Labour supply in New Zealand and the 2010 tax and transfer changes

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ABSTRACT

This paper 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\%, 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 the GST. The simulated labour supply responses were obtained using the Treasury’s behavioural microsimulation model, TaxWell-B. The 2009/10 Household Economic Survey was used. The combined effect of all policy changes is to increase average labour supply slightly for all demographic groups, with a weighted average increase of 0.10 hours per person. The average hours increase is the largest for single parents, at 0.33 hours per person. Labour force participation of sole parents is simulated to increase by 0.86 percentage points. 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.

1. Introduction

In October 2010, several policy changes were implemented to the New Zealand personal tax and social security system, as part of a larger package of tax reforms, including changes to corporation tax, excise taxes and depreciation rules. The changes included an increase in the Goods and Services Tax (GST) rate from 12.5\% to 15\%, combined with reduced personal income tax rates and increases in the main benefit payments and assistance to families with children.\textsuperscript{1} The reforms, involving a shift in the tax mix from direct to indirect taxes, were motivated by a desire to increase economic efficiency and stimulate growth and savings. The argument is based on comparisons of excess tax burdens and empirical studies of the relationship between growth and different forms of taxation: see also the Tax Working Group (2010) and Mirrlees (2011). A number of the reforms were suggested in the report of the independent Tax Working Group (2010), conducted under the aegis of Victoria University of Wellington and Chaired by Professor Bob Buckle.\textsuperscript{2}

In the multi-rate income tax structure, income thresholds were unchanged, but a set of marginal tax rate changes were introduced whereby the percentage reductions in the rates were lower for
higher marginal rates. They were designed with the aim of leaving the distributional effects of the direct tax and transfer system largely unchanged, along with total revenue.

The increase in the GST rate had the effect of increasing consumer prices and hence reducing households’ real disposable (net) incomes. The compensation for the increase in consumer prices, by reducing personal income tax rates, clearly affects only those who are working and paying income tax. Those relying on transfer payments are compensated by the increase in main benefit payments, in particular the Working for Families (WfF) payment. In a preliminary analysis of a change in the tax mix, Creedy and Mellish (2011), concentrating on those paying income tax and using a cross-sectional framework with unchanged labour supply, showed that the reforms were expected to be approximately revenue and distribution neutral, though it is not possible to achieve these joint objectives precisely.

The tax changes would be expected to influence labour supply incentives at both the intensive and extensive margins, that is, hours worked and participation in the labour market. In examining the likely effects on labour supply, New Zealand Treasury (2010c) used estimates of average wage elasticities relating to hours worked and participation for five demographic groups (married men and women, single men and women, and sole parents), obtained by Kalb and Scutella (2003). These aggregative results were based on the earlier Treasury simulation model, TaxMod-B, but at the time of the 2010 changes, this model was no longer operational, so that more disaggregated modelling was not possible: see New Zealand Treasury (2010c).

It is therefore useful to evaluate the detailed labour supply responses to these policy changes, allowing for the considerable extent of population heterogeneity that exists. This paper presents ex ante simulations of the effects on labour supply of the policy changes made in 2010, using the Treasury’s new behavioural microsimulation model for New Zealand, TaxWell-B. The model also allows the full distributional implications of the policy changes to be examined, after allowing for potential labour supply effects.

TaxWell-B models the New Zealand population based on the Household Economic Survey (HES), which contains information about the characteristics of individuals and households and their labour supply and earnings. Individuals are regarded as choosing labour supply from a discrete set of hours levels. Utility functions contain both a deterministic component, which can also reflect the individual’s characteristics, and a random component. This gives rise to a probability distribution over the set of discrete hours points. It is a partial-equilibrium supply-side model where, effectively, it is assumed that all additional labour supply is met at unchanged wages by a sufficient demand for labour. Individuals in reality may not be able to work their desired number of hours and outcomes may be determined to some extent by the availability of jobs. In simulating the policy change, the model is calibrated to the observed labour supply to ensure that, for each individual, the simulated optimal labour supply in the pre-reform situation is the same as the observed (discretised) labour supply: on discrete hours modelling and the calibration approach in microsimulation, see Creedy and Kalb (2005).

The increase in the consumption tax rate was found to result in an increase in the Consumer Price Indices (CPIs) by 2%; see Statistics New Zealand (2010). This was applied to determine the level of compensation for benefit payments, WfF and other payments such as New Zealand Superannuation. The same indexation was applied in this paper to account for the rise in the GST.

This paper examines the effects of the tax-and-transfer changes in 2010 on the labour supply of New Zealand individuals and households and on government expenditure and revenue. The effects on revenue are examined with and without allowing for labour supply responses. The HES for 2009/10 was used for simulations of the effect of the change in tax and transfer rules. The HES survey was carried out between 1 July 2009 and 30 June 2010. The changes did not actually come into effect until 1 October 2010. Couples, single men, single women and sole parents are examined separately. Throughout this paper the terms married men and women refer to partnered men and women regardless of whether they are married legally or de facto. The labour supply responses produced by TaxWell-B are measured by a change in the probability of working and the change in the average hours of work (that is, the expected value over the conditional distribution of discrete hours levels
after the policy change). More detailed information is also provided by transition matrices for each demographic group. Changes in inequality are also examined.

It is also possible to examine the effect of the policy changes separately for each component. Individual policy changes included in this paper are the personal income tax, WfF and main benefit payments. The superannuation payment was adjusted, as mentioned earlier, using the CPI indexation. However, only the labour supply responses for working-age individuals were simulated. It should be recognised that the combined effect of changes does not necessarily equal the sum of all individual changes, since the components are not additive.

Section 2 briefly describes the main relevant tax and benefit changes. Section 3 describes the behavioural microsimulation approach and the data used. Section 4 presents simulation labour supply changes for the different demographic groups. The implications for tax revenue are examined in Section 5. The effect on the distribution of disposable income is reported in Section 6. Section 7 examines the effects of the policy changes separately for each component. Section 8 concludes.

2. The 2010 tax changes

Section 2.1 summarises the details of the tax rate and benefit changes made in 2010. In more recent years some of these benefits have been replaced by Jobseeker Support and Sole Parent Support, introduced in July 2013. The changes operate via their effects on individuals’ budget constraints showing the relationship between hours worked and net incomes. It is therefore useful to consider in Section 2.2 some examples of the ways in which the reform affected budget constraints, for a number of hypothetical individuals.

2.1. Tax and transfer policy changes

Table 1 summarises the changes made to the basic income tax schedule and the tax credits relating to the benefit, WfF. All income tax rates were reduced as part of the tax shift, while the income thresholds remained unchanged, and tax credit levels were increased. The changes made to the main benefit types are indicated in Table 2, showing that all benefit levels were increased, reflecting the increase in the GST rate from 12.5% to 15%.

Table 1. Income tax rates and Working for Families tax credits.

| Income tax rates (%) | Pre-October 2010 | From October 2010 |
|----------------------|------------------|-------------------|
| Income band ($ annual) |                  |                   |
| 0 to 14,000           | 12.5             | 10.5              |
| 14,001 to 48,000      | 21               | 17.5              |
| 48,001 to 70,000      | 33               | 30                |
| 70,000 and over       | 38               | 33                |

| Working for Families tax credit |
|-------------------------------|
| Family tax credit rates ($ annual) | Pre-October 2010 | From October 2010 |
| First or only child, 0—15 years | 4,487            | 4,578             |
| First or only child, 16—18 years | 5,198            | 5,303             |
| Second or subsequent child, 0—12 years | 3,119            | 3,182             |
| Second or subsequent child, 13—15 years | 3,557            | 3,629             |
| Second or subsequent child, 16—18 years | 4,651            | 4,745             |
| Minimum family tax credit rates ($ annual) | 20,800          | 21,216            |
2.2. Examples of budget constraints

In considering the possible effect on labour supply of a tax reform, the budget constraint facing individuals plays a crucial role. Hence it is first useful to examine the way in which net income, and the schedule of effective marginal tax rate (EMTRs), vary as the number of hours of work increases, for hypothetical individuals with specified gross wage rates. Each individual’s constraint depends crucially on personal circumstances and the wage rate, so the examples given here can be illustrative, using only one selected wage rate for each particular type of person. The examples nevertheless help illustrate the ways in which the various income and hours thresholds, and taper rates, introduce nonlinearities and discontinuities into the budget sets.

Figures 1–4 show the effect of the reform on disposable incomes and EMTRs for four hypothetical individuals. These are, respectively, a sole parent with one child, the male in a couple with two children, the female in a couple with two children and a single person. Male and female sole parents are combined in the following analysis, the vast majority being female. Net incomes are disposable incomes after the direct tax and transfer system, and hence do not include the effect of the higher GST rate in reducing the real value of expenditure: allowance for the GST increase is, however, made in the simulations below. For simplicity, these households are assumed not to receive the benefit, Accommodation Supplement, although again this is modelled in the simulations reported below. Furthermore, allowance also needs to be made for a fixed cost of working, which means that at zero hours of work, disposable income is higher than the intercept on the vertical axis shown in each of the figures. Hence, the budget constraint has a short vertical segment, the length of which equals the fixed cost of working. Each case applies to a specified type of individual facing a given wage, as indicated below. Those with higher wages move more quickly across the EMRT ranges as hours of work change.

Table 2. Main benefits allowances ($ weekly).

| Benefit type | Pre-October 2010 | From October 2010 |
|--------------|-----------------|------------------|
| **Unemployment Benefit and Sickness Benefit** | | |
| Single 18–19 years – At home | 129.41 | 132.02 |
| Single 18–19 years – Away from home | 161.76 | 165.03 |
| Single 20–24 years | 161.76 | 165.03 |
| Single 25 years or over | 194.12 | 198.04 |
| Sole parent | 278.04 | 283.66 |
| Married, civil union or de facto couple per person | 161.76 | 165.03 |
| **Domestic Purposes Benefit** | | |
| Woman alone (Single adult) | 202.20 | 206.28 |
| Sole parent | 278.04 | 283.66 |
| Carer, single 16–17 years | 196.35 | 200.32 |
| Carer, single 18 years or over | 242.63 | 247.53 |
| Carer, sole parent | 318.75 | 325.19 |
| Married, civil union or de facto couple per person | 202.20 | 206.28 |
| **Invalids Benefit** | | |
| Single 16–17 years | 196.35 | 200.32 |
| Single 18 years or over | 242.63 | 247.53 |
| Sole parent | 318.75 | 325.19 |
| Married, civil union or de facto couple per person | 202.20 | 206.28 |
| **Independent Youth Benefit** | | |
| Single or married, civil union or de facto | 161.76 | 165.03 |
| **Widow’s Benefit** | | |
| Woman alone (single adult) | 202.20 | 206.28 |
| Sole parent | 278.04 | 283.66 |
Figure 1. EMTR and budget constraint: A sole parent.

Figure 2. EMTR and budget constraint: A married man.

Figure 3. EMTR and budget constraint: A married woman.

Figure 4. EMTR and budget constraint: A single woman.
The sole parent shown in Figure 1 is assumed to have one child aged three, and faces a gross wage rate of $13.70 per hour. The hypothetical person is assumed to pay annual rent of $11,000. Figures 2 and 3 illustrate the budget constraints and EMTR for a couple with two children, the youngest of which is three years of age. The male faces a gross wage rate of $18.30 per hour and the female has $14.00 per hour. They pay annual rent of around $12,000. Figure 2 shows the net incomes and EMTRs as the male labour supply are increased, on the assumption that the female does not work. The EMTR for the married male is lower in most ranges of labour supply post-reform, with the largest decrease in the 30-hour work range where the family starts to receive the in-work tax credit (IWTC). Figure 3 shows the budget constraint and EMTRs for the female, assuming that the male works 40 hours a week. The constraint for this hypothetical individual differs from that of the others examined here in that it does not appear to have the kind of non-convexity in the budget set associated with exhaustion of means-tested benefits. However, the effect of the fixed cost of working is to introduce a non-convexity right at the beginning of the constraint. Such fixed costs imply that very low working hours are unlikely to be supplied.

Figure 4 presents the budget constraint and EMTRs for a single woman without children on a wage of $12.60 per hour and paying annual rent of $9,200. This low wage rate is selected as being between the statutory minimum wage in New Zealand in 2009 of $12.50 and that of $12.75 in 2010 (in each case starting on 1 April): see Ministry of Business, Innovation and Employment (2014). As shown in Figure 4, the EMTR decrease for single woman is at its highest in the 36-hour work range where she starts to receive the Independent Earner tax credit (IETC). The IETC is a tax credit available to New Zealand tax residents who earn annual income between $24,000 and $48,000, are not entitled to WfF tax credits and are not receiving income-tested benefit, New Zealand Superannuation and Veteran’s Pension. The budget constraint and EMTR for a single man is similar to that of a single woman with the same wage.

All figures show that the disposable or net incomes after the reform are higher than pre-reform, remembering that they do not allow for the higher GST rate. The EMTRs for all households have decreased over most work-hour ranges.

For the hypothetical sole parent, the decrease is at its highest in the 40-hour work range where there is a sharp fall in the EMTR (the negative range is not shown in the figure). This is where the Domestic Purposes Benefit (DPB) is completely abated and the person starts to receive the IWTC from the WfF. The WfF tax credits comprise four main tax credits: the family tax credit (FTC), the IWTC, the minimum family tax credit (MFTC) and the parental tax credit (PTC). The first two are observed in the hypothetical sole parent. All families with children are eligible for the FTC regardless of whether they have been receiving income-tested benefit. The IWTC is work-tested where sole parents must work at least 20 hours per week and to be eligible, do not receive any main welfare benefit. Hence, the sole parent receives the FTC from 0 hour, and at 40-hour work the person receives both FCT and IWTC until the FCT starts to be abated at $36,827 of the family annual income. The person may receive the IWTC above 20 hours of work if the person earns a relatively low wage rate and still receives some main welfare benefits.

Except for the hypothetical married woman, the constraints have several kinks where there are convexities and non-convexities in the budget sets. These reflect respectively the income thresholds where there are increases in the EMTR and reductions in effective rates. The latter arise where individuals exhaust their eligibility for a means-tested benefit. The budget constraints for the sole parent and the married woman have discontinuities at particular hours levels where WfF tax credits begin to be received. The implications for labour supply of this type of discontinuity, arising from an hours threshold, is discussed in detail in Creedy (2005).

In the case where hours of work can be varied continuously, the piecewise-linear budget constraints can give rise to a complex range of labour supply responses. In cases where the marginal tax rate rises at an income threshold, an increase in the net wage rate causes the (concave) kink in the budget line to move horizontally to the left (as the threshold is reached at a lower hours level). This kind of kink is associated with a certain amount of ‘stickiness’ where the individual remains at the
kink for a range of wage rates. For the 2010 simulations, the income thresholds and gross wage remain unchanged. This means that labour supply remains unchanged at such kink points: the hours levels at which the upward rises in the EMTRs take place are unchanged, as shown in the hypothetical examples.

In the opposite case where the marginal tax rate falls, or there is a discontinuity associated with a tax credit with an hours threshold, the range where there is a non-convexity can give rise to large ‘jumps’ in hours for very small variations in the wage rate. This is because a single indifference curve can be tangential to two segments of the budget constraint, or it can be tangential to one section while simultaneously touching a corner of the constraint. For further discussion of the complexities arising from this type of budget constraint in the continuous-hours context, see Creedy (2004).

For the tax reforms considered here, it is thus difficult to predict, a priori, how labour supply is likely to vary for a particular individual, since it depends on where the individual is on the initial (pre-reform) budget line, and whether a ‘jump’ may take place or whether the individual is at a threshold where ‘stickiness’ is involved. Further complications also obviously arise in view of the existence of both and income and substitution effects of changes in the net wage, the ‘price of leisure’. A full analysis of the expected labour supply effects of a tax reform therefore requires the use of a behavioural microsimulation model that is able to capture the full heterogeneity of the population as well as the full complexity of the income tax and benefit system. As mentioned earlier, such a model was not available in New Zealand at the time of the reforms and for this reason policy advice was based on earlier highly aggregate estimates of a labour supply elasticity. The following section provides a very brief description of the current behavioural microsimulation model maintained by the Treasury, called TaxWell-B.

3. The Treasury’s microsimulation model

The Treasury’s behavioural microsimulation model is based on the Melbourne Institute Tax and Transfer Simulator (MITTS), a simulation model for Australia: see Creedy, Duncan, Harris, and Scutella (2002). The basis of the labour supply modelling is a structural model where individuals are assumed to be able to work a number of discrete hours only. Each individual maximises a utility function whose arguments are net income and leisure. Couples maximise a joint utility function. There is a deterministic component of utility: this takes a quadratic form where parameters depend on a range of individual and family characteristics. In addition, a random component is added, reflecting ‘optimising errors’, so that each discrete hours level has associated with a probability level for each person.5 The discrete hours approach has substantial advantages over the continuous hours model; for a pioneering study using discrete hours, see Van Soest (1995). For further references and an exposition of estimation and simulation, see Creedy and Kalb (2005). The random component of utility is assumed to follow the Type-I extreme-value distribution.

TaxWell is a non-behavioural (or arithmetic) microsimulation model developed by the New Zealand Treasury. It contains the details of the social security and personal tax system and produces analyses at individual, family and household levels. It utilises the HES, a cross-sectional data set collected by Statistics New Zealand. The model uses most of the income data from HES which includes income from current jobs and other income such as interest and dividends. The name is a tribute to Ivan Tuckwell, who played a substantial role in the development of the previous Treasury arithmetic model, TaxMod.

The Treasury’s behavioural model, TaxWell-B, uses information for each sample individual, provided by TaxWell, on disposable incomes at the specified range of discrete hours labour supply levels before and after the reform, along with the individual and household characteristics. TaxWell-B thus uses estimated parameters of the deterministic component of preference functions on which the behavioural responses are based. An earlier Treasury behavioural model, called TaxMod-B, was not maintained and could not be integrated with TaxWell. An extensive programme of work was required to convert TaxMod-B to TaxWell-B and to re-estimate all the necessary imputed wages
and preference functions. This was completed in 2014. The first application of this model, an analysis of WfF, is reported in Mok and Mercante (2014).

TaxWell-B assumes a 100% take-up rate for welfare benefits. This may lead to some overestimation of expenditure on the different payments in both pre-reform and post-reform situations. However, as the policy changes do not expand eligibility, the simulated percentage changes reported here are not expected to be biased. All persons for whom labour supply is modelled, except sole parents, are potentially eligible for Unemployment Benefits (UB). Sole parents are eligible for DPB. The income-test rules are then applied to calculate actual benefit levels.

The budget constraints for each individual, giving net incomes at each discrete hours level, clearly require knowledge of hourly wage rates. For workers these are directly observed. However, they are unobserved for non-workers in the survey data. For these individuals, it is therefore necessary to impute their wage rates using wage equations which correct for potential sample selection bias. Wage equations were estimated separately for partnered men, partnered women, single men, single women and sole parents using pooled HES data from 2006/07 to 2010/11: see Mercante and Mok (2014b).

As mentioned earlier, the behavioural responses generated by TaxWell-B are based on the use of quadratic preference functions allowing for observed and unobserved heterogeneity. For couples, labour supplies are jointly determined. The parameters of the preference functions were again estimated using pooled HES data set from 2006/07 to 2010/11: see Mercante and Mok (2014a).

A policy simulation involves comparing the observed hours level of each individual in the base HES sample, having the pre-reform tax and benefit structure, with the distribution of hours (over the discrete points) generated by the post-reform tax structure and net incomes. The HES 2009/10 (with a survey period from 1 July 2009 to 30 June 2010) was used as the base sample for simulations of the effect of the change in tax and transfer rules which were announced in the April 2010 Budget but which did not come into operation until 1 October 2010.

It is important to ensure that the observed hours in the pre-reform case can be regarded as an optimal position for each individual. For this reason a 'calibration' process is used to select a set of random draws from the distribution of the stochastic component of utility which are used for post-reform computations. This is described briefly as follows.

The behavioural simulation procedure for each individual or couple begins by converting the observed working hours to the closest discrete working-hours level. Then, given the parameter estimates of the preference functions (using a range of characteristics of individuals to 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. Then a set of random draws is taken from the Type-I extreme-value distribution. For each set of draws (one for each discrete hours level) the utility-maximising hours level is determined by adding the random draw to the deterministic component of utility for each discrete working-hours level and determining the hours level giving maximum total utility. The sets for which observed and optimum hours in the pre-reform situation are equal are retained for use in the post-reform evaluation.

The retained draws are then used to determine the distribution of optimal hours levels after the reform for each individual. Hence, the resulting distribution for each individual after the reform is the conditional probability distribution, given that the individual is at observed discretised hours initially. To obtain sufficient information regarding the post-reform hours distribution over the available discrete hours levels for each individual, a number of such sets of draws are obtained (and retained): in the simulations reported below, this number of sets is 100. An alternative approach would be to obtain unconditional distributions pre- and post-reform, based on the multinomial logit properties. However, it is preferred to make use of the sample information about actual hours in the base, that is pre-reform, situation. Importantly, the calibration approach also ensures that the results before the reform are comparable between TaxWell and TaxWell-B (except that TaxWell does not discretise the hours levels before the reform).

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

Labour supply for some groups is held constant: these are retirees (801 cases), self-employed (390 cases), full-time students, disabled and others (660 cases). These groups are expected to behave differently from the other individuals of working age and tend to be less responsive to changes in financial incentives. After excluding these groups, there are 2160 (from the total of 4011) families in the HES sample for whom the effects of the policy reform on labour supply are simulated, representing 67% of the working age population.

4. Simulated labour supply responses

As explained in the previous section, the policy simulation generates, for each individual, a conditional probability distribution of hours supplied under the post-reform structure, conditional on the individual being placed at the pre-reform observed (discretised) hours level. A range of summary measures of the labour supply changes is thus available. Section 4.1 provides preliminary results relating to arithmetic mean changes in hours supplied and participation rates for each demographic group. The arithmetic means are obtained over all hours levels and individuals. These aggregative measures necessarily conceal a considerable amount of heterogeneity. Indeed, a small positive increase in average hours of work supplied at, say, the intensive margin can be associated with many large positive and negative changes made by individuals (who are also, by assumption, limited to making changes with at least five-hour intervals). More details are thus revealed by transition matrices, which are reported for the different demographic groups in Section 4.2.

4.1. Average labour supply responses

Table 3 presents the simulated labour supply responses for all demographic groups. However, the first block of the table provides information about the composition of the population (the percentages in each labour market and demographic category).

As explained earlier, the microsimulation model produces, for each individual, a conditional distribution of hours supplied after the tax reform, given that the individual’s optimal hours before the reform correspond to actual observed hours. The labour supply responses in Table 3 refer to the

| Labour force status (%) | Couples | Single persons | Sole parents |
|-------------------------|---------|----------------|--------------|
|                        | M       | F       | M       | F       | M       | F       | M       | F       | M       | F       |
| Wage and self employed: pre-reform | 66.05 | 60.34 | 88.20 | 65.21 | 57.45 | 54.26 | 45.99 |
| Wage and salary workers: pre-reform | 50.88 | 54.32 | 70.97 | 56.71 | 52.58 | 51.22 | 42.05 |
| Wage and salary workers: post-reform | 50.98 | 54.47 | 71.07 | 56.85 | 52.71 | 51.55 | 42.91 |
| Behavioural Response | | | | | | | | | | |
| Non-work to work transition (ppt) | 0.12 | 0.16 | 0.11 | 0.22 | 0.13 | 0.32 | 0.32 | 0.13 | 0.86 | 0.32 | 0.86 |
| Work to non-work transition (ppt) | 0.01 | 0.02 | 0.01 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Workers working more (ppt) | 0.14 | 0.10 | 0.32 | 0.26 | 0.05 | 0.35 | 0.35 | 0.05 | 0.56 | 0.35 | 0.56 |
| Workers working less (ppt) | 0.02 | 0.03 | 0.07 | 0.05 | 0.00 | 0.01 | 0.01 | 0.00 | 0.04 | 0.01 | 0.04 |
| Average hours change | 0.06 | 0.07 | 0.07 | 0.09 | 0.06 | 0.17 | 0.17 | 0.06 | 0.33 | 0.17 | 0.33 |
| Average hours: pre-reform | 20.2 | 18.4 | 29.5 | 17.8 | 18.9 | 16.8 | 13.3 |
| Average hours change: workers only | 0.03 | 0.03 | 0.04 | 0.09 | 0.03 | 0.11 | 0.11 | 0.03 | 0.14 | 0.11 | 0.14 |
| Average hours: pre-reform workers | 39.7 | 33.8 | 41.6 | 31.4 | 36.0 | 32.8 | 31.6 |

Note: ppt denotes the percentage points.
difference for each person between the pre-reform discretised hours and the arithmetic mean of the post-reform conditional hours distribution. The average working hours post-reform are then obtained for each group as the mean of the individual conditional averages. Average hours pre-reform are simply the average for the group of the actual discretised hours levels. The table shows that average hours supplied increase for all groups, reflecting the dominance of the substitution effect of the policy change. Using a weighted average over all of the above groups, the average hours change is found to be 0.10 per person.

The largest change shown in Table 3 is observed for sole parents, with an average weekly increase in the arithmetic mean hours supplied of around 20 minutes (0.33 hours). In addition, sole parents show the largest increase at the intensive margin, with average workers working more hours increasing by 0.56 percentage points. At the extensive margin, relating to entering the labour force when initially working zero hours, the proportion working increases by 0.86 percentage points. This implies (after grossing up to population values using the sample weights), around 49,000 hours of work increase a week by sole parents, where 82% of this is attributed to workers entering the labour market. Only 46% participated in the labour market before the policy changes. Before the reform, sole parents who were working worked 31.6 hours on average.

It is possible to obtain confidence intervals for these changes, following the method proposed by Creedy, Kalb, and Kew (2007). These were calculated separately for sole parents, married couples with and without dependents and single men and women. Consider the change in average hours of sole parents, which from Table 3 is 0.33. The 90% confidence interval for this group is found to be 0.29–0.51 hours. The 90% interval for married men with dependents is 0.06–0.09. For married women with dependents this interval is 0.07–0.11 hours. The average hours change for single women has a 90% confidence interval of 0.14–0.2 hours. These relatively low confidence intervals are explained by the low standard errors of the parameter estimates of the preference functions on which the simulations are based. They do not allow for sampling errors. Confidence intervals were obtained for the other responses, but in view of their relatively small size they are not reported here.

The policy changes result in higher participation and average working hours for both married men and women. The effects are more prominent for couples with children. The net percentage point increase in working hours is the highest for married men with children. Their participation rate is also the highest amongst the subgroups. However, the net increase in participation is higher for married women. These changes imply (after grossing up) approximately 60,000 and 80,000 hours of work increase a week for married men and women respectively. Here, 70% and 60% of these increases, respectively, for married men and women, are attributed to increased participation rates for couples with and without children. Married men with children who are working prior the reform are already working on average 41.6 hours a week, and the policy reform causes a slight increase in their average hours of work supplied of 0.04.

For singles, the simulated policy changes also result in higher participation and working hours for both men and women. However, the effects are more prominent for single women. Single women experienced the highest net percentage point increase in their participation rates and average hours of work supplied. On average, single men work around 18.9 hours a week while single men who are currently working work around 36 hours. These are higher than for single women, who work on average around 16.8 hours a week, while single women who are working work about 32.8 hours. This implies more than 80,000 hours of work increase a week for single women, where 67% of this is attributed to new participants in the labour market.

### 4.2. Transition matrices

Further details of the potential labour supply responses, reflecting the complexities arising from the highly nonlinear budget constraints discussed earlier, are provided by transition matrices. These use the full information about the conditional post-reform hours distributions obtained for each individual.
The transition matrix for sole parents is shown in Table 4. Movements are effectively from rows to columns so that, for example, of those who initially did not work, there is a probability of 98.5% that they continue not to work after the reform. In this and the following tables an entry of ‘—’ indicates that no transitions arise, whereas an entry of zero indicates a negligible proportion of transitions.

Of the off-diagonal entries, relatively few positive values are below the leading diagonal. In addition, the higher probabilities of increasing hours worked are for those working 20 hours or more before the reform. A feature of the conditional distributions shown along the rows of the table is that they are multi-modal. This reflects the non-convexity of the budget sets discussed above, where small changes in the net wage can lead to relatively large ‘jumps’ in the number of hours of work supplied.

Further details of the conditional distributions of labour supply changes for couples with children are shown in Tables 5 and 6. A small proportion of married men and women with children increased hours of work. However, a small proportion of married women with children exit the labour market, especially where they were working at higher hours before the policy reform takes place, as indicated in the first column of Table 6. Again the conditional distributions show the kind of multi-modality that is expected as a result of non-convexities in the budget set, such that even small changes in the net wage can lead the individual to make a large change in labour supply. The

| Labour supply transitions (row to column). |
| --- |
| **Labour supply in hours per week** |
| **Post-reform** |
| **Pre-reform** | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | Total |
| 0 | 98.5 — 0 | 0.2 | 0.3 | 0.3 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 58 |
| 5 | — 98.1 — — — — — 0.3 | 0.1 | 0.6 | 0.8 | 0.2 | 2.4 |
| 10 | — — 98 | 0.2 | 0.1 | 0.4 | 0.4 | 0.3 | 0.2 | 0.3 | 3.2 |
| 15 | — — — 97.1 | 0.2 | 1 | 0.2 | 0.7 | — | 0.4 | 0.3 | 2.0 |
| 20 | — — — — 97.8 | — | 0 | 0.1 | 0.5 | 0.8 | 0.7 | 3.8 |
| 25 | — — — — — 99 | — | 0.3 | 0.1 | 0.4 | 0.2 | 1.5 |
| 30 | — — — — — — 0.1 | 0 | 99.5 | 0 | 0.1 | 0.1 | 0.2 | 3.8 |
| 35 | — — — — — — 0.1 | 0 | 0.1 | 97.1 | 0.2 | 0.9 | 1.6 | 5.4 |
| 40 | — — — — — — — 0.1 | — | 99.1 | 0.2 | 0.5 | 15.5 |
| 45 | — — — — — — — — 0.3 | — — 99.4 | 0.4 | 1.3 |
| 50 | — — — — — — — — — 100 | — | 3.2 |
| Total % | 57.1 | 2.4 | 3.1 | 2.1 | 3.9 | 1.7 | 4 | 5.4 | 15.5 | 1.5 | 3.5 | 100 |

| Labour supply transitions (row to column). |
| --- |
| **Labour supply in hours per week** |
| **Post-reform** |
| **Pre-reform** | 0 | 10 | 20 | 30 | 40 | 50 | Total % |
| 0 | 99.6 — — — — — — — — — — — — — — | 0.2 | 0.2 | 29 |
| 10 | — — 99.9 — — — — — 0.1 | — | 1.6 |
| 20 | 0.2 — — 99.5 — — — — — | 0.1 | 0.2 | 0.8 |
| 30 | — — — — — 99.2 | 0.4 | 0.4 | 2.6 |
| 40 | 0 | — — — — — — — — — — | 0.1 | 99.3 | 0.6 | 45.8 |
| 50 | 0 | — — — — — — — — — — — | 0 | 0.1 | 99.8 | 20.3 |
| Total % | 28.9 | 1.6 | 0.8 | 2.6 | 45.5 | 20.6 | 100 |
small probability of movement from work to non-work for the married women is associated with the non-convexity in the budget sets for many of this group, caused by the fixed cost of working.

Tables 7 and 8 present the labour supply transition matrices for single men and women. These show that single men mostly stay at their current working hours or, at the higher hours levels, increase their labour supply due to the policy changes. For single women, a small proportion increase their hours of work.

5. Tax and revenue changes

The labour supply responses affect estimates of government expenditure and revenue. As mentioned earlier, the calibration approach used in TaxWell-B ensures that the results before the reform are comparable with those in TaxWell. Table 9 presents the expected change in government revenue and expenditure, with and without labour supply responses, for all subgroups. However, increased revenue from the GST increase is not included in these comparisons.
The reduction in the marginal tax rates reduces income tax revenue by about $3,275.8 million and $3,412.1 million, with and without accounting for labour supply responses respectively. The estimated non-behavioural personal income tax revenue reduction is similar to the previous Treasury estimates of $3,467 million in 2011/12 (adjusted to constant 2010, second quarter, dollars) from the Budget 2010 report: see New Zealand Treasury (2010a, 2010b). The reduction in revenue of $136.3 million (equal to \( \frac{3412.1}{275.8} \)) is smaller when labour supply effects are taken into account, as a result of the improved work incentives. This estimate is slightly lower than the estimated tax effect accounting for labour supply responses in the 2010 budget forecast of $183 million in 2011/12 (adjusted to constant 2010, second quarter, dollars). This is caused by the use of a higher overall hours-worked labour supply elasticity of 0.44 used in the budget report which, as mentioned above, was drawn from the earlier estimates of preference functions using data from 1991 to 2001: see New Zealand Treasury (2010c). The recently estimated overall hours-worked elasticity is about 0.31.8

Table 8. Single women labour supply transitions (row to column).

|Labour supply in hours per week|Post-reform|
|---|---|
|Pre-reform 0|5|10|15|20|25|30|35|40|45|50|Total %|
|0|99.3|0|0|0.1|0.1|0.1|0.1|0.1|0.1|0.1|48.8|
|5|---|99|---|0.1|0.1|0.1|0.2|0.1|0.1|0.1|0.2|1.8|
|10|---|---|99.5|---|---|0|0|0.2|0.2|0.1|0.1|0.4|4.1|
|15|---|---|---|99.2|---|0|0.1|0.2|0.3|0.1|0.1|0.6|3.6|
|20|---|---|---|---|---|99.3|---|0.1|0.2|0.2|0.3|0.8|2.7|
|25|---|---|---|---|---|0|0.1|98.4|0|0.1|0.4|0.5|0.4|3.3|
|30|---|---|---|---|---|---|98.9|0.2|0.3|0.4|0.3|3.2|
|35|---|---|---|---|---|---|---|98.5|0.2|0.2|0.5|0.8|6.4|
|40|---|---|---|---|---|---|---|---|---|99.5|0.2|0.2|16.8|
|45|---|---|---|---|---|---|---|---|---|---|99.8|0.2|3.9|
|50|---|---|---|---|---|---|---|---|---|---|---|99.9|5.5|
|Total %|48.5|1.8|4.1|3.6|2.7|3.3|3.2|6.3|16.8|4.1|5.7|100|

Table 9. Tax revenue and expenditure on transfer payments ($ million): with and without labour supply responses.

|Benefit Family|income|Rebate|Total |Total |Net |
|---|---|---|---|---|
|Pre-reform|1861.9|166.3|1908.7|4121.9|8058.7|19924.5|
|With LS (Δ)|-21.8|0.6|32.4|84.1|94.1|-2437.7|2531.8|
|Without LS (Δ)|5.6|1.9|42.1|84.1|129.9|-2537.8|2667.6|
|Single men|1857.0|62.4|0|964.1|2883.5|2941.7|
|With LS (Δ)|-12.7|0.2|0|19.5|7.0|-389.6|396.5|
|Without LS (Δ)|-3|0|0|19.5|16.5|-398.3|414.8|
|Single women|1592.6|47.1|0|2178.7|3818.4|2675.6|
|With LS (Δ)|-33.0|1.1|0|44.0|12.1|-337.7|349.8|
|Without LS (Δ)|-1.3|0|0|44.0|42.7|-355.4|398.2|
|Sole parents|2107.8|0|976.5|8.2|3092.5|835.2|
|With LS (Δ)|-31.9|0|18.2|2|13.7|-110.8|97.0|
|Without LS (Δ)|-8.8|0|19.4|0|2|10.8|-120.6|131.4|
|Total|2107.8|0|976.5|8.2|3092.5|835.2|
|With LS (Δ)|-31.9|0|18.2|2|13.7|-110.8|97.0|
|Without LS (Δ)|-8.8|0|19.4|0|2|10.8|-120.6|131.4|
|Note: Δ denotes the absolute change.
Table 9 shows that all compensation payments, excluding the superannuation payment, cause total government expenditure to increase by $52.1 million (equal to 199.9 – 147.8), when labour supply is assumed to remain constant. Importantly, after allowing for labour supply changes, the expenditure falls by about $48.3 million (equal to 147.8 – 99.5). This fall in benefit payments is caused by the increased average working hours and participation rates for all demographic groups. The largest reduction in benefit payments arising from labour supply changes are for single women, followed by sole parents. In summary, the labour supply effects help reduce the cost of the policy changes to the government by about $236.7 million (equal to 3612.0 – 3375.3), from the total of $4.9 billion without labour supply changes. These comparisons clearly demonstrate the importance of allowing for potential labour supply responses when considering tax reforms.

It was previously estimated that the tax package will cause an increase of the GST revenue of $2,672 million in 2011/12 (adjusted to constant 2010, second quarter, dollars) and other changes in tax revenues such as company tax reductions: see New Zealand Treasury (2010a). The results in Table 9 do not capture these additional forms of revenue. The negative fiscal impact in the first few years is a transitional effect owing to the time required for revenue to accrue from some of the base-broadening measures. From the fourth year onwards (up to the fifth year) of the forecast period (from 2010/11 to 2014/15), the impact on the fiscal cost is positive, and the tax package is expected to be broadly fiscally neutral taking into account labour supply responses (for example the extra tax revenue the government receives due to more people working). Hence, this is important to bear in mind when comparing the fiscal costs and revenue from the behavioural microsimulation with the actual costs of the tax package.

6. Income distribution

It is of interest to consider the potential effects of the 2010 reforms on the distribution of disposable incomes. The conditions under which such a change in the tax mix could be exactly distribution-neutral are extremely strong and not expected to hold in the present case: see Creedy and Mellish (2011) for further details. Examining the distributional impact of a policy change in the TaxWell-B behavioural microsimulation model, a special approach is needed to deal with the fact that it generates a conditional distribution of hours worked for each individual, rather than a deterministic hours level. For example, using simply the arithmetic mean hours for each individual provides a poor approximation. However, a ‘pseudo-distribution’ method, examined in detail in Creedy, Kalb, and Scutella (2004, 2006), can be used to obtain a range of inequality measures.

Inequality comparisons using the Gini measure are shown in Table 10. Similar results applied using, for example, the Atkinson inequality measure for various degrees of inequality aversion. The disposable income measure (or ‘welfare metric’) used is household income per adult equivalent person, where equivalisation is based on the Whiteford (1985) adult equivalence scales. The unit of analysis is the individual. The inequality measures use the sample weights, so that they apply to population aggregates rather than simply the individuals in the sample. Table 10 shows that there is a very slight increase of 0.002 in the overall Gini coefficient. Indeed, plots of the Lorenz curves before

| Group               | Pre-reform | Post-reform | Difference |
|---------------------|------------|-------------|------------|
| Couple              | 0.335      | 0.337       | 0.002      |
| Couple and dependents| 0.290      | 0.294       | 0.004      |
| Single              | 0.372      | 0.374       | 0.002      |
| Sole parents        | 0.224      | 0.228       | 0.004      |
| All                 | 0.356      | 0.358       | 0.002      |
and after the reform were found to be indistinguishable. The use of different equivalent adult scales produced similar changes, though of course different absolute levels.

7. The effects of separate policy changes

In this section, the effects of individual policy changes are discussed separately. Although the separate effects are not expected to be additive, it is useful to obtain some idea of the relative importance of the different elements of the package of policy changes.

7.1. Marginal tax rates changes

The simulated effects on average labour supply of changes in only marginal income tax rates are shown in Table 11. Here the group of married men and women includes those with and without children combined. Not surprisingly, these labour supply changes are larger than those shown in Table 3. The effects of combining the income tax rate changes with the change in the GST are shown in the second block of Table 11. As expected, they are closer to those in Table 3.

7.2. WfF changes

The higher GST tax rate was compensated by the increase in the Family Tax Credit rates and the Minimum Family Tax Credit, while other features (for example, the abatement threshold) of the WfF scheme remain unchanged. The unchanged component includes the work tested IWTC where couples must work at least 30 hours per week (as combined hours) and sole parents for at least 20 hours per week. Table 12 shows that these WfF changes alone — and excluding the GST increase — induce an

| Table 11. Labour supply effects of income tax rate changes. |
|-------------------------------------------------------------|
| Behavioural response                                      | Married men | Married women | Single men | Single women | Sole parents |
|------------------------------------------------------------|
| **Income tax only**                                        |             |               |            |              |              |
| Non-work to work transition (ppt)                         | 0.31        | 0.50          | 0.23       | 0.80         | 1.63         |
| Work to non-work transition (ppt)                         | 0.02        | 0.05          | 0.00       | 0.00         | 0.00         |
| Workers working more (ppt)                                | 0.35        | 0.36          | 0.11       | 0.74         | 1.10         |
| Workers working less (ppt)                                | 0.11        | 0.05          | 0.00       | 0.03         | 0.02         |
| Average hours change (hours)                              | 0.15        | 0.22          | 0.11       | 0.42         | 0.67         |
| **Income tax combined with GST change**                   |             |               |            |              |              |
| Non-work to work transition (ppt)                         | 0.22        | 0.31          | 0.20       | 0.64         | 0.99         |
| Work to non-work transition (ppt)                         | 0.01        | 0.07          | 0.00       | 0.00         | 0.00         |
| Workers working more (ppt)                                | 0.32        | 0.25          | 0.08       | 0.56         | 0.87         |
| Workers working less (ppt)                                | 0.06        | 0.04          | 0.00       | 0.01         | 0.01         |
| Average hours change (hours)                              | 0.12        | 0.13          | 0.10       | 0.33         | 0.45         |

Note: ppt denotes the percentage points.

| Table 12. Labour supply effects of Working for Families changes. |
|---------------------------------------------------------------|
| Behavioural response                                         | Couples with children |
|                                                             | Men       | Women     | Sole parents |
|--------------------------------------------------------------|
| Non-work to work transition (ppt)                            | 0.00      | 0.00      | 0.03         |
| Work to non-work transition (ppt)                            | 0.01      | 0.03      | 0.00         |
| Workers working more (ppt)                                   | 0.01      | 0.00      | 0.00         |
| Workers working less (ppt)                                   | 0.02      | 0.01      | 0.03         |
| Average hours change (hours)                                 | 0.00      | -0.01     | 0.00         |

Note: ppt denotes the percentage points.
increase in sole parent participation of 0.03 percentage points. Married men and women with children are more likely to leave the labour market and work fewer hours. The transition to non-participation effect of this reform alone is more prominent for married women. Average labour supply over all married women is expected to decrease by the negligible amount of 0.01 hours per week. This is consistent with the finding that the reduction in the labour supply of married women is affected mainly by the dominant income effect and most of the married men with children are already participating in the labour force and are working over 30 hours before the reform: for further analysis of labour supply effects of WfF, see Mok and Mercante (2014). Clearly, the labour supply effects would be slightly lower than the responses shown in Table 12, when combined with the GST increase.

7.3. Benefit rates changes

Table 13 shows the simulated responses to changes in only benefit payment rates, and excluding GST effects. This shows that, for all groups, the income effect seems to dominate the substitution effect. This leads to an overall decrease in the average hours work. Single women are more likely to leave the labour market while sole parents are more likely to work fewer hours. This is probably due to the different abatement rates and thresholds faced by a single unemployed person and a sole parent who are entitled to the DPB. The UB has an income abatement rate where any income over $80 per week before tax is reduced by 70 cents for every $1 of income earned. For the DPB, income between $80 and $180 per week is reduced by 30 cents for each $1 earned and by 70 cents for every $1 for income above that.

8. Conclusions

This paper has examined the simulated labour supply responses to the personal tax and transfer policy changes in 2010. The changes included the increase in the GST rate from 12.5% to 15%. Simultaneously, the government reduced personal income tax rates and increased the main benefit payments and assistance to families with children to compensate for the rise in the GST. The switch from income tax towards the GST was aimed to enhance the incentive to save, encourage economic growth and improve efficiency.

Simulated responses were obtained using the Treasury’s behavioural microsimulation model for New Zealand, TaxWell-B, and were based on the HES in 2009/10. The simulation began with the complete set of changes and then some of its components were discussed separately. The full effect of policy changes was found to produce small average increases in labour supply for all demographic groups, reflecting the dominance of the substitution effect of the policy change: the weighted average hours increase was 0.10 per person.

However, this overall average masks some larger changes for particular demographic groups. The largest average increase was observed for sole parents, who have low participation rates. The simulated average weekly increase in arithmetic mean hours supplied by sole parents was about 20 minutes (0.33 hours). The average increase for single females was found to be 0.17 hours per person, while the corresponding average increase for single men and married men without children was
0.06. Sole parents show the largest responses from the reform with large increases in the intensive and extensive margins. At the extensive margin, relating to entering the labour force when initially working zero hours, the proportion working increases by 0.86 percentage points.

The policy changes were found to result in higher participation and working hours for both married men and women, with the effects being more prominent for couples with children. The net percentage point increase in working hours was the highest for married men with children, whose participation rate is also the highest amongst the demographic groups. However, the net increase in participation was higher for married women. Of the single individuals, single women experienced the highest net percentage-point increase in their participation rate and average working hours. The averages mask larger and more varied hours changes, which were reflected in transition matrices showing probabilities of movements between the discrete hours levels from pre-reform to post-reform structures.

The positive simulated increases in the average labour supply of all demographic groups, stimulated by the policy reform, also affect estimates of government expenditure and revenue. After allowing for labour supply changes, the cost of the policy change decreases for all demographic groups. This is mainly reflected in the tax revenue and welfare benefits. As expected, income tax payments decrease due to the marginal tax reductions. However, the reduction in revenue is mitigated by the labour supply changes resulting from the improved work incentives. In addition, the increased labour supply reduces expenditure on welfare benefits. The largest benefit reduction is observed for single women and sole parents due to the relatively larger increases in their labour supply. Importantly, these results contrast strongly with those obtained on the assumption of unchanged labour supply, where benefit expenditure is expected to increase.

The reform was also found to be approximately distribution-neutral, with an increase in the overall Gini inequality measure of income per adult equivalent person of only 0.002. Lorenz curves for pre- and post-reform distributions were found to be indistinguishable. When considering individual policy changes separately, the reductions in marginal income tax rates was found to have the largest effect on labour supply. This is not surprising, given that it affects a large proportion of the population while the changes to the benefit system and assistance to families with children are relevant only to certain groups. The increases in the main benefit payment rates, taken in isolation, have a work-disincentive effect for all groups, leading to an overall decrease in the average hours worked.

It must again be stressed that the simulation model, TaxWell-B, is a supply-side partial-equilibrium model. It can thus examine only individuals’ desired working hours and participation rates, on the further assumption that wage rates are not affected. The results are thus ex ante simulations. Whether actual labour supply, revenue and expenditure move in similar ways depends crucially on the demand side of the labour market. Here it is worth bearing in mind that the reforms came when the effects of the global financial crisis were at their largest. The use of a microsimulation model of this kind can therefore provide only one component, rather than a prediction, of the likely effects of a tax policy change. However, such information is preferred to the exclusive reliance on a simple assumption of fixed labour supply. In addition, it is important to allow for the considerable degree of heterogeneity found in the population, regarding both characteristics and preferences for consumption and leisure.

Notes

1 The Hon. Bill English, Minister of Finance, stated (2010) that ‘Tax reform is a centrepiece of this budget’. For a summary of the budget, see http://www.treasury.govt.nz/budget/2010/execsumm/10.htm

2 The influence of the report is underscored by the statement (2010) of the Hon. John Key, Prime Minister, that ‘the Tax Working Group discussed a broad range of options for tax reform. The Government has considered all of these options closely ... While the Government has ruled out some of the proposals ... most of the options discussed by the group still remain on the table’. For reflections on the review process, see Buckle (2010, 2015).

3 The time between the announcement of the changes and their implementation is likely to have induced some income shifting of non-wage income in order to benefit from the future reduction in the top income tax rate. However, this would not affect labour supply over the survey period.
4 For details of minimum wages in New Zealand, see http://employment.govt.nz/er/pay/minimumwage/previous
minimum.asp
5 This random component should be distinguished from ‘optimising frictions’ associated with adjustment costs,
discussed by Chetty (2012). He argued that these are more important at the intensive margin, and may bias
microeconometric estimates of labour supply responses.
6 The specification does not include any components relating to the number of jobs available at the various discrete
hours levels. It must therefore be acknowledged that the estimation of preferences may be affected by the state of
the labour market following the global financial crisis of 2008.
7 For discussion of small differences between TaxWell and TaxWell-B in the no-response setting, see Mok and
Mercante (2014, Appendix B).
8 This was obtained using the same sample weights as the previous report.

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in, or for the correctness of, the information contained in these working papers. The paper is presented not as policy,
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References

Buckle, R.A. (2010). Tax policy reform New Zealand style. New Zealand Economic Papers, 44, 129–136.
Buckle, R.A. (2015, August). New Zealand Tax Working Group: Are there lessons for tax reform processes? Paper pre-
sented at the ANZSOC Annual Conference, Melbourne, Australia.
Chetty, R. (2012). Bounds on elasticities with optimization frictions: A synthesis of micro and macro evidence on labor
supply. Econometrica, 80, 969–1018.
Creedy, John (2004). Labour supply incentives in alternative tax and transfer schemes: A diagrammatic introduction.
Australian Economic Review, 37, 230–241.
Creedy, J. (2005). An in-work payment with an hours threshold: Labour supply and social welfare. Economic Record,
81, 367–377.
Creedy, J., Duncan, A.S., Harris, M., & Scutella, R. (2002). Microsimulation modelling of taxation and the labour mar-
et: The Melbourne institute tax and transfer simulator. Cheltenham: Edward Elgar.
Creedy, J., & Kalb, G. (2005). Discrete hours microsimulation: Specification, estimation and simulation. Journal of
Economic Surveys, 19, 697–734.
Creedy, J., Kalb, G., & Kew, H. (2007). Confidence intervals for policy reforms in behavioural tax microsimulation
modelling. Bulletin of Economic Research, 59, 37–65.
Creedy, J., Kalb, G., & Scutella, R. (2004). Evaluating the income distribution effects of tax reforms in discrete hours
models. In Y. Amiel & J. Bishop (Eds.), Research in economic inequality (Vol. 12, pp. 199–226). New York, NY:
JAI Press.
Creedy, J., Kalb, G., & Scutella, R. (2006). Income distribution in discrete hours behavioural microsimulation models:
An illustration. Journal of Economic Inequality, 4, 57–76.
Creedy, J., & Mellish, A. (2011). Changes in the tax mix from income taxation to GST: Revenue and redistribution.
New Zealand Economic Papers, 45, 299–309.
English, B. (2010). The 2010 Budget: Building the Recovery. New Zealand Government, 20 May. Retrieved from http://
www.treasury.govt.nz/budget/2010
Kalb, G., & Scutella, R. (2003). New Zealand labour supply from 1991 to 2001: An analysis based on a discrete choice
structural model (New Zealand Treasury Working Paper, 03/23). New Zealand: New Zealand Treasury.
Key, J. (2010). Statement to Parliament. Presented to the New Zealand House of Representatives, 9 February.
Mercante, J., & Mok, P. (2014a). Estimation of labour supply for New Zealand (New Zealand Treasury Working Paper, 14/08). New Zealand: New Zealand Treasury.

Mercante, Joseph, & Mok, P. (2014b). Estimation of wage equations for New Zealand (New Zealand Treasury Working Paper, 14/09). New Zealand: New Zealand Treasury.

Ministry of Business, Innovation and Employment. (2014). Previous minimum wage rates. Wellington: Ministry of Business, Innovation and Employment. Retrieved from http://www.dol.govt.nz/er/pay/minimumwage/previousminimum.asp

Mirrlees, James (Ed.). (2011). Tax by design. London: Oxford University Press.

Mok, Penny, & Mercante, Joseph (2014). Working for Families changes: The effect on labour supply in New Zealand (New Zealand Treasury Working Paper, 14/18). New Zealand: New Zealand Treasury.

New Zealand Treasury. (2010a). Budget 2010 Tax package and the preliminary economic and fiscal outlook. Retrieved from http://www.treasury.govt.nz/publications/informationreleases/budget/2010/tax

New Zealand Treasury. (2010b). Budget economic and fiscal update 2010. Retrieved from http://www.treasury.govt.nz/budget/forecasts/befu2010

New Zealand Treasury. (2010c). Technical note on the basis of assumptions regarding the effect of the tax package on forecast and projected economic growth. Retrieved from http://www.treasury.govt.nz/budget/forecasts/befu2010/assumptions-taxpackage-may10.pdf

Statistics New Zealand. (2010). Statistics New Zealand clarifies impact of GST on CPI. Retrieved from http://www.stats.govt.nz/browse_for_stats/Corporate/Corporate/CorporateCommunications_MRimpact-of-GST-on-CPlimitation-of-GST-on-CPI.aspx

Tax Working Group. (2010). A tax system for New Zealand’s future. Victoria University of Wellington. Retrieved from http://www.victoria.ac.nz/sacl/cagtr/twg/Report.aspx

Van Soest, A. (1995). Structural models of family labor supply: A discrete choice approach. The Journal of Human Resources, 30, 63–88.

Whiteford, P. (1985). A family’s needs: Equivalence scales, poverty and social security Research Paper, no. 27). Canberra: Department of Social Security.