respectively.

Table Five A - Deadweight loss calculations: Labour income

Year	Deadweight loss (millions of NZ dollars)			
	Elasticity			
	0.82	0.36	1.10	0.52
1986	3,677	1,602	4,955	2,340
1988	3,359	1,464	4,527	2,138
1999	2,830	1,233	3,814	1,801
2002	4,168	1,817	5,618	2,653
2004	4,870	2,122	6,562	3,099

Table Five B - Deadweight loss calculations: Labour income

Year	Deadweight loss per NZ dollar of income tax revenue			
	Elasticity			
	0.82	0.36	1.10	0.52
1986	0.46	0.20	0.61	0.29
1988	0.36	0.16	0.49	0.23
1999	0.22	0.10	0.30	0.14
2002	0.24	0.10	0.32	0.15
2004	0.25	0.11	0.33	0.16

Table Six A - Deadweight loss calculations: Taxable income

Year	Deadweight loss (millions of NZ dollars)			
	Elasticity			
	0.82	0.36	1.10	0.52
1986	4,133	1,801	5,569	2,630
1988	3,676	1,602	4,954	2,339
1999	3,081	1,343	4,152	1,961
2002	4,410	1,922	5,943	2,806
2004	5,226	2,277	7,043	3,326

Table Six B - Deadweight loss calculations: Taxable income

Year	Deadweight loss per NZ dollar of income tax revenue			
	Elasticity			
	0.82	0.36	1.10	0.52
1986	0.51	0.22	0.69	0.33
1988	0.40	0.17	0.53	0.25
1999	0.24	0.10	0.32	0.15
2002	0.25	0.11	0.34	0.16
2004	0.27	0.12	0.36	0.17

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