Labour Supply in New Zealand and the 2010 Tax and Transfer Changes

John Creedy and Penny Mok

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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 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 simulated labour supply responses were obtained using the Treasury's behavioural microsimulation model, TaxWell-B. The 2009/10 Household Economic Survey (HES) was used. The combined effect of all policy changes is to increase average labour supply slightly for all demographic groups. 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.

JEL Classification: C25; J22

Keywords: Taxes and transfers; labour supply; discrete choice model; microsimulation; New Zealand.

Executive Summary

This paper examines the simulated labour supply responses to the personal tax and transfer policy changes made in New Zealand in 2010, along with the implications for revenue and income distribution. The main changes involved an increase in the GST rate from 12.5 to 15 per cent, along with reduced 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 results presented in this paper were obtained using the Treasury's behavioural microsimulation model for New Zealand, TaxWell-B. This model examines only the supply side of the labour market, so that the simulated labour supply responses make no allowance for the demand side, or possible consequences for wage rates.

It is estimated that the policy changes produced a small increase in average hours of work supplied, and a small increase in participation rates. The largest increases were found for sole parents.

The simulations demonstrate the importance of allowing for potential labour supply effects when examining cost and revenue implications of personal tax and benefit changes. Without labour supply responses, expenditure on benefits is expected to increase, but with allowance for the increase in labour supply (resulting largely from the income tax rate reductions), expenditure is projected to fall. The income tax rate reductions are expected to reduce income tax revenue, but the extent of the reduction is mitigated by the small increase in average hours of work and the overall increase in the participation rate.

Earlier Treasury estimates were based on the use of average hours and participation elasticities of labour supply, with respect to an increase in the net-of-tax wage rate, for each of a number of demographic groups. The results obtained here were based on the Treasury microsimulation model which can allow for the considerable degree of population heterogeneity found in practice. In addition, more recent econometric estimates of preference functions were obtained, based on more recent data. The new results produce slightly lower aggregate labour supply elasticities than those previously used.

An analysis of the inequality of income per adult equivalent person (after allowing for income tax and benefit payments) found that the personal tax changes were approximately distribution neutral in their overall effect.

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Labour Supply in New Zealand and the 2010 Tax and Transfer Changes

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 per cent, combined with reduced personal income tax rates and increases in the main benefit payments and assistance to families with children.[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.[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

[1] The Hon. Bill English, Minister of Finance, stated (2010) that, 'Tax reform is a centrepiece of this budget'.

[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).

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 (2010) 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 (CPI) by 2 per cent: 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, with and without allowing for labour supply responses. The Household Economic Survey (HES) for 2009/10 was used for simulations of the effect of the change in tax and transfer rules from April 2010 to 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 above, 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

Subsection 2.1 summarises the details of the tax rate and benefit changes made in 2010.[3] 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 Subsection 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, Working for Families (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 Goods and Services Tax (GST) rate from 12.5 to 15 per cent.

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 rates, 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 only.

[3] In more recent years some of these benefits have been replaced by Jobseeker Support (JSS) and Sole Parent Support (SPS), introduced in July 2013.

Table 1: Income Tax rates and Working for Families Tax Credits

Income tax rates (per cent)		
Income band ($ annual)	Pre-Oct 2010	From Oct 2010
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-Oct 2010	From Oct 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)		
Rates	20,800	21,216

Table 2: Main benefits allowances ($ weekly)

Benefit type	Pre-Oct 2010	From Oct 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 year	161.76	165.03
Single 25 years or over	194.12	198.04
Sole parent	278.04	283.66
Married, civil union or defacto 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 defacto 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 defacto couple per person	202.20	206.28
Independent Youth Benefit		
Single or married, civil union or defacto	161.76	165.03
Widow's Benefit		
Woman alone (single adult)	202.20	206.28
Sole parent	278.04	283.66

Figures 1 to 4 show the effect of the reform on disposable incomes and effective marginal tax rates (EMTRs) for four hypothetical individuals. These are, respectively: a sole parent with one child;[4] the male in a couple with two children; the female in a couple with two children and; a single person. These 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.

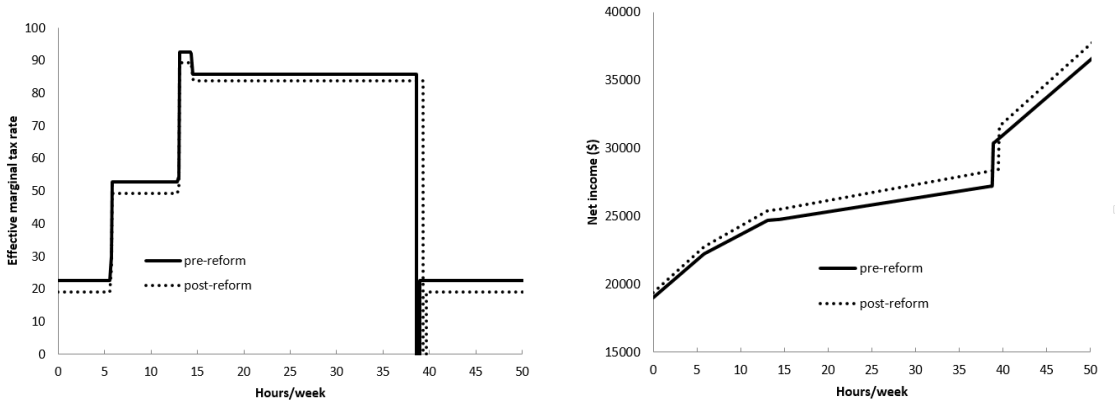

Figure 1: EMTR and Budget Constraint: A Sole Parent

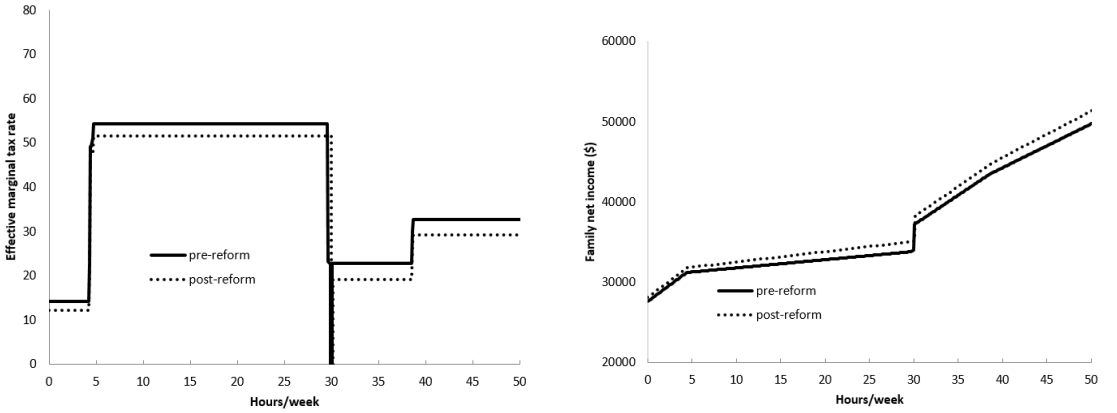

Figure 2: EMTR and Budget Constraint: A Married Man

[4] Male and female sole parents are combined in the following analysis, the vast majority being female.

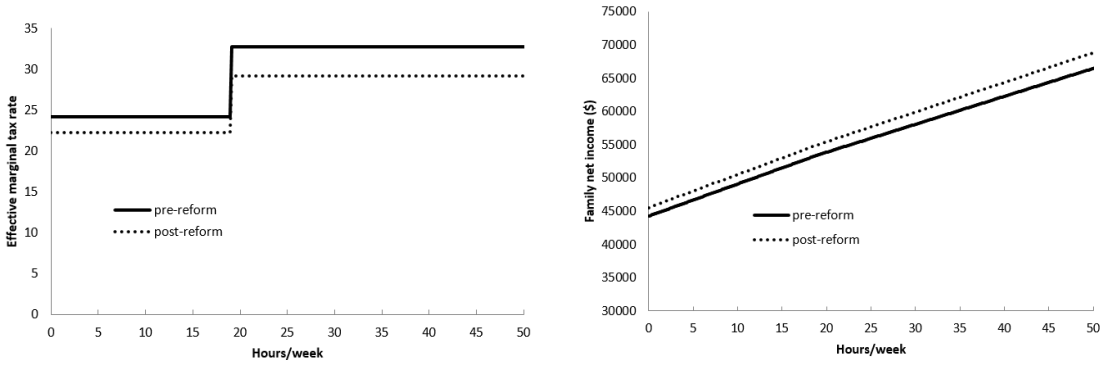

Figure 3: EMTR and Budget Constraint: A Married Woman

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 is equivalent to the statutory minimum wage in New Zealand: 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 the 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 in-work tax credit (IWTC) from the WfF. The WfF tax credits comprise four main tax credits: the family tax credit (FTC); the in-work tax credit (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 family tax credit (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 FTC from 0-hour and at 40-hour work the person receives both FCT and IWTC until FCT starts to be abated at $36,827 of the family annual income. The person may receive IWTC above 20 hours of work if the person earns a relatively low wage rate and still receives some main welfare benefits.

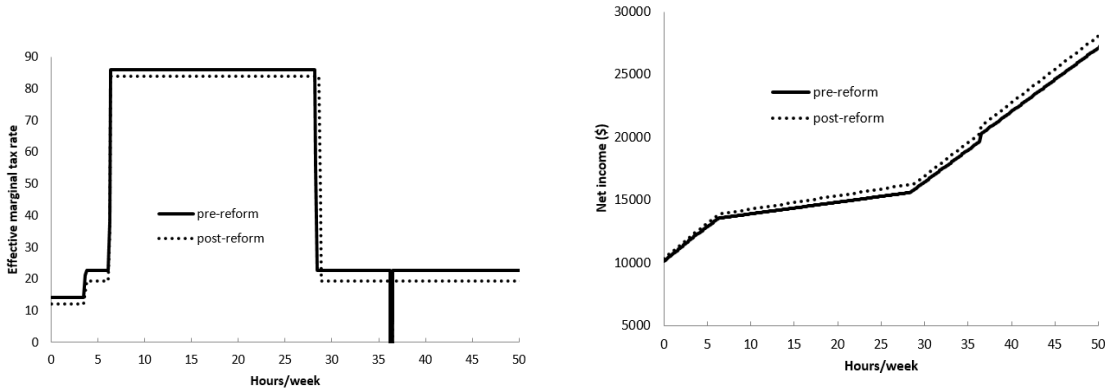

Figure 4: EMTR and Budget Constraint: A Single Woman

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 begins 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 effective marginal tax rates 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 above, 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.[5] 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 *et al*. (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 it a probability level for each person.[6] 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.[7] It contains the details of the social security and personal tax system and produces analyses at individual, family and household level. It utilises the Household Economic Survey (HES), a cross-sectional dataset collected by Statistics New Zealand. The model uses most of the income data from

5 The earlier Treasury behavioural model, called TaxMod-B, had not been maintained and could not be integrated with the newer non-behavioural model then in existence, 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 Working for Families, is reported in Mok and Mercante (2014).

6 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.

7 The name is a tribute to Ivan Tuckwell, who played a substantial role in the development of the previous Treasury arithmetic model, TaxMod.

HES which includes income from current jobs and other income such as interest and dividends. 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.

TaxWell-B assumes a 100 per cent 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 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 above, 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 estimated using pooled HES dataset 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 basic 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 was used for simulations of the effect of the change in tax and transfer rules from April 2010 to October 2010. It is important 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.

To obtain a distribution over the available discrete hours levels, a number of sets of draws are obtained (and retained) in order to provide a sufficient number of sets for which the optimal hours level matches the observed working hours before the reform: in the simulations reported below, this number of sets is 100. 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. 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. 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 2,160 (from the total of 4,011) families in the HES sample for whom the effects of the policy reform on labour supply are simulated, representing 67 per cent 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. Subsection 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 Subsection 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 above, 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 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.

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 per cent of this is attributed to workers entering the labour market. Only 46 per cent 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 per cent confidence interval for this group is found to be 0.29 to 0.51 hours. The 90 per cent interval for married men with dependents is 0.06 to 0.09. For married women with dependents this interval is 0.07 to 0.11 hours. The average hours change for single women has a 90 per cent confidence interval of 0.14 to 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.[8] They do not allow for sampling errors.

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 highest for married men with children. Their participation rate is also the highest amongst the

[8] Confidence intervals were obtained for the other responses, but in view of their relatively small size they are not reported here.

Table 3: Simulated responses of labour supply (All groups)

	Couples						
	No children		With children		Single persons		Sole
Labour force status (percentage)	M	F	M	F	M	F	Parents
Wage & self employed: pre reform	66.05	60.34	88.20	65.21	57.45	54.26	45.99
Wage & salary workers: pre reform	50.88	54.32	70.97	56.71	52.58	51.22	42.05
Wage & 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	0.86
Work to non-work transition (ppt)	0.01	0.02	0.01	0.08	0.00	0.00	0.00
Workers working more (ppt)	0.14	0.10	0.32	0.26	0.05	0.35	0.56
Workers working less (ppt)	0.02	0.03	0.07	0.05	0.00	0.01	0.04
Average hours change	0.06	0.07	0.07	0.09	0.06	0.17	0.33
Average hours: pre reform	20.2	18.4	29.5	17.8	18.9	16.8	13.3
Average hrs change: workers only	0.03	0.03	0.04	0.09	0.03	0.11	0.14
Average hours: pre reform workers	39.7	33.8	41.6	31.4	36.0	32.8	31.6

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 per cent and 60 per cent 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 per cent 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 above, 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 per cent 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.

Table 4: Sole parents' 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	0.1	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

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 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.

Table 5: Married men with children 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	0	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	0.1	99.3	0.6	45.8
50	0	–	0	0	0.1	99.8	20.3
Total %	28.9	1.6	0.8	2.6	45.5	20.6	100

Table 6: Married women with children labour supply transitions (row to column)

	Labour supply hours per week										
	Post-reform										
Pre-reform	0	5	10	15	20	25	30	35	40	45	50	Total %
0	99.5	0	0	0	0	0.1	0.1	0.1	0.1	0.1	0	43.3
5	–	99.7	–	–	–	–	–	0.2	–	–	0.1	1.5
10	0.2	0	98.4	–	0	–	–	0.2	0.7	0.1	0.3	2.6
15	0.1	0	–	98.5	0.1	0	0.2	0.1	0.1	0.4	0.4	4.2
20	0.2	–	–	–	98.8	0.1	0.2	0.2	0.2	0.2	0.2	5.6
25	0.3	0	–	–	0	98.9	0.1	0	0.2	0.1	0.2	6.5
30	0.1	0	0	0	–	0	99.6	0.1	0	0.1	0.1	7.2
35	0.2	–	–	–	0	0	0.2	99.2	–	0.1	0.2	5.7
40	0.1	–	0	–	0	0	0	0	99.7	0.1	0.1	16.1
45	0	–	–	–	0	–	0	0	0	99.9	–	3.4
50	0.4	0.1	–	–	–	–	0	0	0	0	99.5	4
Total %	43.2	1.5	2.6	4.2	5.5	6.4	7.2	5.7	16.1	3.5	4.1	100

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.

Table 7: Single men 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	99.7	–	–	–	–	0	0	0	0.1	0.1	0.1	47.4
5	–	100	–	–	–	–	–	–	–	–	–	1.8
10	–	–	100	–	–	–	–	–	–	–	0	2.1
15	–	–	–	100	–	–	–	–	–	0	–	2.3
20	–	–	–	–	99.9	–	–	0	–	0.1	–	3.1
25	–	–	–	–	–	99.5	–	–	–	0.3	0.2	1.2
30	–	–	–	–	–	–	99.9	–	0	0	0.1	3.7
35	–	–	–	–	–	–	–	99.7	0	0.1	0.2	3.4
40	–	–	–	–	–	–	–	–	99.9	0.1	0.1	21
45	–	–	–	–	–	–	–	–	–	100	0	6.4
50	–	–	–	–	–	–	–	–	–	–	100	7.5
Total %	47.3	1.8	2.1	2.3	3.1	1.2	3.7	3.4	21	6.5	7.6	100

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	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	0.1	0.1	0	4.1
15	–	–	–	99.2	0	0	0.1	0.2	0.3	0.1	0.1	3.6
20	–	–	–	–	99.3	–	–	0.1	0.2	0.2	0.3	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	–	–	–	–	–	0	–	98.5	0.2	0.5	0.8	6.4
40	–	–	–	–	–	0	0	–	99.5	0.2	0.2	16.8
45	–	–	–	–	–	–	–	–	–	99.8	0.2	3.9
50	–	–	–	–	–	–	–	0	0.1	–	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

5 Tax and revenue changes

The labour supply responses affect estimates of government expenditure and revenue. As mentioned above, the calibration approach used in TaxWell-B ensures that the results before the reform are comparable with those in TaxWell.[9] 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 3,412–3,275.8) 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.[10]

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 to reduce the cost of the policy changes to the government by about $236.7

9 For discussion of small differences between TaxWell and TaxWell-B in the no-response setting, see Mok and Mercante (2014, Appendix B).

10 This was obtained using the same sample weights as the previous report.

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 $2,672m 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.

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

	Benefit Income	Rebate	Family payment	NZS	Total Expend	Total Income tax	Net Expend
Couples							
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							
Pre-reform	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							
Pre-reform	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							
Pre-reform (Abs)	2107.8	0	976.5	8.2	3092.5	835.2	
With LS (Δ)	-31.9	0	18	0.2	-13.7	-110.8	97.0
Without LS (Δ)	-8.8	0	19.4	0.2	10.8	-120.6	131.4
Total							
With LS (Δ)	-99.4	0.7	50.4	147.8	99.5	-3275.8	3375.3
Without LS (Δ)	-7.5	-1.9	61.5	147.8	199.9	-3412.1	3612.0

Note: Δ denotes the absolute change

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.

Table 10: Gini coefficients by Income unit type

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

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.[11] 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 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.

[11] The inequality measures use the sample weights, so that they apply to population aggregates rather than simply the individuals in the sample.

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 GST are shown in the second block of Table 11. As expected, they are closer to those in Table 3.

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 (hrs)	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 (hrs)	0.12	0.13	0.10	0.33	0.45

7.2 Working for families 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 Working for Families scheme remain unchanged. The unchanged component includes the work tested in-work tax credit 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 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.

Table 12: Labour supply effects of Working for Families changes

Behavioural Response	Couples with children		Sole
	Men	Women	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 (hrs)	0.00	-0.01	0.00

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 unemployment benefit 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.

Table 13: Labour supply effects of benefit changes

Behavioural Response	Married Men	Married Women	Single Men	Single Women	Sole Parents
Non-work to work transition (ppt)	0.00	0.01	0.00	0.00	0.03
Work to non-work transition (ppt)	0.06	0.06	0.04	0.26	0.22
Workers working more (ppt)	0.01	0.00	0.00	0.00	0.00
Workers working less (ppt)	0.02	0.01	0.00	0.06	0.22
Average hours change (hrs)	-0.03	-0.02	-0.02	-0.11	-0.12

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 per cent. 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 GST. The switch from income tax towards 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 Household Economic Survey 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 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). 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 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 affects 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.

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