The Elasticity of Taxable Income: A Non-Technical Summary

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Abstract

This paper provides a non-technical summary of the concept of the elasticity of taxable income, with respect to the net-of-tax, or retention, rate. This measure captures all potential responses to income tax changes. The calculation of efficiency costs of tax changes is discussed, along with potential orders of magnitude.

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1 Introduction

This paper reviews an approach to capturing the way in which taxable income responds to incentive effects created by income taxation. This involves the concept of the elasticity of taxable income with respect to the net-of-tax rate, defined as the proportional change in declared taxable income (for a specified population group) resulting from a proportional change in the 'net of tax' rate (one minus the marginal tax rate). This elasticity aims to encapsulate all potential responses to income taxation in a single elasticity measure, without the need to specify the nature of the various adjustment processes involved or consider the details of tax regulations. These adjustments include, as well as labour supply changes, income shifting between sources which are taxed at different rates, as well as tax evasion through non-declaration of income. The elasticity of taxable income has the added attraction that, under certain assumptions, it provides information which is sufficient to obtain a measure of the efficiency costs of income taxation, such as the excess burden and the marginal welfare cost (the marginal excess burden per extra dollar of revenue raised).

Section 2 discusses the motivation for using this elasticity measure. The way it can be used in calculating the distortionary costs of taxation is described in Section 3. In these sections, the main formulae expressing the elasticity and the efficiency costs of taxation are given in order to illustrate how the concept can be used. However, the analytical results are not derived here.[1] Approaches to estimating the elasticity, and likely orders of magnitude, are examined in Sections 4 and 5. Brief conclusions are in Section 6.

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[1] A more extensive technical treatment is in Creedy (2009).

2   The Elasticity

Income taxation creates a number of incentives for people to change their behaviour. The response which has received most discussion is that they may decide to reduce the amount of time spent in paid employment, since a higher tax rate implies a lower net wage rate and thus a lower opportunity cost of leisure. In addition, people may reduce the intensity of effort devoted to obtaining income. They may decide to change the composition of their income by 'shifting' income into sources which are taxed according to a different schedule and lower tax rate. They may change the timing of the receipt of certain income flows. And they may even decide to evade some of the tax by not declaring all income.

In view of the complexity of the tax structure, and the many detailed rules in the tax legislation, the economic modelling of these responses creates substantial challenges. This is made especially difficult by the considerable population heterogeneity found in cross-sectional data and by the difficulty of obtaining relevant data, not to mention the often substantial costs of constructing and estimating appropriate models. This is exemplified by the difficulties of modelling labour supply behaviour, just one of the possible responses to taxation.[2] Adding yet more structure to the models to allow for a wider range of options would be far from straightforward.

In principle, all these potential responses for a single individual can be summarised in a single elasticity, the 'elasticity of taxable income', η. This is defined with respect to a change in the 'retention rate' or 'net of tax rate'. If the marginal tax rate is τ, the net of tax rate, the amount of each extra

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[2]One motivation often given for the analysis of all potential responses, rather than concentrating on labour supply alone, is the argument that labour supply elasticities are generally low. However, this kind of statement must be treated with caution. Low aggregate responses to specified tax changes can be associated with considerable variations among individuals. Furthermore, in considering excess burdens and marginal welfare costs of taxation, the important response is the compensated supply elasticity (which describes only pure substitution effects arising from a change in the price of leisure, that is the net wage rate, and excludes any income effects).

dollar retained by the individual after paying tax at the marginal rate, is $1 - \tau$.

The elasticity, η, of declared income, z, with respect to the net-of-tax rate, $1 - \tau$, is defined for small changes, Δz and $\Delta (1 - \tau)$, as the proportional change in z divided by the proportional change in $1 - \tau$. Hence:

$$\eta = \frac{\frac{\Delta z}{z}}{\frac{\Delta (1-\tau)}{1-\tau}} \tag{1}$$

An increase in the marginal effective tax rate reduces the retention rate and leads to a reduction in declared taxable income: the elasticity is thus positive.

The precise way in which the elasticity may be expected to result from the details of the tax system and the characteristics of individuals is highly complex, in view of the many components. This means that the production of a 'structural model' of the elasticity would be a considerable challenge. However, it is common in the vast majority of empirical studies in economics to specify 'reduced form' relationships between variables, without attempting to uncover the detailed structural model underlying the estimated relationship. Conclusions about the effects of variables thought to influence the variable of interest are drawn from the functional form adopted for the 'reduced form equation' and the relevant estimated coefficients.[3]

In the present context there are now many studies using a simple reduce form relationship in which a single elasticity of taxable income is measured for a specified population group, using a simple equation in which declared income is a function of the income which would be declared in the absence of taxation, say z_0, and the marginal retention or net of tax rate. The specification used is:

$$z = z_0 (1 - \tau)^{\eta} \tag{2}$$

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[3]However, the use of reduced form relationships to estimate labour supply behaviour (by relating, say, hours worked to a net wage measure), proved to be unsatisfactory because of the endogeneity involved: the net wage and hours worked are jointly determined, given the nonlinearity of tax structures (so that each individual faces a range of marginal tax rates over the feasible range of hours).

This is linear in the logarithms, such that $\log z = \log z_0 + \eta \log (1 - \tau)$.

The attraction of a simple functional form, and the use of a single elasticity covering all tax responses and describing the behaviour of a population group, is clear. However, it is worth stressing several features of this approach. First, it is not free of endogeneity problems – this could be said of most reduced form studies and its importance is clearly a matter of degree and judgement. In this case, for any individual the effective marginal tax and declared income are jointly determined, in view of the fact that each individual actually faces a number of marginal rates over the range of hours available for working (depending on the individual's gross wage rate).

Second, while labour supply adjustments may be viewed as depending on individuals' preferences (relating to market consumption and leisure), the overall responses to tax changes depend in part on the details of the tax legislation. Thus the elasticity may itself be regarded as a policy variable. One implication of this feature concerns attitudes towards tax rates and government expenditure. That is, a high elasticity implies lower optimal tax rates and lower expenditure, yet a more appropriate policy response may well be to modify the tax legislation to reduce incentives to shift income. Further implications are that it is unlikely to remain constant over time if regulations are changed and, importantly, values estimated for one country and tax regime cannot simply be expected to hold in other countries.

A third feature, associated with this last argument, is the point that changes in tax legislation (or even anticipated changes in legislation) can produce changes in income shifting behaviour which are quite independent of, and thus not reflected in, marginal tax *rates*. This may well influence empirical estimates of the taxable income elasticity. Hence attention must continue to be paid to the precise nature of the tax structure and its various components.

3   Efficiency Costs

A further reason for the great popularity of the elasticity of taxable income concept is that, under certain conditions, various welfare measures are easy to compute, when the elasticity is combined with other information that is relatively easy to obtain from the distribution of taxable income. The efficiency cost of a tax is reflected in the extent to which the change in welfare, expressed in money units, exceeds the tax paid: this is the 'excess burden'. The tax paid is directly measured, but the change in welfare – which is defined in terms of the change in the cost of achieving a given level of wellbeing – is clearly not directly observable.

When a tax is changed, the appropriate efficiency cost is the 'marginal excess burden' and the associated 'marginal welfare cost' (the excess burden per dollar of extra revenue raised) for the relevant population group. In other contexts these measure are not easy to produce, for example when using structural models of labour supply, where attention needs to be given to individuals before any aggregation is explicitly carried out.[4]

Consider the efficiency costs of changing the top marginal rate of income tax, τ_T, which applies to those with declared income above the income threshold, z_T.[5] It is necessary to define a feature of the income distribution. Let $\bar{z}$ denote the arithmetic mean of the complete distribution of z, and let $\bar{z}_T$ denote the arithmetic mean of the N people who are above the top income tax threshold. Then define the ratio, α, as:

$$\alpha = \frac{\bar{z}_T}{\bar{z}_T - z_T} \tag{3}$$

This term can easily be calculated given information about the distribution of declared income. It is possible to show that, under certain conditions, the aggregate marginal excess burden, MEB, from a small increase in the value

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[4]For extensive discussion of these concepts, see Creedy (1998).

[5]The modification to the following expressions for other marginal rates is discussed in Creedy (2009).

of τ, is given by the following expression:

$$MEB = N\left(\bar{z} - z_T\right)\eta\alpha\left(\frac{\tau}{1-\tau}\right) \tag{4}$$

Furthermore, the marginal welfare cost, MWC, defined as the marginal excess burden divided by the change in tax revenue, is:[6]

$$MWC = \frac{\eta\alpha\tau}{1 - \tau - \eta\alpha\tau} \tag{5}$$

This expression is relevant only when the marginal tax rate is below the revenue-maximising rate. The tax rate, τ^*, which maximises revenue from those who are above the top marginal rate, is a simple function of α and the elasticity, η, whereby:

$$\tau^* = (1 + \alpha\eta)^{-1} \tag{6}$$

Hence, given an estimated value of the elasticity of taxable income, it is a straightforward matter to obtain these central efficiency measures. This explains much of the attraction for this approach.

Suppose that the value of α is equal to 1.6, which is approximately the case for the top rate in New Zealand. If the top tax rate is $\tau = 0.4$ and the elasticity of taxable income is $\eta = 0.4$ (a value that is suggested from studies of other countries, bearing in mind the caveat mentioned above), substitution into (5) gives a marginal welfare cost of 74 cents. This represents substantial inefficiency in raising tax revenue: for an extra dollar of tax revenue, obtained by raising τ, there would be an efficiency loss of 74 cents (representing the welfare loss over and above the extra revenue).

It is important to recognise that the results of using the expression in (5) are highly sensitive to the terms involved. For example, if the elasticity of taxable income were 0.6 instead of 0.4, the marginal welfare cost would increase to \$1.78. But for $\eta = 0.2$, the marginal welfare cost falls to 27 cents.

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[6]Saez *et al.* (2009, p. 6) call the MWC the 'marginal efficiency cost of funds (MECF)'. However, the 'marginal cost of funds', or MCF, is usually defined as $1 + MWC$. On these concepts, see Creedy (1998, pp. 54-59).

As a further example, if the top marginal tax rate is 0.5, the marginal welfare costs for elasticities of 0.2, 0.4 and 0.6 respectively are found to be 47 cents, $1.78 and $24.00. Given this kind of sensitivity, much care clearly needs to be used in applying empirical estimates of the elasticity which are, in the best of circumstances, subject to some uncertainty.

There is one crucial assumption (in addition, of course, to the basic integrity of the reduced form relationship specified) that is necessary for the production of these welfare measures. This is the assumption that 'income effects' – in contrast to marginal tax rate or 'price' effects – can be neglected.[7] In general any price change (in this case the relevant price is the implicit price of leisure, equal to the net wage rate) gives rise to two effects. The first and most obvious is a substitution effect because the good in question is relatively cheaper or more expensive than other goods. The second effect is an 'income effect' because the price change gives rise to a change in real income. In the present context, it is assumed that the relevant income effect is sufficiently small that it can be neglected.

It has to be admitted that the use of this assumption, where it is explicitly recognised, is usually untested. Indeed, very little direct evidence exists. The use made of this lacuna varies. Those who make the argument that 'there is little compelling evidence to suggest that income effects are significant' are really just using rhetoric, because there is also an absence of evidence to show that they are not significant.[8] This clearly warrants further investigation.

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[7]The same assumption is required for the concept of consumers' surplus (associated with Marshallian demand curves) to provide a satisfactory welfare change measure.

[8]Some evidence for Australia, concerning labour supply and obtained using the Melbourne Institute Tax and Transfer Simulator, is reported for a range of individual characteristics, by Kalb and Ghantous (2006). Their results suggest some caution in neglecting income effects.

4   Estimating the Elasticity

The ease of estimation of the elasticity of taxable income – in the appropriate circumstances – compares with the challenges faced by those wishing to estimate labour supply elasticities. The reduced form relationship contains only one parameter of concern, the elasticity.

A simple regression (in logarithmic form) of declared income on the net of tax marginal rate would not be appropriate in view of the endogeneity mentioned above. Ideally it would be useful to have information about a group of individuals who experience a tax increase, along with details of a group over the same period with the same characteristics but who do not experience a change in the marginal tax rate (or regulations regarding deductible expenses, timing of payments and so on). This of course is not possible.

Hence it is necessary to search for situations in which two groups can be identified as being similar, except for the tax rate they face. One possibility is where a tax policy change involves a change in only one tax rate, for example the top marginal tax rate. If the changes, on average, in the declared incomes of those affected by the tax change are compared with those of a group such as those near to the top threshold, but in the next tax bracket and thus not affected, it is possible to compute an elasticity. There is still a danger of attributing all income changes in the 'treatment group' (those facing a tax change) to the tax change, even though there may have been systematic changes taking place anyway. For example, there may be systematic relative income changes as part of the dynamics of the income distribution, or macroeconomic factors may affect one group (or income source) relatively more than others.

Instead of taking such a policy change, some investigators have looked at changes over time in a specified part of the distribution of income (defined in terms of the proportion of total income attributed to the group) and compared this group with a closely connected group. In each group, differences

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in average marginal tax rates are obtained along with average incomes.[9]

Another situation in which individuals experience changes in effective marginal tax rates, which do not arise from an explicit policy change, is where fiscal drag takes them into the next tax bracket. A period of inflation, without a corresponding adjustment to income tax thresholds, takes some individuals, who where initially relatively close to the next highest threshold, into the higher rate bracket. Their characteristics may be considered similar to those who were in the lower ranges of the same tax bracket but who do not cross thresholds. Of course, virtually all individuals experience an increase in their average tax rate (as more of their income is taxed at higher rates). But, as discussed above in the context of welfare changes, the approach assumes negligible income effects. In making comparisons between groups at the start and end of the relevant period, incomes clearly need to be inflation adjusted.

5   Orders of Magnitude

Many empirical estimates of the elasticity of taxable income have been produced for a large range of countries. The values vary considerably, depending on the method of estimation used, the particular reform examined, and the country. After mentioning that a number of authors suggest a 'consensus value of about 0.4', Giertz (2004, pp. 14, 37) warns that this 'masks considerable variation in the estimates'. Indeed, from the above discussion of the nature of the concept, there is no reason to expect the elasticity to remain unchanged over time, or to be similar across countries having different tax structures and regulations.

Another feature of many estimates is that much uncertainty is attached to them, in that they have wide confidence intervals. After reviewing elasticities, Meghir and Richards (2007, p. 19) comment that 'the estimates of the

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[9]These approaches cannot entirely avoid the charge of endogeneity, though it is clearly less important than with a simple regression.

effect of taxes on taxable income, whose purpose is to identify the impact of taxation on other dimensions of effort, should be regarded with caution'. Furthermore, Saez *et al.* (2009, p. 59) suggest that, 'there are no convincing estimates of the long-run elasticity'. Furthermore, some 'short run' elasticity estimates obtained from tax reforms may perhaps capture changes in the timing of declarations.

The use of a 'reduced form' specification inevitably carries with it the difficulty that, when a parameter estimate is found to change from one dataset to another, there is no way of knowing precisely what has caused the change. It is perhaps too optimistic to expect to be able so easily to capture all the effects of a tax change without needing to pay attention to the various income components and their separate treatment by the tax regime.[10]

Where it has been possible to estimate elasticities for different income ranges, for example where estimates were based on changes in marginal tax rates arising from fiscal drag, a common result is that they vary with income, being higher for higher incomes. This result is perhaps not surprising in view of the fact that higher income groups may be expected to have more opportunities to shift income between sources.

The estimates of the elasticity of taxable income generally have much bigger marginal welfare costs than were previously found in relation to labour supply adjustments alone.[11] This is of course not surprising in view of the fact that hours worked represent only one possible form of distortion created by taxation. Indeed, the desire to investigate wider responses is what motivated the analysis of the elasticity of taxable income concept.

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[10]Thus, Giertz (2004, p. 39) suggested that, 'much work is still needed in order to better understand the process by which incomes respond to changes'. This judgement was repeated by Saez *et al.* (2009) who stressed the need to look at the various margins involved in responses to taxation.

[11]Care must be taken with such comparisons, which typically involve results from elasticity estimates with highly aggregative results regarding labour supply elasticities. Recent disaggregated structural approaches to labour supply modelling have found considerable population heterogeneity in marginal welfare costs.

Faced with the difficulty of obtaining data in New Zealand, it is perhaps not surprising that there is only one study containing estimates of the elasticity of taxable income for New Zealand. Using a variety of methods, covering a number of tax structure changes, Thomas (2007, p. 22) obtained estimates which 'ranged from 0.35 to 1.10, with a preferred estimate of 0.52'; see also Thomas (2007, p. 18). He found that the tax rate reductions in the mid-1980s produced substantial reductions in the excess burden from income taxation. Similarly, the increase in rates in 2000 again raised excess burdens, though to levels below those of the 1980s. He found marginal welfare costs of as high as $8 per extra dollar of revenue raised.

In view of the limited information relating to New Zealand, it is perhaps appropriate to discuss one study which refers to a possible role of taxation in influencing changes in the shares of top income groups. Atkinson and Leigh (2008) mainly provide a descriptive study of changing shares of top incomes in New Zealand, but then discuss possible explanations. They refer to the impact of top marginal rates which have experienced substantial changes over the period examined, along with a factor associated with the threat of emigration, and macroeconomic factors (whether high incomes are 'insulated' from fluctuations). The argument relating to the threat of emigration is that top incomes in New Zealand have had to respond to increases in top incomes in the UK and Australia, which are popular destinations for migrants. They used a time series regression in which the share of the top 1 per cent was regressed on 1 minus the top marginal rate, top income shares in Australia and the UK, and GDP growth. But they acknowledged that shares in all three countries may have been influenced by other common factors, including technological change. It is hard to see how such a regression, involving changes for a single part of the distribution only, could be regarded as providing a 'test' of the 'theories'.

6 Conclusions

This paper has reviewed the concept of the elasticity of taxable income and its role in obtaining marginal welfare costs of taxation. The approach uses a 'reduced form' specification of the relationship, between declared taxable income and the marginal tax rate, which is believed to capture all the possible responses to taxation without having to examine the tax structure and the behaviour of individual taxpayers in detail.

The basic approach cannot claim to be entirely free of strong assumptions (such as the absence of income effects), and difficulties in its application (such as the high degree of sensitivity of welfare costs to the elasticity) and its estimation (such as the danger of attributing changes in income in various ranges of the distribution, which may arise from other causes, to responses to tax changes). However, it offers some promise of obtaining information about the wider efficiency aspects of taxation, a task which otherwise faces enormous difficulties if approached from the point of view of structural modelling.

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