Chapter 1

Introduction

1.1 Aims and Outline

This book is concerned with the evaluation of actual and proposed policy reforms to direct tax and transfer systems, using a behavioural tax microsimulation model. With developments in labour supply modelling, improved access to large-scale micro-datasets and increased computer speeds, microsimulation modelling is now used by a range of government departments and academic institutes. In the former case, they are valuable in considering the potential implications of policies being considered by governments, while in the latter case emphasis tends to be more on evaluating actual policy reforms, and the development of improved techniques, although there are often overlaps in functions.

In addition to policy simulations, behavioural microsimulation models can be used to obtain summary measures that are relevant in tax debates. These include elasticities of labour supply, relating both to hours changes and movement into the labour market, along with measures of welfare effects of tax changes, in terms of excess burdens. In addition, models can be used to search systematically, across a defined range of policy changes, for revenue-neutral changes which result in an increase in an evaluation, or social welfare, function. Where such uses are discussed here, they are illustrated in the context
of New Zealand, although the methods developed clearly have wider applicability. The model used, TaxWell-B, is described briefly in Section 1.2 below. When using such models it is nevertheless important to be aware of their limitations. In particular, they deal only with the supply side of the labour market and, despite modelling labour supply, have no genuine dynamic element. Furthermore, they deal only with financial incentive effects rather than administrative behaviour and monitoring features designed to reduce moral hazard.

Chapter 2 considers the problems facing those charged with providing advice to governments about proposed reforms. Given the great propensity of governments to tinker with taxes and transfers, there is almost a continuous demand for advice. For example, a regular concern is the top personal income tax rate. The question arises of whether there is an optimal structure of tax rates and thresholds? Despite numerous value judgements being required to answer such questions, this chapter suggests that rational policy analysis principles can nevertheless be applied to support policy advice on these and other direct tax design questions. It is argued that the economic models thought suitable as the basis for tax analysis vary according to the precise ways in which the policy question is formulated, the underlying behavioural responses to taxation expected across the taxpaying population, the precise definitions of key variables such as income inequality, and the specification of policy objectives such as redistribution, revenue-raising or tax efficiency. Comparison of alternative models are provided. Major advantages of behavioural tax microsimulation models, in addition to their ability to handle the supply side of the labour market, are that they can deal with the full complexity of tax and transfer systems, and the considerable population heterogeneity observed in cross-sectional household surveys. Those concerned with policy design need to be able to consider the potential effects on particular demographic groups of specific policy changes.

In considering potential labour supply responses to direct tax changes,
emphasis is often placed on elasticities of labour supply. In the context of a microsimulation model, this is problematic because elasticities are known to vary along each individual’s supply curve, and therefore also for groups, since aggregation is involved. It is necessary to be clear about the particular elasticity concept that is relevant. Nevertheless some indication of orders of magnitude can be useful and, in addition, they allow for comparisons with other studies of labour supply behaviour. Chapter 3 explores alternative labour supply elasticity concepts in cross-sectional contexts. Emphasis is placed on the elasticity of hours worked with respect to a change in the gross wage rate, though it is shown that the gross wage elasticity is usually sufficient when considering labour supply responses to effective marginal tax rate changes. The elasticities presented in Chapter 3, for both intensive and extensive margins and for a range of demographic groups, are based on simulated labour supply responses to a proportional change in gross wage rates. Comparisons between elasticities at the extensive margin and the intensive margin are also made.

An advantage of a behavioural model over a non-behavioural microsimulation model is that the former is able to produce welfare effects of tax, rather than simply the implied changes in net incomes. Reference can thus be made to the central public finance concept of the excess burden of taxation. Chapter 4 reports estimates of welfare changes and the marginal welfare cost of income taxation for a wide range of income and demographic groups, in the context of a uniform increase in all marginal income tax rates. Considerable variation is found in the marginal welfare costs for different groups. The chapter also demonstrates the use of a money metric utility measure in a social welfare function evaluation.

Chapter 5 illustrates the use of a behavioural model to examine the impact of a tax reform which took place some years previously, but which could not, because of the absence of a behavioural model, be evaluated at the time when the reform was being debated. Evaluation is nevertheless worthwhile,
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so that the policy can be judged against the claims made for it at the time of introduction. The context considered in Chapter 5 is the major package of welfare reforms, collectively referred to as Working for Families (WiF). These reforms were announced in May 2004, and involved a phased introduction of changes, with annual modifications from October 2004 until April 2007. Concentrating on welfare payments for families with dependent children, this remains a cornerstone of the New Zealand welfare system. This necessarily involves the design of a backward-looking approach, by comparing labour supply under the 2008 database and tax structure with that obtained using the 2008 data and 2004 tax structure (suitably adjusted for inflation).

Chapter 6 examines the simulated labour supply responses to the personal tax and transfer policy changes introduced in New Zealand in 2010, and the implications for revenue and income distribution. The main changes examined are the increase in the Goods and Services Tax (GST) rate from 12.5 to 15 per cent, along with reductions in personal income tax rates and increases in the main benefit payments and assistance to families with children, to compensate for the rise in GST. The combined effect of all policy changes is to increase average labour supply slightly for all demographic groups, but with an average hours increase that is largest for single parents, at about half an hour per person. Labour force participation of sole parents is simulated to increase by a little under one percentage point. In considering separate components, the change in income tax rates is found to have the largest effect on labour supply. This is not surprising given that it affected a large proportion of the population while the changes to the benefit system and assistance to families with children apply only to certain groups. The reforms are found to be approximately distribution neutral, in terms of the Gini inequality measure of after-tax income per adult equivalent person.

Chapter 7 turns to the consideration of whether a movement towards an optimal structure can be devised using a behavioural microsimulation model. For this purpose, an evaluation or social welfare function is required.
to represent the value judgements of a policy maker or judge. In this chapter, social welfare functions are defined in terms of either money metric utility or net income. While the search for an optimal policy is impractical, it is possible to carry out a more limited search to explore the optimal direction of tax changes. The implications of the results for specific combinations of tax rate or threshold changes, that are both revenue neutral and welfare improving, are explored in detail, recognising the role of distributional value judgements.

Chapter 8 turns to a different kind of policy, not involving a tax and transfer change, which can nevertheless be examined using a microsimulation model. The chapter examines the potential effects on inequality and poverty of a minimum wage increase. Such a policy has often been suggested on redistributive grounds. The chapter then compares these outcomes with an alternative, commonly used policy of raising government welfare benefits, similarly aimed at poverty or inequality reduction. Results suggested that, due to the composition of household incomes, a policy of increasing the minimum wage appears to have a relatively small effect on the inequality of income per adult equivalent person, using several inequality indices.

The minimum wage policy is not particularly well targeted at its objective, largely due to many low-wage earners being secondary earners in higher-income households, while many low-income households have no wage earners at all. However, an equivalent policy of raising welfare benefits does not clearly demonstrate target superiority. Results suggest that while raising benefits has a greater ability to reduce most poverty measures examined, substantially smaller inequality reductions are found to be associated with benefit increases compared to a minimum wage increase. Thus benefit increases represent a relatively effective strategy for poverty reduction, mainly by targeting sole parents, but (like minimum wages) are also relatively ineffective if inequality reduction is the objective.
1.2 The New Zealand Microsimulation Model

The simulation results presented here were obtained using the New Zealand Treasury’s microsimulation model, TaxWell. This actually consists of two components, an arithmetic model called TaxWell-A and the behavioural model, TaxWell-B. This model, at the time the only microsimulation model in New Zealand, has had a complex history. The precursor to TaxWell-A was a model called TaxMod. In late 2003, the Treasury commissioned TaxMod-B from the Melbourne Institute of Economic and Social Research in Australia. The model was based on the Melbourne Institute Tax and Transfer Simulator (MITTS); see Creedy et al. (2002). The main work involved in producing Taxmod-B, including estimation of wage functions and preference functions for various demographic groups, was carried out by Kalb and Scutella (2003, 2004). Shortly after its development, the person who was responsible for maintaining and running the microsimulation models, Ivan Tuckwell, died, and it was necessary to build a new arithmetic model. This was called TaxWell; this name refers to Tax and Welfare and at the same time the double-L honours Ivan for his invaluable work in the Treasury. The arithmetic model, TaxWell-A, was initially constructed without regard to the need to link with the behavioural model. This considerably complicated the subsequent attempts to connect the A and B versions of TaxWell. Behavioural modelling was then neglected in the Treasury, until further work was carried out after 2011. The econometric work thus needed to be brought up to date, involving estimation of wage equations and preference functions; this was carried out by Mercante and Mok (2014a, 2014b). Separate estimates were obtained for married men, married women, single men, single women and sole parents, using pooled Household Economic Survey data from 2006/2007 to 2010/2011, resulting in TaxWell-B, the modified version of TaxMod-B.

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1.2. THE NEW ZEALAND MICROSIMULATION MODEL

TaxWell-B requires, for each individual in the database, net incomes for a range of work hours before and after a tax and transfer change. These are obtained using the arithmetic model, TaxWell-A, containing the details of the social security and personal tax system. Both models utilise the Household Economic Survey, a cross-sectional survey collected by Statistics New Zealand. This records, for each individual, income from current jobs and other non-wage income such as interest and dividends. Given information about an individual’s wage rate and a wide range of characteristics, it is possible to determine net income for each of a range of discrete hours levels. For those not working at the time of the survey, a wage rate is imputed, based on econometric estimates of wage functions for a range of demographic groups.

Labour supply is based on a structural model where individuals are assumed to be able to work at only a number of discrete hours levels, rather than being able to vary hours of work continuously. Individuals are assumed to choose a combination of leisure and income to maximise utility. Preferences are assumed to have a deterministic component which is quadratic in work hours and net income, and where parameters vary depending on a range of characteristics. Letting \( y \) and \( h \) respectively denote net income and hours of work, the quadratic component of utility for an individual takes the form:

\[
U = \beta_y y + \beta_h h + \alpha_y y^2 + \alpha_h h^2 + \alpha_{yh} yh
\]

The \( \beta \)s and \( \alpha \)s are preference parameters, themselves specified as functions of a range of individual characteristics. Hours of work contribute negatively, while net income contributes positively to utility. The specification allows for diminishing returns through the quadratic terms \( \alpha_y \) and \( \alpha_h \). Thus, if \( \alpha_y \) is negative the marginal utility of income decreases with the amount of income. Furthermore, the cross-product term allows for complementarity or substitutability. For example, the value of income may decrease if less leisure time is available, that is extra income may be appreciated less if there is no time for consumption. The quadratic can be extended to allow for house-
holds consisting of couples, where both partners simultaneously determine labour supply, by assuming that the couple maximises a single utility function; this is a reasonable assumption for households where the members pool their incomes. The joint labour supply of couples is estimated simultaneously, unlike a common approach in which female labour supply is estimated with the spouse’s labour supply taken as exogenous. A fixed cost of working parameter is also included (and subtracted from net income), in order to prevent low part-time working hours being over-estimated. Separate equations are estimated for each of the groups of single males, single females and single parents, in addition to couples. Maximum likelihood estimation of the preference functions, and the simulation procedure, is described in Creedy and Kalb (2005a).

A random utility component, from a Type-I extreme-value distribution, is added to the deterministic component, for example, to capture optimisation errors. This means that the model does not produce a single deterministic hours level for each individual following a change to the tax and transfer system. Each discrete hours level is associated with a probability for each person. The discrete hours approach has substantial advantages over the continuous hours model, in allowing the full details of the tax structure to be modelled and overcoming the endogeneity problem that would otherwise be raised by the fact that both the hours worked and the marginal tax rate faced are jointly determined when there are piecewise linear budget constraints. A pioneering use of this kind of structural approach to examine labour supply is Van Soest (1995).

Single men and women, sole parents and married women have working hours choices of 0, 5, 10, 15, 20, 25, 30, 35, 40, 45 and 50 hours of work. Married men have hours choices of 0, 10, 20, 30, 40 and 50 hours of work. Hence, couples have a total of 66 working-hour choices. For couples, the female hours distribution therefore covers a wider range of part-time and full-time hours than the male distribution.
In calculating net incomes, Taxwell-A assumes a take-up rate for welfare benefits and tax credits of 100 per cent, for both tax systems examined. This may lead to some overestimation of expenditure on the different payments in both pre- and post-reform. Experiments have been carried out assuming that small amounts are not claimed, but this has a negligible effect on results. The simulated changes reported here are not expected to be biased as the policy changes did not expand eligibility to a large extent. All persons for whom labour supply is modelled, except sole parents, are potentially eligible for Unemployment Benefits. Sole parents are eligible for Domestic Purpose Benefit. The income-test rules are then applied to calculate actual benefit levels.

A policy simulation involves comparing the observed hours level of each individual in the base Household Economic Survey sample, facing the pre-reform tax and transfer structure, with the (conditional) expected value of hours for the individual obtained after the reform is imposed. It is important to ensure that the observed hours in the pre-reform case can be regarded as an optimal position for each individual. Hence, a calibration process is used to select a large number of sets of random draws from the distribution of the stochastic component of utility which are used for post-reform computations. Briefly, this process is as follows.\(^2\)

The behavioural simulation procedure for each individual or couple begins by converting the observed working hours to the closest discrete level. Then, given the parameter estimates of the preference functions (which allow for observed heterogeneity), the deterministic components of utility for each hours level are calculated for the net incomes generated by the pre-reform tax and transfer system. A set of random draws, one for each discrete hours level, is then taken from the Type-I extreme value distribution. For each hours level, the total value of utility is determined by adding a random draw

\(^2\)For further details, see Creedy and Kalb (2005a).
to the deterministic component of utility. The hours level giving maximum total utility can then be obtained for that set of random draws. The sets for which observed hours are equal to optimum hours in the pre-reform situation are retained and used to determine the conditional distribution of optimal hours levels after the reform for each individual. To obtain sufficient information regarding the post-reform hours distribution over the discrete hours levels for each individual, 100 such sets of draws are used in the simulations. The calibration approach also ensures that the results before the reform are comparable between TaxWell-A and TaxWell-B.

For the post-reform analysis, the new net incomes cause the deterministic component of utility at each hours level to change. Using the 100 sets of draws retained for each individual from the calibration procedure, a distribution of optimal hours of work is determined. This is essentially a conditional probability distribution over the set of discrete hours for each individual under the post-reform policy. Post-reform labour supply is obtained as the expected value of hours of labour supply after the change, conditional on starting from the observed hours before the change.

In some cases, the required number of successful random draws producing pre-reform observed hours as the optimal hours cannot be generated within the designated number of drawings. Under such circumstances, the individual’s labour supply is held fixed at their observed hours. However, this problem arises for very few individuals in the sample.