Estimation of Labour Supply in New Zealand

Joseph Mercante and Penny Mok

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Abstract

In this paper we estimate labour supply using a discrete choice approach for single men, single women and single parents and a joint labour supply equation for couples in New Zealand. The data are based on pooled cross-sectional data from the Household Economic Survey over 2006/07 to 2010/11. We allow singles to choose from eleven discrete hours whilst couples choose from 66 combined working hour choices. Net incomes at all possible discrete working-hours are calculated using Treasury's TAXWELL microsimulation model. For non-workers, net incomes are estimated based on an imputed wage. In order to fit the model to the observed working hour distribution we include a fixed cost of working parameter and we explicitly take account of observed and unobserved heterogeneity in the data. We find that the coefficient estimates of the labour supply equations mostly accord with expectations and are reasonably comparable with previously estimated equations for New Zealand. Using the equations we find that the labour supply predictions fit the observed data reasonably well. However, despite the inclusion of a fixed cost of working parameter, the peak working hours of around 40 hours per week in the observed data is under-predicted by the models, while part-time hours of work remain over-predicted. We compute labour supply elasticities from the estimated parameters which show that single parents and single women are the most responsive, whilst partnered men and single men are the least responsive.

JEL CLASSIFICATION C25
J22

KEYWORDS labour supply; discrete choice; random utility; multinomial logit.

Executive Summary

The purpose of this paper is to estimate labour supply for New Zealand based on the Household Economic Survey (HES) from 2006/07 to 2010/11. This paper updates previous estimates by Kalb and Scutella (2003) based on data from 1991/92 to 2000/01.

Over the decade since the last labour supply estimates, important changes have occurred in the New Zealand labour market including the increasing education of the workforce and the reduction in the gender earnings disparities over time which had created a positive environment for women to participate in the labour market. The labour supply equations estimated in this paper incorporate the recent economic changes and are used as the basis of Treasury's TAXMOD-B behavioural microsimulation model, used to predict labour supply responses to tax and transfer policy changes.

In this paper, we estimate discrete choice labour supply models separately for couples, single men and women and single parents. We allow singles to choose from eleven discrete hours whilst couples choose from 66 combined working hour choices. The net incomes for all possible discrete working hours are obtained from Treasury's TAXWELL microsimulation model. The net incomes for non-workers are calculated based on imputed wages.

The labour supply models assume a quadratic preference function, and depend on individual and household characteristics to allow for heterogeneity in preferences among households. In order to fit the model to the observed working hour distribution, we also include a fixed cost of working parameter and allow for unobserved heterogeneity in the models.

Our results largely accord with the earlier estimates by Kalb and Scutella (2003). The preference for work is significantly higher for partnered women with higher education, lower for those with more children, and lower for those with a youngest child between 0 and 3 years of age. The impact of children is not significant for partnered men.

The preference for work for single men seems to be slightly different from single women. However when we take account of single men living with parents we found that their preference for work is also higher with higher education levels.

The preference for work for single parents has been increasing over time, and is lower for single parents with more children. Single parents living with their parents tend to increase their preferences for work, indicating the possibility of obtaining childcare from their parents. This finding corroborates past research, though the effect is not significant.

We used the estimated parameters to produce confidence intervals for expected labour supply and the probability of working at the different discrete hours for the different demographic groups. The average expected labour supply predicted from the models are close to the observed averages and the confidence intervals around the expected values are reasonably narrow for most groups.

Despite the inclusion of a fixed cost of working parameter, the peak working hours of around 40 hours per week in the observed data remains under-predicted by the models and part-time hours of work over-predicted.

We calculate implicit labour supply elasticities, which show that single parents and single women are the most responsive to changes in wages and non-labour incomes, while single and partnered men to be the least responsive. Married women are fairly responsive as well, however their own wage elasticity estimate is likely to be higher than that reported in this paper.

This paper is the second from the suite of papers emerging from NZ Treasury's behavioural microsimulation modelling project. The first paper estimated wage equations used to impute wage rates (see Mercante and Mok, 2014). The third paper will describe the labour supply responses to selected tax and benefit policies in New Zealand. Together, the papers will offer substantive evidence on labour supply responses to tax and benefit policy changes in New Zealand.

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Estimation of Labour Supply in New Zealand

1 Introduction

The aim of this paper is to estimate the preference equations for hours of work and income for four demographic groups of the New Zealand population. The groups are couples[1], single men, single women and single parents. The parameters of these preference equations are principally used in Treasury's behavioural microsimulation model, (TAXMOD-B).[2] This model predicts labour supply responses to policy changes and is useful when assessing policy changes because many policy changes (for example, changes in taxes or transfers) are designed with the aim of altering labour market behaviours. For the behavioural microsimulation model to produce reliable results, it is helpful that the parameters are based on the most up-to-date data.

The model in this paper draws mainly from Kalb and Scutella (2003) who estimated the parameters based on the 1991/92 to 2000/01 Household Economic Survey (HES). We estimate the preference parameters for four demographic groups in New Zealand using pooled information from the 2006/07 to 2010/11 Household Economic Survey (HES). The availability of five data sets covering a period of six years allows us to explore some of the economic changes since the models were last estimated. We estimate a model that allows for the presence of fixed costs associated with working and for observed and unobserved heterogeneity.

Given the tax and transfer systems, budget constraints are likely to be highly non-linear and complex and the model would have to cope with ranges that are non-convex and where there are the possibilities of many optimal labour supply points. We adopt the discrete choice framework pioneered by Van Soest (1995) as it offers several advantages from the estimation viewpoint, over the continuous labour supply models.[3] Restricting the number of working hours to a limited set of discrete values allows for the complexity of the tax and transfer system which is crucial for policy consideration. It also avoids the problems with endogeneity between the net wage and hours worked which are present when a standard labour supply function is applied. In addition, estimation involves direct utility functions, which is relatively straightforward and can be allowed to depend on individual characteristics.

The other advantage of the discrete choice approach in labour supply is that it considers decision makers choosing between discrete hour levels, and given the 'lumpiness' of

1 Throughout this paper the terms married men (husbands) and women (wives) refer to partnered men and women regardless of whether they are married legally or *de facto*.

2 For the TAXMOD-B model we use a slightly modified model than that presented in this paper, which is presented in Appendix A. Essentially, the parameters used in TAXMOD-B exclude the year trend and unemployment rate. However, the parameter estimates and implied wage and non-labour income elasticities for the alternative model are very similar to the estimates presented in this paper.

3 Some examples of continuous hours labour supply models with complex budget sets are by Hausman (1979) and Moffitt (1986).

hours choices, this seems to be closer to reality than choosing exact working hours (and minutes). Our discussion focuses primarily on the multinomial logit specification in the discrete choice model. We also extend our analyses in predicting the hours of work for workers using the estimated parameters.

This is the second paper of a suite of papers from the behavioural microsimulation modelling project aimed at updating TAXMOD-B. The first paper, Mercante and Mok (2014), estimated wage rates for those who are currently not working (non-workers). The observed and imputed wage rates were used to calculate the net incomes at a range of discrete labour supply levels, which are a crucial input for this paper. The third paper will describe the labour supply responses to selected tax and benefit policies in New Zealand using TAXMOD-B. Together, the papers will offer substantive evidence on labour supply responses to tax and benefit policy changes in New Zealand.

Section 2 describes the economic model and econometric methodology to estimate the preference functions. Section 3 briefly describes the data. The estimates of the preference parameters are reported in Section 4. In this section, we further present the predicted labour supply using the estimated parameters. The last section concludes.

2 Economic Model and Econometric Specification

In this section we describe the theoretical model adopted to analyse labour supply. We describe assumptions we make about the treatment of wages for non-workers and in relation to the take-up of welfare benefits.

2.1 Utility maximisation

We adopt a neo-classical utility maximisation approach to analyse household labour supply.[4] In this approach an individual maximises his/her utility subject to a budget constraint. Utility is determined by the individual's choice between two goods, consumption and leisure. Leisure is defined as time spent not engaged in paid employment. It includes time spent in production of household goods (childcare, meals, cleaning etc) and more 'pure' leisure activities (time watching television, eating at a restaurant, going to a concert or sporting event etc). Consumption is defined as expenditure of income, whether this is earned from employment, investments or from government transfers. Our model considers a single time period and therefore we assume that all income is consumed. There is a trade-off between leisure and consumption: more leisure time means less time for work and less income for consumption. However, the choice is constrained by the amount of income. The individual chooses a combination of leisure (or equivalently time engaged in work) and income that gives them the greatest utility.

For couple households, we assume that a single utility is maximised and that there is a single budget constraint. Only the leisure (or work time) and incomes of husbands and wives are considered. This is a unitary model of labour supply. This is not the only possible configuration. For example, there may be some bargaining over income and how this is spent. Also, each member of a couple may be maximising their separate utilities. Leisure includes both time spent in the home production of goods and in 'pure' leisure. Couple households are heterogeneous. For example, the traditional household of husband specialising in market work and the wife specialising in domestic work is less of a norm now than in earlier time periods. Women's participation in the paid workforce has increased over time and varies with life-cycle stage. Today there are many households where the wife is the principal earner (27% of couple households in our study) or households where there is a more equal sharing of both paid employment and domestic work. In this study we treat all households as homogeneous with a single utility function and single budget, and we estimate one model for all couples.

[4] The framework used in this paper largely draws on Kalb and Scutella (2003).

A simple model of labour supply for couple households is for husbands and wives to simultaneously maximise a joint utility (*U*) and for husbands and wives choosing between the amount of joint consumption (which is equivalent to total household income), *x* and leisure of the husband l_1 and wife l_2.[5] The model is as follows:

$$
\begin{aligned}
&\max U(x, l_1, l_2) \\
&\text{subject to:} \\
&l_1 + h_1 = T \\
&l_2 + h_2 = T \\
&\text{where } h_1, h_2 \text{ chosen from a discrete set } (h_1, h_2) \in A \times B \\
&x = w_1 h_1 + w_2 h_2 + y_1 + y_2 + B(c, w_1 h_1 + w_2 h_2 + y_1 + y_2) \\
&\quad - \tau(B(c, w_1 h_1 + w_2 h_2 + y_1 + y_2), w_1 h_1 + w_2 h_2 + y_1 + y_2)
\end{aligned}
\tag{1}
$$

where *x* is consumption, that is, a composite of all goods and services consumed by the household which we assume equals to net (or disposable) weekly household income. h_1 and h_2 are hours of work per week of husbands and wives and is the total time available (*T*) minus leisure time l_1 or l_2. h_1 and h_2 are chosen from a discrete set of hours where *A* is the set of m_1 labour supply choices for the husband and *B* the set of m_2 labour supply choices for the wife.

y_1 and y_2 are non-labour income of the husband and wife. The wage rates for the husband and wife are w_1 and w_2. *B(.)* is the amount of transfers given a person's characteristics *c* and gross income. τ(.) is the tax function.

The first constraint means that hours of work h_1 and h_2 and leisure l_1 and l_2 are restricted by the total available time per week. The second constraint means that the total amount of consumption *x* equals total net income received from employment, other non-labour income and transfers.

In this formulation, we assume that utility increases with the consumption of any one of the goods, that is, marginal utility with respect to each good is positive and marginal utilities are diminishing with more consumption of each good.

The model presented involves household choices over the amount of hours of work to supply. People choose desired hours to maximise their household utility. It ignores the demand side of the labour market. To estimate the model we assume that desired hours of work is equivalent to observed hours of work which is what is reported in our micro data. However, desired hours are not the same as observed hours. For example, there may be labour market constraints (labour demand constraints) that restrict the amount of jobs available (unemployment), as well as institutional constraints on the number of hours of work that could be available for workers (underemployment). It would be interesting to analyse desired hours of work and allow for the labour market demand and institutional constraints. However, in this paper, our focus is on the observed hours of work as this is the only information available in the data.

2.2 Random utility

Working hours of husbands and wives in equation (1) is taken from a given set of discrete hour points $(h_1, h_2) \in A \times B$. If *A* is the set of m_1 labour supply choices for the husband and *B* the set of m_2 labour supply choices for the wife, then the couple household faces $m = m_1 m_2$ possible working-hour choices. We use the subscript *j* to represent any one of

[5] The utility framework for single households is the same as for couples with the only difference that utility depends on income and labour supply of one individual only.

the (h_1,h_2)={(0,0),...(m_1,m_2)} choices. For the moment we suppress subscript *i* representing *i={1,2,...N}* couple households. For any working-hour choice *j,* the household utility can be represented by a random utility model.

$$U_j^* = U_j + \varepsilon_j \quad \forall \mathrm{j} \tag{2}$$

U_j^* is the utility of the household at choice *j*.[6] It is made up of a deterministic part U_j depending on observable factors and a random part ε_j which is unobserved. Of all the possible *m* choices alternative *j* will be chosen if it results in the highest utility compared to all the other choices. Therefore the probability that option *j* hours will be chosen is:

$$\begin{aligned} p_j = \Pr(\{h_1,h_2\} = j) &= \Pr(U_j^* \geq U_k^*) \ \forall \mathrm{k} \neq j \\ &= \Pr(\varepsilon_k - \varepsilon_j \leq \mathrm{U_j - U_k}) \end{aligned} \tag{3}$$

Assuming that ε_j are independently and identically distributed extreme value with density and cumulative distributions

$$\begin{aligned} f(\varepsilon_j) &= e^{-\varepsilon_j} e^{-e^{-\varepsilon_j}} \\ F(\varepsilon_j) &= \Pr(\varepsilon < \varepsilon_j) = e^{-e^{-\varepsilon_j}} \end{aligned} \tag{4}$$

The difference between the error terms $\varepsilon_k - \varepsilon_j$ follows a logistic distribution. The probability of the couple choosing the *j* hours combination follows a multinomial logit model

$$p_j = \frac{e^{U_j}}{\sum_{k=1}^{m} e^{U_k}} \tag{5}$$

The multinomial logit model is widely used to model discrete choices. Its principal assumption is that the unobservable random terms ε_j are uncorrelated over alternative choices.[7]

2.3 Estimation

Define *z* as an indicator of the observed labour supply of a couple as follows:

$$z_j = \begin{cases} 1 \text{ if j=observed working-hour choice} \\ 0 \text{ otherwise} \end{cases} \tag{6}$$

The probability of the couple's labour supply for choice *j* is p_j. Generalising, the probability of the couple's observed labour supply is $\prod_{j=1}^{m} (p_j)^{z_j}$.

Over all couples *i*, and given that couples' labour supply choices are independent, the probability of each couple choosing their observed labour supply is given by the product of the probabilities of each couple's observed choice

$$L = \prod_{i=1}^{N} \left(\prod_{j=1}^{m} (p_{i,j})^{z_{i,j}} \right) \tag{7}$$

6 Much of this derivation is taken from Train (2009) and Cameron and Trivedi (2005).

7 This is the assumption of the independence of irrelevant alternatives (IIA).

This is the likelihood function. Given that *U* is some (non-linear) function of explanatory variables *x* and coefficients *β* (that is *U=f(x, β))* then maximum likelihood can be used to estimate the coefficient vector *β* that maximises the log likelihood function

$$\mathrm{L}(\beta)=\ln \mathrm{L}=\sum_{i=1}^{\mathrm{N}}\sum_{j=1}^{m} z_{i,j}\ln(p_{i,j}) \tag{8}$$

Here each $p_{i,j}$ is defined by (5). Substituting for $p_{i,j}$ gives

$$\mathrm{L}(\beta)=\ln \mathrm{L}=\sum_{i=1}^{\mathrm{N}}\sum_{j=1}^{m} z_{i,j}\left\{U_j-\ln\sum_{k=1}^{m} e^{U_k}\right\} \tag{9}$$

The derivation for singles is synonymous except the choice set is $(h_1)\in A$ for *m* possible labour supply choices.

The choice set for partnered men is $h_1\in\{0,10,20,30,40,50\}$ hours per week and for partnered women is $h_2\in\{0,5,10,15,20,25,30,35,40,45,50\}$ hours per week, giving the choice set for couples $(h_1,h_2)\in\{(0,0),(0,5),(0,10)...(10,0),(10,5),(10,10)...(50,50)\}$ for a total of 66 discrete choices. For single men, single women and single parents the choice set is $h\in\{0,5,10,15,20,25,30,35,40,45,50\}$ for a total of 11 choices.

2.4 Specification of utility functions

We follow the same approach as in Kalb and Scutella (2003) in their choice of a quadratic specification for the utility functions. A quadratic functional form allows for leisure and consumption to be substitutes or complements and for couple households the form allows leisure between partners to be substitutes or complements. Although flexible, the quadratic utility function is not guaranteed to be quasi-concave. As described in Van Soest (1995), quasi-concavity can be checked after the model is estimated.

Specifying the model using hours of work rather than leisure, the utility equation for couples is given by

$$\begin{aligned}U(x,h_1,h_2)=\beta_x(x-\gamma_1-\gamma_2)+\beta_1h_1+\beta_2h_2+\alpha_{xx}(x-\gamma_1-\gamma_2)^2+\alpha_{11}(h_1)^2+\alpha_{22}(h_2)^2\\+\alpha_{x1}(x-\gamma_1-\gamma_2)h_1+\alpha_{x2}(x-\gamma_1-\gamma_2)h_2+\alpha_{12}h_1h_2\end{aligned} \tag{10}$$

We have *x* representing income (or consumption) and h_1 and h_2 are the husband's and wife's hours of work. The *α, β* and *γ* are parameters to be estimated by maximum likelihood.

As found by Van Soest (1995) a basic model of labour supply over-estimates part-time working hours. In addition, Kalb and Scutella (2003) also reported that non-participation was under-estimated. One way to account for this problem is to include a "cost of working" parameter *γ* (one for each partner) which is subtracted from income. The estimated values of the parameter would be such that the "costs" of part-time hours would make part-time hours less likely to be chosen than would otherwise be the case without the inclusion of the parameter. We subtract an amount representing the "cost of work" from income as in Kalb and Scutella (2003), though an alternative is to subtract directly from utility as in Van Soest (1995). The *γ* parameters are zero for a partner who is observed to be a non-worker.

From (10) the marginal utility of income U_x is expected to be positive and decreasing. The marginal utilities of work of both partners U_1 and U_2 are also expected to be decreasing.

The marginal utility of the husband's work with respect to the wife's work could be positive (leisure of partners are complements) or negative (leisure of partners are substitutes).

The parameters to be estimated are made dependent on various characteristics. In this way observed heterogeneity can be introduced into the model. In this model the linear parameters β_1, β_2, β_x, γ_1 and γ_2 are dependent on characteristics. For example, β_x can be represented as $\beta_x = \beta_{x0} + \beta_{x1} * kids$ where *kids* is the number of children. The characteristics used as regressors are listed in Table 2 and Table 3, which present the coefficient estimates.

The ε_j in equation (2) represents the random component in the utilities for each alternative choice of working hours. It cannot be interpreted as random preferences (or unobserved heterogeneity between households) resulting from unobserved household and individual characteristics (Van Soest, 1995). For this reason, random preferences need to be incorporated explicitly. We use the same method described in Van Soest (1995) also used by Kalb and Scutella (2003).

The equations for singles and single parent households are similar to those of couples.[8]

2.5 Expected labour supply

From the multinomial logit model it is straightforward to obtain probabilities at each discrete hour point. These are given by equation (5). The equation is fairly generic and we rewrite it for the specific case of couples. The estimated probability $\hat{p}$ of a couple choosing combination (h_1, h_2) of labour supply can be calculated from the estimated parameters. It is given by

$$\hat{p}(h_1, h_2) = \frac{e^{\hat{U}(x(h_1,h_2),h_1,h_2)}}{\sum_{\text{all } h_1,h_2} e^{\hat{U}(x(h_1,h_2),h_1,h_2)}} \tag{11}$$

The expected hours of work can then be calculated from

$$\hat{E}(h_1) = \sum_{h_1}\left(\sum_{h_2}\hat{p}(h_1,h_2)h_1\right) \text{ and } \hat{E}(h_2) = \sum_{h_2}\left(\sum_{h_1}\hat{p}(h_1,h_2)h_2\right) \tag{12}$$

Finally, the expected hours of working conditional on working can be calculated from

$$\hat{E}(h_1 \mid h_1 > 0) = \frac{\hat{E}(h_1)}{\Pr(h_1 > 0)} = \frac{\hat{E}(h_1)}{1 - \sum_{h_2}\hat{p}(h_1 = 0, h_2)}, \hat{E}(h_2 \mid h_2 > 0) = \frac{\hat{E}(h_2)}{1 - \sum_{h_1}\hat{p}(h_1, h_2 = 0)} \tag{13}$$

Similar equations can be derived for singles.

[8] For singles the utility equation is $U(x, h_1) = \beta_x(x - \gamma_1) + \beta_1 h_1 + \alpha_{xx}(x - \gamma_1)^2 + \alpha_{11}(h_1)^2 + \alpha_{x1}(x - \gamma_1)h_1$

2.6 Unobserved wages

The budget constraints in the labour supply model (1) require knowledge of the hourly wage rates of individuals. For workers these are observed. However they are unobserved for non-workers.

For non-workers we require the offered wage if they were to enter employment. We impute wages using wage equations that correct for potential sample selection bias. We estimate wage equations separately for partnered men, partnered women, single men, single women and single parents. For partnered men, single women and single parents a sample selection model was used to estimate wages for non-workers. For single men and partnered women a linear regression model was used. Further details of the wage imputation method are in Mercante and Mok (2014). Alternative methods to impute wages of non-workers are to simultaneously estimate wages and labour supply as in Keane and Moffitt (1998) or to estimate wage equations taking account of wage prediction errors as in Van Soest (1995).

2.7 Take-up of benefits

At zero or low hours of work, we assume a 100% take-up of welfare benefits if the individual is eligible. This assumption is required to enable the calculation of labour supply responses. However, this is not necessarily true as for example, stigma associated with benefit receipt may dissuade some people from claiming benefits. Incomplete take-up is more likely for types of benefits which have low benefit values – people may simply not claim because the amounts are too small and the effort required is too great. One example is Accommodation Supplement (AS). Accommodation Supplement is a supplement for renters (depending on rent paid) and home-owners (depending on mortgage repayments) who face high housing costs. The AS entitlement amounts also depend on the region of residence. For people who are currently receiving government benefits, the assignment of AS is calculated by the Ministry of Social Development (MSD). For people who are not beneficiaries, but are within the AS income bands, they may not take-up the benefit as the amount may be small or they are unaware of AS. In contrast, welfare program participation has been modelled jointly with labour supply by Keane and Moffitt (1998) for the US and by Kalb (2000) for Australia.

In this paper we have assumed that all persons (except single parents) for whom labour supply is modelled, are eligible for Unemployment Benefits (UB). Single parents are eligible for Domestic Purpose Benefit (DPB). The income-test rules are then applied to calculate actual benefit levels.

3 Data

The data used are taken from the HES. The HES is produced by Statistics New Zealand (SNZ) and is conducted every year. Every 3 years HES collects detailed information on household expenditures and incomes and a range of demographic variables. Every other year, HES only collects income and demographic information. Households are interviewed throughout the year and the quarter of interview is recorded. On average, the sample is around 8,000 individuals in each survey year over the period 2006/07 to 2010/11.

Sample selection

We pooled the data of the HES in 2006/07, 2007/08, 2008/09, 2009/10 and 2010/11 with a total sample size of 39,670. The sample is subdivided into four population groups (couples, single men, single women and single parents). Our dataset has 10,143 singles (one-adult) families and 9,548 couple (two-adult) families.

Some couples and individuals are omitted from the estimation sample. Utility equations are modelled for the working age population (aged 16 to 64 inclusive); that is persons who are not on disability or sickness benefits, are not retired and are not full-time students. In addition, we do not model labour supply for persons engaged in any self-employment activity. We also omit dependants. Finally, we omit observations where the observed wage rates are unrealistically small or large (less than 50% of the minimum wage relevant for the given period[9] or more than $150 per hour), where wage or hours of work information is contradictory, and/or where industry or educational qualification information are missing. We omit a couple household if at least one member of the couple falls into one of these categories.

Our final sample size consists of 4,995 couples, 2,177 single men, 2,000 single women and 1,199 single parents.

Net incomes

Estimating utility equations using a discrete choice approach requires net income information at all possible discrete labour supply points. For each labour supply equation (couples, single men, single women and single parents), we estimate net incomes over the possible labour supply points using Treasury's TAXWELL microsimulation model. TAXWELL is a tax-transfer model which applies the tax and benefit rules applicable for a given year. Net income information is based on income of all non-dependents in the family. Net income is based on individuals' observed earned and unearned income. For non-workers, earned income is calculated by imputing a wage rate for them as discussed in Mercante and Mok (2014). When pooling the data we adjust net incomes to the December 2011 level using the Consumer Price Index (CPI) to make them comparable across the different HES datasets.[10] We omit couples and singles who have disposable incomes less than zero and higher than $5,000 per week.

Family types

We follow the previous study by Kalb and Scutella (2003) distinguishing between men/husbands and women/wives in order to account for the different effects of children, age and education for each partner.

[9] Minimum wage information is from the Ministry of Business, Innovation and Employment (MBIE) 2012.

[10] CPI data are from Statistics New Zealand (SNZ), 2006-2012.

From our TAXWELL sample, we are able to distinguish between principal and secondary earners. 73% of principal earners are male. A principal earner is defined as the partner either earning or working the most in the couple family. As we are aware that couples are likely to be heterogeneous in their composition, it would be interesting to include the information on principal and secondary earners to explore their impacts on the couples' behaviour. Also, there may be large differences between couples with children and couples without children that may warrant separate modelling. In future we hope to explore alternative labour supply models that take these heterogeneities into account.

For singles we estimate separate equations for men and women. Single women appear to be a slightly more educated group than single men. We model them separately in keeping with Kalb and Scutella (2003). Over 86% of our single parent sample were women so we did not estimate separate models for male single parents, however we included an indicator variable for sex to take account of differences in preferences for work between male and female single parents.

Sample means

The descriptions of all variables and the sample means of each variable are shown in

Table 1. The majority are dummy variables with a value of 0 or 1. For example, *noqual* has a value of 1 if the person has less than school completion and a value of 0 if otherwise. A person is considered to participate in work if they are currently working positive hours to earn salary and wage income. Non-workers are considered as a single group and we do not distinguish between persons who are classified as unemployed and those persons classified as not in the labour force.

We include variables for the age and presence of children as we would expect these to influence the preferences to work particularly of partnered women and single parents. For the age of children we include variables for the age of the youngest child. From Table A.1 in the appendix we see that the negative impact of children on labour supply (the employment rate and average weekly working hours) mainly affects partnered women and single parents. The presence of children, in particular children of a young age means that these women (most single parents are women) are more likely to stay home to look after their children. Partnered men's labour supply is slightly higher with the presence of children, though unchanged in relation to the ages of children.

We include quadratic variables in age to take into account the changes in preferences of work over the life-cycle. Evidence suggests that older and younger persons have higher preferences for leisure. In addition we include a dummy variable for people 60 years and above. Older persons close to retirement age may have lower preferences for work compared to the rest of the work-force. In our sample employment rates tend to increase with age then decrease for the older age groups (see Table A.1 in the appendix).

We have several dummy variables for education. From the point of view of investment in human capital, we expect persons with higher educational qualifications to have higher preferences for work than those with lower qualifications. In our sample, individuals with higher qualifications (university or postgraduate) are more likely to be employed (see Table A.1 in the appendix).

Tenure variables include an indicator of whether a person is living with parents. This is only relevant to singles and single parents. Singles living with their parents may have lower preferences for income (and work) compared to those that do not because living costs are expected to be lower as their parents are more likely to support them financially. This is more pronounced for single men. Amongst those single men who are living with their parents, those who have tertiary education or higher tend to have higher employment

rates and hours of work than those with lower education level. We would expect that single parents living with their parents may have higher preferences for work from the point of view of parents providing childcare. Interestingly, our sample shows that single parents have a lower employment rate if they live with their parents (see Table A.1 in the appendix).[11] However, the preference to work for single parents living with their parents is positive though not statistically significant once we control for other variables in our model (see Table 3).

For persons who are in couple relationships, partner variables are included as these may be relevant in determining preferences for work between the adults in couple families. We also include variables for geographic region which on the one hand may pick up the different job opportunities and on the other hand different costs of working between urban and rural areas. As a rough approximation we take living in Auckland and Wellington to be "urban" and the rest of the country as "non-urban". However from our sample, there is no obvious difference in employment rates between these two categories.

Finally we include the unemployment rate based on quarterly data separately for males and females. This is included to take into account impacts on labour demand from business cycles, particularly the impact of the global financial crisis in 2008 and 2009. We also include a time trend to capture any changing patterns of labour supply over the 5 years of the HES.

Observed working-hours distributions

Table 1 shows the employment rates to be highest for partnered men, and lowest for partnered women and single parents (who are mostly women). Average working hours of workers are also highest for partnered men and lowest for partnered women and single parents. This is primarily due to the higher prevalence of part-time working hours for the latter two groups as indicated in the working hour distributions shown in Figure 1, 2 and 3. Partnered men, on the other hand work predominantly full-time at 40 hours or more.

Single men tend to have lower employment rates than partnered men, and of those who work, single men are more likely to work part-time hours. On the other hand, single women are more likely to work full-time than partnered women or single parents.

In comparison to the previous study by Kalb and Scutella (2003), the employment rates have increased for all demographic groups with the largest increase observed for single parents and single women. This indicates that a larger proportion of individuals are actively participating in the workforce. The high rate of employment could be explained by the overall increase in education attainment over the years and are observed in the HES data (see Mercante and Mok, 2014).

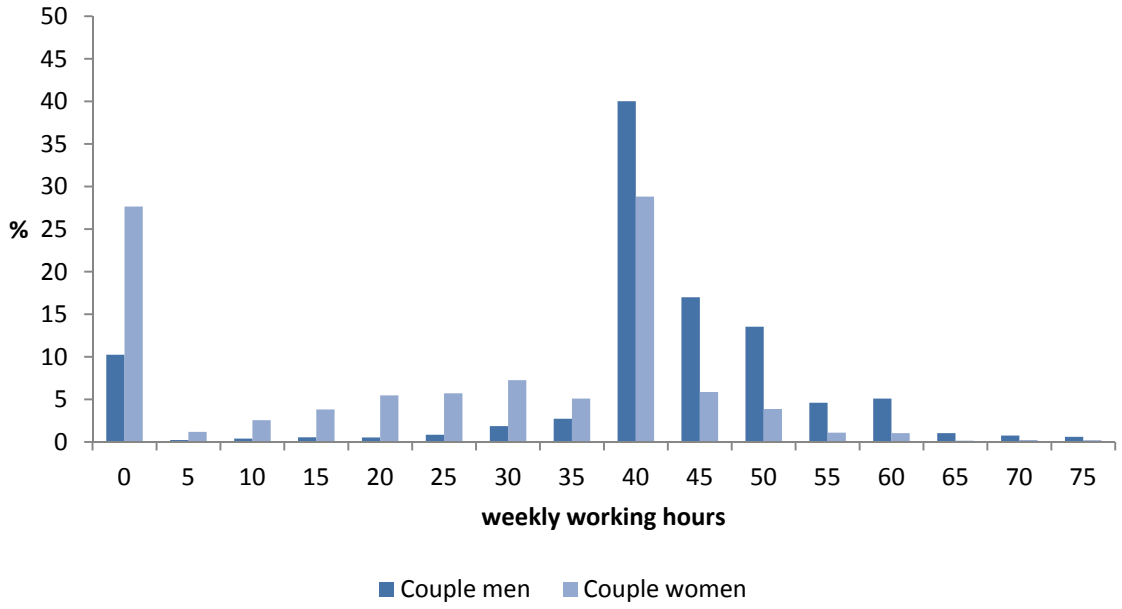
[11] There could be a selection issue here – single parents could be living with parents due to financial reasons (for example if they are not working) and thus this could conceal the otherwise positive impact on employment by living with parents (in terms of the provision of childcare).

Table 1 – Summary statistics and variable descriptions

		Partnered men	Partnered women	Single men	Single women	Single parents
No. observations		4995	4995	2177	2000	1199
No. employed		4483	3628	1810	1664	663
Employment rate %		90	73	83	83	55
with children		91	65	-	-	-
without children		88	82	-	-	-
Average hours worked for workers (hours per week)		41.9	33.9	41.2	37.9	32.9
Average wage (workers) $ per hour (1)		30.6	22.2	21.3	21.4	22.5
Average predicted wage (non-workers) $ per hour (1)		18.4	19.5	20.1	13.1	11.4
Variable	Description	Sample mean				
female	female	-	-	-	-	0.862
age10	age/10	4.330	4.101	3.410	3.855	3.740
age60p	age>=60	0.095	0.043	0.051	0.102	0.003
kids	number of children	1.901	1.901	-	-	1.710
ageychild	age of youngest child	2.983	2.983	-	-	7.776
ageyk0	age of youngest child is 0 years	0.082	0.082	-	-	0.066
ageyk1_3	age of youngest child is 1 to 3 years	0.142	0.142	-	-	0.212
ageyk4_5	age of youngest child is 4 to 5 years	0.052	0.052	-	-	0.109
ageyk6_9	age of youngest child is 6 to 9 years	0.093	0.093	-	-	0.220
ageykg9	age of youngest child is over 9 years	0.169	0.169	-	-	0.393
noqual	less than school qualification	0.135	0.123	0.168	0.134	0.199
cert	completed school	0.278	0.361	0.384	0.362	0.413
voc_tr	bursary, diploma (including vocational)	0.314	0.207	0.224	0.20	0.203
bach	bachelor, post-graduate and other degree	0.272	0.309	0.224	0.305	0.185
nn_isl	Northern North Island	0.135	0.135	0.123	0.123	0.167
auckl	Auckland	0.272	0.272	0.281	0.292	0.298
cn_isl	Central North Island	0.109	0.109	0.104	0.099	0.125
well	Wellington	0.168	0.168	0.169	0.173	0.137
cant	Canterbury	0.163	0.163	0.178	0.181	0.158
sth_isl	South Island	0.154	0.154	0.144	0.133	0.115
un_rate	unemployment rate	5.066	5.428	5.001	5.438	5.285
unprt	partner unemployment rate	5.428	5.066	-	-	-
yr	year trend	3.656	3.656	3.597	3.670	3.586
livewp	lives with parents	-	-	0.285	0.201	0.064

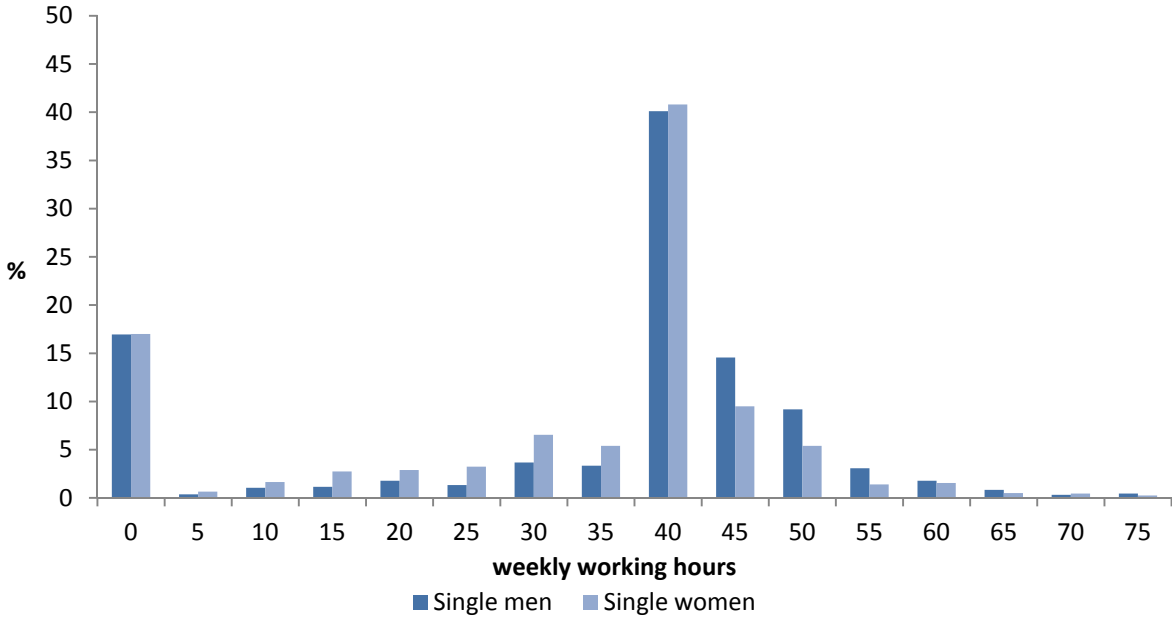
Note: (1) Observed and predicted wage rates are adjusted by AWE to December quarter 2011.

Figure 1 – Observed working hour distribution of partnered men and women



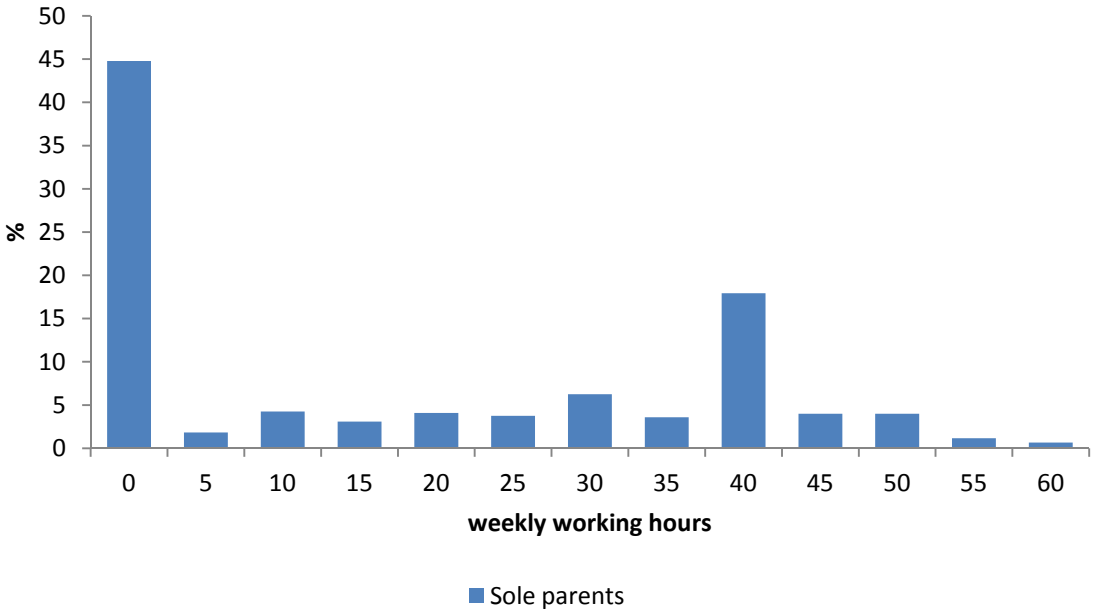
Note: Working hour categories are: 0<=hours<2.5, 2.5<=hours<7.5 etc. The final category is hours>=72.5. The distribution is based on the un-weighted sample.

Figure 2 – Observed working hour distribution of single men and women



Note: Working hour categories are: 0<=hours<2.5, 2.5<=hours<7.5 etc. The final category is hours>=72.5.

Figure 3 – Observed working hour distributions of single parents



Note: Working hour categories are: 0<=hours<2.5, 2.5<=hours<7.5 etc.

4 Results

In this section, we look at the main empirical results. Our results are set out in three sections. In the first section we examine the coefficients for the labour supply models. Next we consider the marginal effects as a way of understanding the implications of the coefficient estimates. Finally we consider the goodness of fit of the model in predicting the observed labour supply.

4.1 Estimated parameters

The parameter estimates of the labour supply equation for couples and singles are shown in Table 2 and 3 respectively. The parameters are organised into quadratic, cross-product and linear terms.

Quadratic and cross-product terms

For most groups, the signs of the coefficients produced are consistent with the theory.

The marginal utility of work for couples is decreasing with hours of work since $\frac{\partial^2 U}{\partial h_1^2} = 2\alpha_{11} = -1.638 < 0$ and $\frac{\partial^2 U}{\partial h_2^2} = 2\alpha_{22} = -0.548 < 0$.

The marginal utility of the husband's (or wife's) labour supply with respect to the wife's (or husband's) labour supply is given by the cross-product term $\frac{\partial^2 U}{\partial h_1 \partial h_2} = \frac{\partial^2 U}{\partial h_2 \partial h_1} = \alpha_{12} = -0.113 < 0$. This suggests that the marginal utility of work of one partner decreases as the other partner increases labour supply – that is, leisure between partners are substitutes. Kalb and Scutella (2003) noted that a negative cross-product term as we have found does not necessarily mean that the net effect of an increase in one partner's labour supply gives a reduced labour supply of the other partner as this is only one factor determining the net labour supply effect of the other partner's labour supply.

The marginal utility of work for couples decreases as income increases since $\frac{\partial^2 U}{\partial h_1 \partial x} = 2\alpha_{x1} = -0.269 < 0$ and $\frac{\partial^2 U}{\partial h_2 \partial x} = 2\alpha_{x2} = -0.121 < 0$, as expected. As income increases, the marginal utility one gets from working decreases.

As we expect, the marginal utility of income is decreasing since $\frac{\partial^2 U}{\partial x^2} = 2\alpha_{xx} = -0.006 < 0$ however it is insignificant.

Table 2 – Estimated parameters of the utility function: Couples

	Coefficients	Std errors	
Quadratic terms			
income * 100,000 (α_{xx})	-0.0031	0.0020	
Labour supply husband * 100 (α_{11})	-0.8192	0.0157	**
Labour supply wife * 100 (α_{22})	-0.274	0.0130	**
Cross-product terms			
Income*Labour supply husband*10,000 (α_{x1})	-0.2692	0.0272	**
Income*Labour supply wife*10,000 (α_{x2})	-0.1210	0.0149	**
Labour supply husband*Labour supply wife*100 (α_{12})	-0.1126	0.0088	**
Linear terms			
*Income*100* (β_x)			
constant	0.4407	0.0193	**
number children	-0.0049	0.0023	**
Labour supply husband (β_1)			
constant	0.5852	0.0223	**
youngest child <1 year (2)	-0.0006	0.0051	
youngest child 1 to 3 years	-0.0016	0.0043	
youngest child 4 to 5 years	-0.0035	0.0056	
youngest child 6 to 9 years	0.0061	0.0047	
number of children	0.0005	0.0018	
age/10	0.0259	0.0093	**
(age/10)^2	-0.0039	0.0011	**
vocational education (3)	0.0013	0.0034	
school certificate	-0.0012	0.0035	
bachelor degree	-0.0074	0.0038	*
partner's education (3)			
vocational education	-0.0027	0.0038	
school certificate	-0.0017	0.0035	
bachelor degree	-0.0020	0.0039	
year time trend	0.0010	0.0016	
unemployment rate (% pa) (1)	-0.0031	0.0018	*
aged 60 or over	-0.0075	0.0050	
Labour supply wife (β_2)			
constant	0.1772	0.0177	**
youngest child <1 year (2)	-0.0569	0.0067	**
youngest child 1 to 3 years	-0.0592	0.0048	**
youngest child 4 to 5 years	-0.0458	0.0064	**
youngest child 6 to 9 years	-0.0357	0.0053	**
number of children	-0.0069	0.0012	**
age/10	0.0207	0.0077	**
(age/10)^2	-0.0039	0.0010	**
vocational education (3)	0.0110	0.0034	**
school certificate	0.0061	0.0030	**
bachelor degree	0.0146	0.0034	**
partner's education (3)			
vocational education	-0.005	0.0031	

	Coefficients	Std errors	
school certificate	-0.0016	0.0032	
bachelor degree	-0.0160	0.0034	**
year time trend	0.0015	0.0015	
unemployment rate (% pa) (1)	-0.0025	0.0016	
aged 60 or over	-0.0100	0.0054	*
Fixed costs husband/100 (γ_1)			
constant	32.5541	1.7682	**
Fixed costs wife/100 (γ_2)			
constant	12.2533	0.7154	**
youngest child <1 year	1.8741	0.7229	**
youngest child 1 to 3 years	-0.8395	0.4985	*
youngest child 4 to 5 years	-2.0153	0.7299	**
youngest child 6 to 9 years	-2.2298	0.5985	**
lives in Auckland or Wellington	0.7090	0.2252	**
Sample size	4995		
Log-likelihood	-15850		
Percent correctly predicted (husband)	40.8		
Percent correctly predicted (wife)	21.2		

Notes: Significance levels: * 10%, ** 5%.

(1) annual unemployment rate on a quarterly basis

(2) reference is no children or children 10 years and over

(3) reference is no education

Table 3 – Estimated parameters of the utility function: Single men, women and parents

	Single men			Single women			Single parents		
	Coefficient	Std errors		Coefficient	Std errors		Coefficient	Std errors	
Quadratic terms									
income^2 * 100,000 (α_{xx})	0.0088	0.0088		-0.2052	0.0488	**	-0.3961	0.0925	**
Labour supply^2 * 100 (α_{11})	-0.4072	0.0479	**	-0.3610	0.0324	**	-0.2833	0.0378	**
Cross-product terms									
Income*Labour supply*10,000 (α_{x1})	-0.0642	0.1283		-1.1691	0.1898	**	-0.0006	0.1989	
Linear terms									
*Income*100* (β_x)									
constant	0.1213	0.0550	**	1.424	0.3238	**	2.6361	0.7649	**
youngest child <1 year (2)							-0.1066	0.4537	
youngest child 1 to 3 years							-0.0700	0.4871	
youngest child 4 to 5 years							-0.0263	0.3575	
youngest child 6 to 9 years							-0.3026	0.3383	
number of children							-0.0083	0.0491	
age/10	0.0414	0.0182	**	0.3063	0.1392	**	-0.2327	0.4356	
(age/10)^2	-0.0037	0.0021	*	-0.0403	0.0171	**	0.0209	0.0548	
vocational education (3)	-0.0110	0.0112		-0.2270	0.0885	**	-0.1548	0.1727	
school certificate	-0.0167	0.0109		-0.1709	0.0759	**	-0.1160	0.1494	
bachelor degree	-0.0277	0.0121	**	-0.1856	0.0875	**	-0.3151	0.1843	*
lives with parents	0.0074	0.0225		-0.1938	0.0715	**			
Interaction terms									
livewp_age	-0.0067	0.0071							
livewp*cert	0.0167	0.0162							
livewp*voc	-0.0034	0.0195							
livewp*bac	0.0193	0.0196							
male							0.1534	0.5869	
Labour supply (β_1)									
constant	0.2366	0.0811	**	0.1411	0.0253	**	0.0579	0.0431	
youngest child <1 year (2)							-0.0543	0.0475	
youngest child 1 to 3 years							-0.0343	0.0384	
youngest child 4 to 5 years							-0.0280	0.0271	
youngest child 6 to 9 years							0.0077	0.0237	
number of children							-0.0058	0.0035	*
age/10	0.0720	0.0163	**	0.0370	0.0105	**	0.0275	0.0185	
(age/10)^2	-0.0082	0.0021	**	-0.0051	0.0014	**	-0.0038	0.0024	
vocational education (3)	-0.0034	0.0113		0.0076	0.0056		0.0069	0.0069	
school certificate	-0.0213	0.0108	**	0.0053	0.0047		0.0012	0.0063	
bachelor degree	-0.0271	0.0115	**	0.0098	0.0058	*	-0.0030	0.0081	
male							0.0660	0.0504	
year time trend							0.0070	0.0031	**
unemployment rate (% pa) (1)	-0.0054	0.0011	**	-0.0046	0.0012	**	-0.0074	0.0034	**
aged 60 or over	-0.0085	0.0075		-0.0019	0.0081		-0.0074	0.0290	
lives with parents	-0.0325	0.0249					0.0050	0.0091	

	Single men			Single women			Single parents		
	Coefficient	Std errors		Coefficient	Std errors		Coefficient	Std errors	
Interaction terms									
livewp_age	-0.0060	0.0074							
livewp*cert	0.0484	0.0175	**						
livewp*voc	0.0122	0.0218							
livewp*bac	0.0392	0.0220	*						
Fixed costs /100 (γ_1)									
constant	48.9138	13.4435	**	3.0718	0.3282	**	2.3941	0.4534	**
youngest child <1 year							0.2589	0.9384	
youngest child 1 to 3 years							0.2208	0.9736	
youngest child 4 to 5 years							-0.0332	0.6672	
youngest child 6 to 9 years							0.8666	0.9564	
lives in Auckld or Wellington	3.7012	1.5859	**	0.4693	0.1097	**	0.3737	0.0922	**
male							1.3142	1.6326	
Unobserved heterogeneity terms									
Variance of income	-0.0034	0.0021		-0.0035	0.0192		0.0137	0.0207	
Variance of labour supply	-0.0010	0.0010		-0.0009	0.0006		0.0004	0.0010	
Variance of fixed costs	0.2489	0.1948		-0.0297	0.0166	*	-0.0072	0.0129	
Covariance income & labour supply	-0.0014	0.0018		0.0004	0.0015		-0.0028	0.0016	*
Covariance income & fixed costs	1.3084	0.7564	*	0.0453	0.0567		-0.0734	0.0421	*
Covariance labour supply & fx costs	-0.5008	0.4521		-0.0262	0.0202		0.0006	0.0225	
Sample size	2177			2000			1199		
Log-likelihood	-4116			-3798			-1899		
Percent correctly predicted	18			20			37		

Notes: Significance levels: * 10%, ** 5%.

(1) annual unemployment rate on a quarterly basis

(2) reference is children 10 years and over

(3) reference is no education

For singles and single parents the marginal utility of work is decreasing with hours of work as predicted by theory since $\frac{\partial^2 U}{\partial h_1^2} = 2\alpha_{11}$ = -0.814, -0.722, -0.567 for single men, single women and single parents respectively. The marginal utility of income is decreasing with income since $\frac{\partial^2 U}{\partial x^2} = 2\alpha_{xx} =$ -0.41 and -0.792 for single women and single parents respectively. For single men it has a positive sign of 0.018, though it is not statistically significant.

Linear terms

The linear terms in hours of work for couples show how various characteristics impact on the preferences for working of each partner. In general, the size of the constant terms in β_1 and β_2 indicate that partnered men's' preferences for work are higher than partnered women – which we expected given the higher employment rate of partnered men.

The preference for work of partnered men and women follows an inverted "U" shape - first it increases with age and then decreases. The turning points are 33 and 27 years of age for men and women respectively. Preferences for work are therefore lowest for younger and older couples. We also added an additional dummy variable for people close to retirement age (aged 60 or over); however this was only significant for partnered women.

The age and number of dependent children was found to significantly reduce the preferences for working of partnered women, and preferences for work are lowest for women with children between 0 and 5 years, and for partnered women with more children. The impact of children is not significant for partnered men. As in the model by Kalb and Scutella (2003), we consider the number of children (to proxy for household size) in the preferences for income and/or consumption for couples. Household size seems to reduce significantly the preferences for income and/or consumption.

For partnered women the preferences for work are higher for women with educational qualifications, compared to having no qualifications. The impact is highest for those who have tertiary qualifications. For partnered men, the only category that is just significant is tertiary education where preferences for working are significantly lower than for partnered men not having any qualification. Historically men have enjoyed high employment rates regardless of their level of educational attainment. Interestingly, this result is different to the one by Kalb and Scutella (2003) where most educational categories were found to be significant.

For partnered women, having a university-educated husband has a negative effect on the wife's preferences for work. The effect is slightly larger than the effect of the wife's own education on preferences for work. So the more educated the husband, the greater the negative impact on the wife's preferences for working. A similar, but much smaller effect is observed for partnered men, though the effect of the wife's education is not significant.

The higher the unemployment rate, the lower the preferences for work, and this is probably due to the discouraged worker effect and/or involuntary unemployment. This effect is only significant for partnered men. The coefficient of the year time trend shows that, controlling for unemployment, preferences for work have increased over the period 2006 to 2011, however this trend is not significant.

For one-adult households, the preference for work also increases with age and then decreases. The turning points are 44, 36 and 36 years of age for single men, women and single parents respectively. Higher education increases the preferences to work for single women and to a certain extent single parents as well. However, this is not true for single

men. However, further investigation showed significant interaction effects between living with parents and education levels for single men. This indicates that educated single men who live with their parents have a higher preference for work than others. The preference for income is significantly lower when a single female lives with her parents, but not for single males. Living with parents did not have a significant effect for single parents.[12]

Over the period of the pooled data, the negative impact of unemployment is significant for all one-adult households. In addition, the time trend is significant for single parents, indicating an increase in the preference for work over time.

Consistent with the previous study by Kalb and Scutella (2003), the number of children reduces significantly the preferences for work in single parents. This is also true for partnered women. Although the preferences for work for single parents is lower as they have more children, we found that the effects of the age of the youngest child on preferences for work are not significant. The preferences for work for single male parents are higher than for females, however it is not a significant result. For single parents, preferences for work are higher if they live with their parents. This could be because of the increased possibility of obtaining childcare. However the effect is not significant.

In relation to preferences for income/consumption, the results show that preferences for income are mostly not significantly dependent on any of the given characteristics, except for single women.

Fixed costs of working

Inevitably, there are fixed costs associated with working, irrespective of the number of hours worked. These are difficult to estimate in view of data limitations. We estimate the fixed cost parameters to include pecuniary and non-pecuniary costs of working (such as transport, childcare). The parameters are measured in dollars per week. Costs of working are only applicable for positive discrete hours of work.

Fixed costs of working parameters also picks up the lack of people working part time. They are used to lessen the problem of over-predicting part-time working hours and under-predicting non-participation in these types of labour supply models. Thus, we will observe a relatively larger fixed cost for those who are least likely to work part time. We found that including the fixed costs of working parameter improved the fit of the model in terms of the proportion of predicted labour supply that matched the observed labour supply and in terms of the predicted working hour distribution.

The parameter values in Tables 2 and 3 are fairly high and are higher for partnered men than partnered women. The cost to income is likely to be higher for partnered men because of the lower incidence of working part-time hours compared to partnered women. However, as noted by Kalb and Scutella (2003), there may be other issues at work here, for example the lack of part-time hours could be a labour demand rather than a labour supply issue. Generally, when looking at the characteristics affecting fixed costs of working of partnered women, characteristics usually associated with a higher probability of part-time work give a smaller predicted fixed cost. For example, having a youngest child of 6 to 9 years of age reduces fixed costs by the most amount – indicating that the 'penalty' for part-time work is smaller since these women have a fairly high incidence of part-time work compared to the sub-group with a youngest child less than 1 year.[13]

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12 The lack of significance in the result could be due to the small sample size of 77 single parents who live with parents.

13 Partnered women with older children have higher employment rates and of those employed substantial proportions work part-time (except those with age of the youngest children greater than 9 years). This shows that the group with older children have a higher incidence of working part-time hours and therefore the penalty for part-time work need not be as great, meaning the fixed costs are smaller.

For single parents, the fixed costs are smaller than for the other groups in keeping with the relatively high part-time employment share of this group. In relation to how fixed costs vary by characteristic, we found that these are mostly insignificant.

Generally fixed costs are lower for partnered women, single women and single parents; that is, groups which have higher part-time employment shares. This gives some support to the above-mentioned discussion on fixed costs reflecting some sort of penalty for part-time work choices for groups with low incidence of part-time work. Kalb and Scutella (2003) find further evidence of the part-time nature of work being partly involved in fixed costs by using an alternative specification of fixed costs that directly estimates the contribution to fixed costs at various observed working-hour categories.

Unobserved heterogeneity

Unobserved heterogeneity was added to linear labour supply, income and fixed costs preference parameters. This was done by adding a normally distributed error term to the parameters as described in Kalb and Scutella (2003) and Van Soest (1995). For singles and single parents, variance and co-variance terms were estimated. Only few of these terms are significant at 10% level of significance. When including unobserved heterogeneity terms for couples we found that the models failed to converge and hence in

Table 1 we only report the model without controlling for unobserved heterogeneity. Both Kalb and Scutella (2003) and Van Soest (1995) found unobserved heterogeneity to be statistically insignificant.

Quasi-concavity

According to Van Soest (1995), imposing quasi-concavity conditions on the utility function a priori is not essential in discrete choice labour supply models unlike in continuous labour supply models. Quasi-concavity can easily be checked after estimation. For quasi-concavity, utility U must increase with income y and the indifference curve needs to be convex. Our estimated equations satisfied both conditions and were found to be quasi-concave for very close to 100% of the sample.

4.2 Marginal effects and labour supply predictions

Another way of interpreting the results of the estimated models is to look at the effect on labour supply by changing one characteristic at a time. In Table 4, we estimate the probability of working predicted by the utility equations using equation (11). We can interpret this as a prediction of the employment rate of the population group in question. In Table 5 we calculate the expected hours of work using equation (13). We can interpret this as the average working hours of workers. The results for these two tables are obtained by changing one characteristic at a time, while all other characteristics remain as observed in the data.

For example, the first row of Table 4 shows the predicted probability of working (or equivalently the employment rate) at the observed characteristics of the data. The predicted probability of working is calculated at the individual's characteristic except for the characteristic being analysed. The fourth row keeps characteristics the same, except everyone is given bachelor and post-graduate qualifications (whether they have or don't have a bachelor and postgraduate qualification), and the other education variables are set to false or zero. The fifth row gives everyone no qualifications. For continuous variables, like age, all variables are unchanged and only age is increased by 10% for all observations. This way we can assess the impact of each characteristic on labour supply.

In comparison to the previous study by Kalb and Scutella (2003), the most obvious difference would be the higher probability of working and expected hours of work for all groups in our current study. This is consistent with the higher employment rate observed in our data (Table 1). However, our results are generally consistent with the previous estimates. The results show that for partnered women and single parents, having an additional child reduces the probability of working for partnered women and single parents compared to not having a child. Having a child aged between 1 to 3 years old also reduces both the probability of working and the expected working hours compared to not having a child aged less than 9 years. Conversely, having a young child has little impact on partnered men's labour supply.

Educational attainment is more important for women and single parents than for men. Having educational qualifications makes a large difference in the probability of working, thus higher qualifications gives higher employment rates. Similar to the previous findings, the effect of partner's education is more pronounced for partnered women than men. However educational attainment hardly affects the expected working hours. Overall, male single parents are predicted to have a slightly lower probability of working but higher working hours than female single parents.[14]

Single men not living with parents are more likely to work and have higher expected working hours compared to those living with parents. Further investigation shows that the effect is more pronounced for single men who have higher qualifications. Interestingly, the effect is less pronounced for single women and single parents.

We also simulate the impact of an increase in wages and non-labour incomes. The wage elasticitiy is based on a 10% increase in wage rates for all individuals whereas the income elasticity is based on a 10% increase in non-labour income and is calculated for persons with positive non-labour incomes.[15] This gives us an indication of the relative responsiveness of labour supply to a change in wages and incomes for each population group. The average wage elasticities implied by the effect are 0.16, 0.39, 0.10, 0.61 and

[14] However note that when we divide our single parent sample into subgroups by gender, male single parents have higher predicted probability of working compared to female single parents, with 66% and 54% respectively (see Table 6). Male single parents also have higher working hours than females in our restricted sample.

[15] In our sample, households who have non-labour incomes range from 31-47% across all groups.

1.07 for partnered men, partnered women, single men, single women and single parents respectively. Single parents are the most responsive to an increase in the wage rate followed by single women and partnered women. Single and partnered men are the least responsive. However, note that for couples these are not the true own wage elasticities as they were simulated by increasing both partners' wage rates, and so include cross-wage effects. Thus the own wage elasticities for partnered men and women are expected to be a little higher than the ones shown here.[16]

The income elasticities are negative and accord with what we expect. Most subgroups are not responsive to an increase in the non-labour incomes, with almost no response for single men and married women.

Table 4 – Predicted probability of working

	Partnered men	Partnered women	Single men	Single women	Single parents
whole sample (1)					
average for all persons	0.90	0.72	0.83	0.83	0.56
youngest child 1-3 years	0.87	0.52	-	-	0.45
no child <9 years	0.91	0.82	-	-	0.66
bachelor and postgraduate qualification	0.87	0.75	0.85	0.85	0.58
no qualification	0.91	0.68	0.82	0.79	0.53
partner bachelor & postgraduate qualification	0.90	0.67	-	-	-
partner no qualification	0.90	0.76	-	-	-
male	-	-	-	-	0.51
female	-	-	-	-	0.56
age increase by 10%	0.87	0.68	0.80	0.82	0.55
partner age increase by 10%	0.89	0.72	-	-	-
one extra child	0.91	0.70	-	-	0.53
has no child	0.89	0.74	-	-	0.60
lives with parents	-	-	0.62	0.85	0.58
does not live with parents	-	-	0.88	0.83	0.55
livewp_bac			0.90		
livewp_no edu			0.79		

Notes:

(1) The predicted probability of working is calculated at the individual's characteristic except for the characteristic being analysed. For example, for "postgraduate", this variable is changed to true for all observations (whether they have or don't have a postgraduate qualification), and the other education variables are set to false. Non-education variables are unchanged. For continuous variables, like age, all variables are unchanged and only age is increased by 10% for all observations.

[16] We also calculated the elasticities using the alternative specification for TAXMOD-B and the elasticities are similar to the ones reported in this paper (see Tables A.2 and A.3).

Table 5 – Predicted expected hours of work of workers

	Partnered men	Partnered women	Single men	Single women	Single parents
whole sample (1)					
average for all persons	41.8	32.9	40.2	36.4	28.8
youngest child 1-3 years	42.1	28.1	-	-	26.3
no child <9 years	41.7	35.1	-	-	30.5
postgraduate qualification	41.7	33.5	39.3	36.5	27.2
no qualification	41.9	31.9	41.3	37.3	29.6
partner postgraduate qualification	41.8	31.8	-	-	-
partner no qualification	42.0	33.6	-	-	-
male	-	-	-	-	36.4
female	-	-	-	-	27.6
age increase by 10%	41.6	32.0	40.3	35.7	28.4
partner age increase by 10%	41.9	33.0	-	-	-
one extra child	41.9	32.0	-	-	28.1
has no child	41.8	33.5	-	-	-
lives with parents	-	-	38.7	34.9	29.3
does not live with parents	-	-	40.8	36.7	28.7
livewp_bac	-	-	42.5	-	-
livewp_no edu	-	-	39.4	-	-

Notes:

(1) The expected hours of work of workers are the expected hours of work conditional on a positive probability of working. It is the expected hours divided by the probability of working. It is calculated at the individual's characteristic except for the characteristic being analysed. For example, for "postgraduate", this variable is changed to true for all observations (whether they have or don't have a postgraduate qualification), and the other education variables are set to false. Non-education variables are unchanged. For continuous variables, like age, all variables are unchanged and only age is increased by 10% for all observations.

4.3 Goodness of fit

This section investigates how well the estimated utility equations fit the underlying data. One measure of the goodness of fit is the percentage correctly predicted as shown at the bottom rows of Tables 2 and 3. They represent how well the predicted labour supply matches the observed labour supply for the individuals in each subgroup. From these results, individual estimates do not seem to reflect the observed data very accurately.

Another measure of the goodness of fit is to see how well the models reproduce the underlying distributions of working hours. Figures B.1 and 2 in Appendix B compare the predicted working-hour distribution and the actual working hour distribution over the various discrete hours of work for all subgroups. We estimate the predicted distribution by calculating the probability of being at each hour point using equation (11). The predicted distribution is based on the average probability at each hour point averaged over the whole sample.[17] The figures show that the working-hour distributions follow the observed distribution quite well. However, for all models the peak (or mode) working-hours around 40 hours per week is under-predicted and working-hour categories just below and above the peak (or mode) are over-predicted.[18] At the other end, the lowest working-hour categories are slightly under-predicted.[19]

We also look at how well the equations predict labour supply for particular sub-groups of people. In Table 6 we compare the actual and predicted probability of working using equation (11). In Table 7 we compare the actual and predicted expected working hours using equation (13). Overall, the actual and predicted values are very close. Confidence intervals of the results are shown in Tables A.9 to A.13 in the appendix. Those tables show that observed values are mostly within the 90% confidence interval of the predictions at an aggregate level. The tables also show that confidence intervals are fairly narrow, except for single men where they are relatively wider, reflecting the prediction error in estimating the parameters. In the earlier study by Kalb and Scutella (2003), a wider confidence interval was observed for single parents, especially at the lower hour distribution.

[17] An alternative would be to use a stochastic approach and draw from the distribution of error terms and calculate the resulting utilities at all hour points. Then a probability distribution of optimal hour points can be established, from which the working hour distribution over all individuals can be calculated by averaging the probability of being at each hour point over all observations.

[18] Similar under-prediction at 40 hours of work was also reported by Van Soest (1995). Some studies have directly incorporated restrictions on choices of jobs and hours of work into modelling to better account for these peaks. One example is by Dickens and Lundberg (1993). Another recent application is by Dadgvik and Jia (2012).

[19] This can be seen from Appendix A Tables A.4 to A.8 which report 90% confidence intervals for the predicted working-hour distributions. The confidence intervals are obtained from the distribution of the estimated parameters of the utility equations for each population group. We draw 1000 parameter estimates using the parameter variances and covariances. For each draw we compute the predicted probability at each discrete hour. We then take the 5th and 95th percentile of these estimates for the lower and upper bound of the confidence interval.

Table 6 – Actual and predicted probability of working for subgroups

	Partnered men		Partnered women		Single men		Single women		Single parents	
	Act	Pred	Act	Pred	Act	Pred	Act	Pred	Act	Pred
whole sample	0.90	0.90	0.72	0.72	0.83	0.83	0.83	0.83	0.55	0.56
kids	0.91	0.91	0.64	0.64	-	-	-	-	-	-
no kids	0.88	0.88	0.82	0.82	-	-	-	-	-	-
age<30	0.92	0.90	0.68	0.71	0.84	0.84	0.83	0.82	0.33	0.31
30<=age<50	0.92	0.93	0.71	0.71	0.87	0.87	0.88	0.89	0.61	0.62
50<=age<60	0.89	0.89	0.80	0.79	0.79	0.79	0.82	0.82	0.72	0.72
age>=60	0.74	0.73	0.67	0.67	0.63	0.61	0.70	0.71	0.50	0.50
no qualification	0.85	0.86	0.64	0.65	0.75	0.75	0.68	0.67	0.37	0.38
vocational	0.91	0.91	0.75	0.74	0.86	0.86	0.86	0.86	0.67	0.67
certificate	0.90	0.89	0.70	0.70	0.83	0.82	0.82	0.82	0.51	0.50
bachelor & postgraduate	0.91	0.91	0.77	0.78	0.87	0.86	0.89	0.90	0.72	0.74
capital city	0.89	0.91	0.71	0.71	0.81	0.81	0.82	0.82	0.52	0.52
not capital city	0.90	0.89	0.73	0.73	0.85	0.84	0.84	0.84	0.58	0.58
age youngest kid 0	0.91	0.90	0.36	0.37	-	-	-	-	0.23	0.23
age youngest kid 1 to 3	0.91	0.91	0.53	0.54	-	-	-	-	0.34	0.36
age youngest kid 4 to 5	0.90	0.91	0.67	0.67	-	-	-	-	0.50	0.51
age youngest kid 6 to 9	0.92	0.94	0.72	0.72	-	-	-	-	0.55	0.55
age partner<30	0.91	0.91	0.68	0.71	-	-	-	-	-	-
30<=age partner<50	0.92	0.93	0.73	0.72	-	-	-	-	-	-
50<=age partner<60	0.86	0.85	0.78	0.77	-	-	-	-	-	-
age partner>=60	0.73	0.72	0.57	0.56	-	-	-	-	-	-
partner no qualification	0.85	0.86	0.72	0.72	-	-	-	-	-	-
partner vocational	0.90	0.90	0.75	0.74	-	-	-	-	-	-
partner certificate	0.90	0.90	0.72	0.72	-	-	-	-	-	-
partner bachelor & post-grad	0.91	0.91	0.70	0.71	-	-	-	-	-	-
male	-	-	-	-	-	-	-	-	0.65	0.66
female	-	-	-	-	-	-	-	-	0.54	0.54
one child	-	-	-	-	-	-	-	-	0.60	0.59
two or more children	-	-	-	-	-	-	-	-	0.50	0.51
lives with parents	-	-	-	-	0.78	0.78	0.82	0.84	0.38	0.38
does not live with parents	-	-	-	-	0.85	0.85	0.83	0.83	0.56	0.57

Table 7 – Actual and predicted expected hours of work of workers for subgroups

	Partnered men		Partnered women		Single men		Single women		Single parents	
	Act	Pred	Act	Pred	Act	Pred	Act	Pred	Act	Pred
whole sample	42.0	41.8	33.9	32.9	40.3	40.2	37.2	36.4	32.3	28.8
kids	42.4	42.1	31.0	30.5	-	-	-	-	-	-
no kids	41.4	41.6	36.6	35.6	-	-	-	-	-	-
age<30	41.6	41.9	37.0	33.6	39.1	38.9	36.2	35.9	25.1	23.5
30<=age<50	42.2	42.2	33.2	32.1	41.4	41.6	39.4	38.9	33.0	30.0
50<=age<60	42.1	41.6	34.3	34.3	42.1	41.7	37.1	35.8	35.9	33.0
age>=60	40.3	40.5	32.7	33.1	39.7	40.5	33.8	32.3	35.0	29.8
no qualification	42.3	41.6	32.9	31.5	40.7	40.4	35.6	34.9	30.0	26.3
vocational	42.1	41.9	33.9	33.2	41.1	41.0	37.2	36.4	34.1	31.7
certificate	41.7	41.8	33.0	32.2	39.8	39.7	36.3	35.8	30.5	27.3
bachelor & postgraduate	41.9	41.9	35.3	34.0	40.1	40.0	38.6	37.7	34.5	31.3
capital city	41.7	42.0	35.2	33.0	39.9	40.2	37.9	37.0	34.5	29.2
not capital city	42.2	41.8	32.9	32.8	40.6	40.2	36.5	35.9	30.7	28.4
age youngest kid 0	41.8	42.3	30.7	28.9	-	-	-	-	25.0	20.3
age youngest kid 1 to 3	42.1	42.3	29.3	28.1	-	-	-	-	28.9	24.0
age youngest kid 4 to 5	42.2	42.0	29.7	29.0	-	-	-	-	28.5	25.9
age youngest kid 6 to 9	42.9	42.3	29.9	29.6	-	-	-	-	31.1	29.6
age partner<30	41.5	42.0	36.9	33.4	-	-	-	-	-	-
30<=age partner<50	42.3	42.1	33.2	32.3	-	-	-	-	-	-
50<=age partner<60	41.7	41.3	33.8	34.2	-	-	-	-	-	-
age partner>=60	39.2	40.8	31.3	31.0	-	-	-	-	-	-
partner no qualification	42.4	41.9	33.6	33.0	-	-	-	-	-	-
partner vocational	41.7	41.8	33.7	33.1	-	-	-	-	-	-
partner certificate	42.0	42.0	34.4	33.1	-	-	-	-	-	-
partner bachelor & postgrad	41.8	41.8	33.8	32.4	-	-	-	-	-	-
male	-	-	-	-	-	-	-	-	42.0	39.6
female	-	-	-	-	-	-	-	-	30.4	27.0
one child	-	-	-	-	-	-	-	-	33.8	30.6
two or more children	-	-	-	-	-	-	-	-	30.1	26.5
lives with parents	-	-	-	-	38.6	38.4	35.1	35.2	31.2	26.1
does not live with parents	-	-	-	-	40.9	40.9	37.7	36.7	32.3	28.9

5 Conclusion

The purpose of the paper is to estimate the labour supply models for different population groups in New Zealand using the HES over the years 2006/07 to 2010/11. We update previous estimates by Kalb and Scutella (2003) who used the HES over the period 1991/92 to 2000/01. The parameters of these preference equations are principally used in Treasury's behavioural microsimulation model, TAXMOD-B. Using recent HES data, our results show a higher predicted probability of working and expected hours of work for all demographic groups than the previous study. For the behavioural microsimulation model to produce reliable results, it is helpful that the parameters are based on the most up-to-date data.

We estimate models that allow for the presence of fixed costs associated with working and for observed and unobserved heterogeneity in the preferences for labour supply. Consistent with previous studies, we found that if we add unobserved heterogeneity parameters, these are mostly statistically insignificant and do not have a significant impact on the estimated values of the other parameters.

Generally, our results are consistent with the previous estimates, with the exception of single men in terms of marginal utility of income. Interestingly, the marginal utilities of income for single men are found to be increasing with income though is not statistically significant. The age and number of dependent children are found to significantly reduce the preferences for work of partnered women, and preferences for work are lowest for partnered women with children between 0 and 5 years and for partnered women with more children. The impact of children is not significant for partnered men. For partnered women, the preferences for work parameters are higher for women with educational qualifications, compared to those having no qualifications. The impact is highest for those who are university educated.

The implied wage and income elasticities of labour supply show that single parents are the most responsive to an increase in the wage rate followed by single women and partnered women. Single and partnered men are the least responsive. The income elasticities are negative for all subgroups and accord with what we would expect.

The predicted distribution over the labour supply hours point using the point estimates of the parameters is similar to the actual distribution for most subgroups. This provides a good basis for our policy microsimulation using TAXMOD-B.

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Appendix A – Additional tables

Table A.1 – Observed employment rate (Part %) and average working hours (Av Hrs) of workers

	Partnered men		Partnered women		Single men		Single women		Single parents	
	Part %	Av Hrs	Part %	Av Hrs	Part %	Av Hrs	Part %	Av Hrs	Part %	Av Hrs
whole sample	0.90	44.1	0.73	34.5	0.83	41.2	0.83	37.9	0.55	32.9
kids	0.91	44.7	0.65	31.4	-	-	-	-	-	-
no kids	0.88	43.4	0.82	37.3	-	-	-	-	-	-
age<30	0.92	43.4	0.68	37.5	0.84	39.6	0.84	36.8	0.33	25.4
30<=age<50	0.92	44.5	0.73	33.8	0.87	42.8	0.88	40.4	0.61	33.5
50<=age<60	0.89	44.3	0.79	34.4	0.79	43.5	0.82	38.1	0.72	37.3
age>=60	0.74	42.3	0.57	31.7	0.63	40.9	0.71	34.1	0.50	34.5
no qualification	0.85	44.8	0.64	33.4	0.76	41.8	0.68	36.2	0.37	30.4
vocational	0.91	44.2	0.75	34.4	0.86	42.1	0.86	37.9	0.67	34.6
certificate	0.90	43.7	0.70	33.4	0.83	40.6	0.82	36.7	0.51	30.9
bachelor & post-grad	0.91	44.1	0.77	36.0	0.87	40.8	0.90	39.8	0.72	35.6
capital city	0.89	43.5	0.72	35.6	0.81	40.6	0.82	38.5	0.52	35.3
not capital city	0.90	44.6	0.74	33.5	0.85	41.7	0.84	37.4	0.58	31.3
age youngest kid 0	0.91	43.5	0.54	30.6	-	-	-	-	0.23	25.8
age youngest kid 1 to 3	0.91	44.4	0.68	29.5	-	-	-	-	0.34	29.2
age youngest kid 4 to 5	0.90	44.3	0.73	29.5	-	-	-	-	0.50	28.7
age youngest kid 6 to 9	0.93	45.5	0.83	30.1	-	-	-	-	0.56	31.5
age youngest kid over 9	0.91	45.2	0.83	33.6					0.73	35.6
age partner<30	0.92	43.4	0.68	37.6	-	-	-	-	-	-
30<=age partner<50	0.92	44.6	0.71	33.7	-	-	-	-	-	-
50<=age partner<60	0.86	43.9	0.80	35	-	-	-	-	-	-
age partner>=60	0.73	40.9	0.68	33.2	-	-	-	-	-	-
partner no qualification	0.85	44.9	0.72	34	-	-	-	-	-	-
partner vocational	0.90	43.7	0.75	34.2	-	-	-	-	-	-
partner certificate	0.90	44.3	0.72	35.0	-	-	-	-	-	-
partner bachelor & post-grad	0.91	43.8	0.71	34.4	-	-	-	-	-	-
male	-	-	-	-	-	-	-	-	0.66	43.4
female	-	-	-	-	-	-	-	-	0.54	30.8
one child	-	-	-	-	-	-	-	-	0.60	34.4
two or more children	-	-	-	-	-	-	-	-	0.50	30.6
lives with parents	-	-	-	-	0.78	38.9	0.82	35.7	0.38	31.6
does not live with parents	-	-	-	-	0.85	42.0	0.84	38.4	0.57	33
livewp*bachelor	-	-	-	-	0.80	40.0	-	-	-	-
livewp*noqual	-	-	-	-	0.64	36.5	-	-	-	-

Notes: These are based the sample and are unweighted

Table A.2 – Estimated parameters of the utility function (for TAXMOD-B): Couples

	Coefficients	Std errors	
Quadratic terms			
income * 100,000 (α_{xx})	-0.0031	0.0020	
Labour supply husband * 100 (α_{11})	-0.8187	0.0157	**
Labour supply wife * 100 (α_{22})	-0.2738	0.0130	**
Cross-product terms			
Income*Labour supply husband*10,000 (α_{x1})	-0.2696	0.0272	**
Income*Labour supply wife*10,000 (α_{x2})	-0.1210	0.0149	**
Labour supply husband*Labour supply wife*100 (α_{12})	-0.1129	0.0088	**
Linear terms			
*Income*100* (β_x)			
constant	0.4396	0.0193	**
number children	-0.0049	0.0023	**
Labour supply husband (β_1)			
constant	0.5732	0.0218	**
youngest child <1 year (2)	-0.0007	0.0051	
youngest child 1 to 3 years	-0.0018	0.0042	
youngest child 4 to 5 years	-0.0038	0.0056	
youngest child 6 to 9 years	0.0061	0.0047	
number of children	0.0005	0.0018	
age/10	0.0257	0.0093	**
(age/10)^2	-0.0039	0.0011	**
vocational education (3)	0.0012	0.0034	
school certificate	-0.0012	0.0034	
bachelor degree	-0.0073	0.0038	*
partner's education (3)			
vocational education	-0.0028	0.0038	
school certificate	-0.0016	0.0035	
bachelor degree	-0.0021	0.0039	
aged 60 or over	-0.0076	0.0050	
Labour supply wife (β_2)			
constant	0.1692	0.0172	**
youngest child <1 year (2)	-0.057	0.0067	**
youngest child 1 to 3 years	-0.0593	0.0048	**
youngest child 4 to 5 years	-0.0459	0.0064	**
youngest child 6 to 9 years	-0.0356	0.0053	**
number of children	-0.0069	0.0012	**
age/10	0.0205	0.0077	**
(age/10)^2	-0.0039	0.0010	**
vocational education (3)	0.0109	0.0033	**
school certificate	0.0062	0.0030	**
bachelor degree	0.0145	0.0034	**
partner's education (3)			
vocational education	-0.005	0.0031	
school certificate	-0.0015	0.0032	
bachelor degree	-0.0159	0.0034	**
aged 60 or over	-0.0103	0.0054	*

	Coefficients	Std errors	
Fixed costs husband/100 (γ_1)			
constant	32.6417	1.7728	**
Fixed costs wife/100 (γ_2)			
constant	12.2989	0.7180	**
youngest child <1 year	1.8834	0.7258	**
youngest child 1 to 3 years	-0.8436	0.4999	*
youngest child 4 to 5 years	-2.0231	0.732	**
youngest child 6 to 9 years	-2.2347	0.6007	**
lives in Auckland or Wellington	0.7089	0.2261	**
Sample size	4995		
Log-likelihood	-15860		
Percent correctly predicted (husband)	40.8		
Percent correctly predicted (wife)	21.2		
Wage elasticity (partnered men)	0.160		
Wage elasticity (partnered women)	0.380		
Income elasticity (partnered men)	-0.011		
Income elasticity (partnered women)	-0.008		

Notes: Significance levels: * 10%, ** 5%

(1) annual unemployment rate on a quarterly basis

(2) reference is no children or children 10 years and over

(3) reference is no education

Table A.3 – Estimated parameters of the utility function (for TAXMOD-B): Single men, women and parents

	Single men			Single women			Single parents		
	Coefficient	Std errors		Coefficient	Std errors		Coefficient	Std errors	
Quadratic terms									
income^2 * 100,000 (α_{xx})	0.0091	0.0102		-0.2023	0.0497	**	-0.3957	0.0925	**
Labour supply^2 * 100 (α_{11})	-0.406	0.0531	**	-0.3555	0.0323	**	-0.2827	0.0378	**
Cross-product terms									
Income*Labour supply*10,000 (α_{x1})	-0.0516	0.1907		-1.1938	0.1982	**	0.0053	0.1983	
Linear terms									
*Income*100* (β_x)									
constant	0.1194	0.0665	*	1.4417	0.3269	**	2.6088	0.7545	**
youngest child <1 year (2)							-0.1137	0.4559	
youngest child 1 to 3 years							-0.0729	0.4966	
youngest child 4 to 5 years							-0.051	0.3624	
youngest child 6 to 9 years							-0.3193	0.3397	
number of children							-0.0076	0.0492	
age/10	0.0392	0.0255		0.3000	0.1400	**	-0.2214	0.4296	
(age/10)^2	-0.0036	0.0026		-0.0397	0.0172	**	0.0195	0.0541	
vocational education (3)	-0.0099	0.0111		-0.2191	0.0885	**	-0.1545	0.1699	
school certificate	-0.0153	0.0122		-0.1676	0.0756	**	-0.1200	0.1470	
bachelor degree	-0.0258	0.0155	*	-0.1813	0.0872	**	-0.3155	0.1826	*
lives with parents	0.0078	0.0215		-0.1999	0.0717	**			
Interaction terms									
livewp_age	-0.0064	0.0074							
livewp*cert	0.015	0.0166							
livewp*voc	-0.0037	0.0185							
livewp*bac	0.0180	0.0192							
male							0.1522	0.5848	
Labour supply (β_1)									
constant	0.2128	0.1101	*	0.1124	0.0234	**	0.0452	0.0424	
youngest child <1 year (2)							-0.0541	0.0481	
youngest child 1 to 3 years							-0.0339	0.0389	
youngest child 4 to 5 years							-0.0270	0.0273	
youngest child 6 to 9 years							0.0088	0.0238	
number of children							-0.0058	0.0036	
age/10	0.0726	0.0166	**	0.0373	0.0104	**	0.0269	0.0184	
(age/10)^2	-0.0083	0.0021	**	-0.0051	0.0014	**	-0.0037	0.0023	
vocational education (3)	-0.0032	0.0114		0.0081	0.0056		0.0062	0.0069	
school certificate	-0.0210	0.0109	*	0.0061	0.0046		0.0010	0.0063	
bachelor degree	-0.0273	0.0119	**	0.0100	0.0057	*	-0.0037	0.0080	
male							0.0687	0.0503	
aged 60 or over	-0.0073	0.0073		-0.0024	0.0080		-0.0126	0.0268	
lives with parents	-0.0322	0.0251					0.0037	0.0090	
Interaction terms									
livewp_age	-0.006	0.0075							
livewp*cert	0.0479	0.0178	**						
livewp*voc	0.0119	0.0220							
livewp*bac	0.0395	0.0225	*						

	Single men			Single women			Single parents		
	Coefficient	Std errors		Coefficient	Std errors		Coefficient	Std errors	
Fixed costs /100 (γ_1)									
constant	52.3376	30.3220	*	3.0515	0.3304	**	2.3986	0.4632	**
youngest child <1 year							0.2726	0.9585	
youngest child 1 to 3 years							0.2262	0.9988	
youngest child 4 to 5 years							0.0048	0.6902	
youngest child 6 to 9 years							0.9073	0.9892	
lives in Auckld or Wellington	4.0508	2.5623		0.4654	0.1095	**	0.3757	0.0927	**
male							1.3229	1.6451	
Sample size	2177			2000			1199		
Log-likelihood	-4130			-3805			-1902		
Percent correctly predicted	18			20			37		
Wage elasticity	0.090			0.620			1.070		
Income elasticity	-0.000			-0.029			-0.042		

Notes: Significance levels: * 10%, ** 5%

(1) annual unemployment rate on a quarterly basis

(2) reference is children 10 years and over

(3) reference is no education

Table A.4 – Actual and predicted working hour distribution of partnered men (proportion of each hour category)

				Confidence interval		
Hours per week category (1)	Actual	Predicted (2)	Mean (3)	5th percentile	Median	95th percentile
0	0.103	0.102	0.101	0.092	0.101	0.109
10	0.009	0.000	0.000	0.000	0.000	0.000
20	0.015	0.007	0.007	0.006	0.007	0.007
30	0.038	0.125	0.126	0.120	0.126	0.133
40	0.564	0.455	0.455	0.447	0.455	0.464
50	0.271	0.311	0.311	0.299	0.311	0.322

Notes:

(1) Hours categories are defined as 0: 0<=hours<2.5; 10: 2.5<=hours<15; 20: 15<=hours<25; 30: 25<=hours<35; 40: 35<=hours<45; 50: hours>45.

(2) The predicted is the point estimate using estimated coefficients of the utility equation.

(3) The mean is the mean predicted labour supply using 1000 draws from the distribution of the coefficient estimates.

Table A.5 – Actual and predicted working hour distribution of partnered women (proportion of each hour category)

				Confidence interval		
Hours per week category (1)	Actual	Predicted (2)	Mean (3)	5th percentile	Median	95th percentile
0	0.277	0.276	0.275	0.264	0.275	0.285
5	0.012	0.010	0.010	0.009	0.010	0.011
10	0.027	0.020	0.020	0.018	0.020	0.022
15	0.037	0.035	0.036	0.034	0.036	0.038
20	0.059	0.057	0.057	0.055	0.057	0.059
25	0.055	0.081	0.081	0.078	0.081	0.084
30	0.072	0.103	0.103	0.100	0.103	0.106
35	0.088	0.117	0.117	0.113	0.117	0.120
40	0.253	0.117	0.117	0.114	0.117	0.119
45	0.054	0.104	0.104	0.100	0.104	0.107
50	0.065	0.082	0.082	0.076	0.082	0.087

Notes:

(1) Hours categories are defined as 0: 0<=hours<2.5; 5: 2.5<=hours<7.5; 10: 7.5<=hours<12.5; 15: 12.5<=hours<17.5; 20: 17.5<=hours<22.5; 25: 22.5<=hours<27.5; 30: 27.5<=hours<32.5; 35: 32.5<=hours<37.5; 40: 37.5<=hours<42.5; 45: 42.5<=hours<47.5; 50: hours>47.5;.

(2) The predicted is the point estimate using estimated coefficients of the utility equation.

(3) The mean is the mean predicted labour supply using 1000 draws from the distribution of the coefficient estimates.

Table A.6 – Actual and predicted working hour distribution of single men (proportion of each hour category)

				Confidence interval		
Hours per week category (1)	Actual	Predicted (2)	Mean (3)	5th percentile	Median	95th percentile
0	0.169	0.170	0.196	0.138	0.178	0.308
5	0.004	0.000	0.001	0.000	0.001	0.003
10	0.011	0.002	0.003	0.001	0.002	0.009
15	0.011	0.006	0.009	0.004	0.007	0.023
20	0.019	0.017	0.023	0.013	0.019	0.046
25	0.013	0.040	0.047	0.032	0.043	0.082
30	0.038	0.079	0.085	0.066	0.081	0.118
35	0.062	0.129	0.130	0.111	0.130	0.151
40	0.380	0.176	0.166	0.131	0.171	0.183
45	0.137	0.198	0.178	0.113	0.189	0.205
50	0.155	0.184	0.160	0.077	0.172	0.200

Notes:

(1) Hours categories are defined as 0: 0<=hours<2.5; 5: 2.5<=hours<7.5; 10: 7.5<=hours<12.5; 15: 12.5<=hours<17.5; 20: 17.5<=hours<22.5; 25: 22.5<=hours<27.5; 30: 27.5<=hours<32.5; 35: 32.5<=hours<37.5; 40: 37.5<=hours<42.5; 45: 42.5<=hours<47.5; 50: hours>47.5;.

(2) The predicted is the point estimate using estimated coefficients of the utility equation.

(3) The mean is the mean predicted labour supply using 1000 draws from the distribution of the coefficient estimates.

Table A.7 – Actual and predicted working hour distribution of single women (proportion of each hour category)

				Confidence interval		
Hours per week category (1)	Actual	Predicted (2)	Mean (3)	5th percentile	Median	95th percentile
0	0.170	0.169	0.166	0.152	0.166	0.180
5	0.007	0.004	0.005	0.003	0.005	0.007
10	0.017	0.011	0.011	0.009	0.011	0.014
15	0.028	0.020	0.021	0.018	0.020	0.024
20	0.029	0.034	0.034	0.031	0.034	0.038
25	0.032	0.058	0.059	0.055	0.059	0.063
30	0.066	0.101	0.101	0.097	0.101	0.106
35	0.115	0.152	0.153	0.146	0.153	0.159
40	0.354	0.181	0.180	0.173	0.180	0.188
45	0.089	0.162	0.161	0.155	0.161	0.167
50	0.095	0.109	0.109	0.099	0.108	0.117

Notes:

(1) Hours categories are defined as 0: 0<=hours<2.5; 5: 2.5<=hours<7.5; 10: 7.5<=hours<12.5; 15: 12.5<=hours<17.5; 20: 17.5<=hours<22.5; 25: 22.5<=hours<27.5; 30: 27.5<=hours<32.5; 35: 32.5<=hours<37.5; 40: 37.5<=hours<42.5; 45: 42.5<=hours<47.5; 50: hours>47.5;.

(2) The predicted is the point estimate using estimated coefficients of the utility equation.

(3) The mean is the mean predicted labour supply using 1000 draws from the distribution of the coefficient estimates.

Table A.8 – Actual and predicted working hour distribution of single parents (proportion of each hour category)

				Confidence interval		
Hours per week category (1)	Actual	Predicted (2)	Mean (3)	5th percentile	Median	95th percentile
0	0.448	0.445	0.400	0.332	0.409	0.444
5	0.020	0.017	0.020	0.014	0.019	0.027
10	0.042	0.032	0.037	0.029	0.036	0.048
15	0.032	0.046	0.052	0.045	0.051	0.064
20	0.043	0.053	0.059	0.052	0.058	0.070
25	0.039	0.056	0.061	0.054	0.060	0.071
30	0.058	0.060	0.064	0.058	0.064	0.074
35	0.063	0.068	0.071	0.065	0.071	0.079
40	0.153	0.074	0.077	0.072	0.077	0.084
45	0.038	0.077	0.080	0.074	0.080	0.087
50	0.064	0.073	0.078	0.068	0.077	0.089

Notes:

(1) Hours categories are defined as 0: 0<=hours<2.5; 5: 2.5<=hours<7.5; 10: 7.5<=hours<12.5; 15: 12.5<=hours<17.5; 20: 17.5<=hours<22.5; 25: 22.5<=hours<27.5; 30: 27.5<=hours<32.5; 35: 32.5<=hours<37.5; 40: 37.5<=hours<42.5; 45: 42.5<=hours<47.5; 50: hours>47.5;.

(2) The predicted is the point estimate using estimated coefficients of the utility equation.

(3) The mean is the mean predicted labour supply using 1000 draws from the distribution of the coefficient estimates.

Table A.9 – Actual and predicted hours of work of partnered men by characteristic

	Probability of working						Expected hours of workers					
				Confidence interval						Confidence interval		
Sub-sample	Act	Pred (1)	Mean (2)	5th pc	Med	95th pc	Act	Pred (1)	Mean (2)	5th pc	Med	95th pc
whole sample	0.90	0.90	0.90	0.89	0.90	0.91	42.0	41.8	41.8	41.6	41.8	42.0
kids	0.91	0.91	0.91	0.90	0.91	0.92	42.4	42.1	42.1	41.8	42.1	42.3
no kids	0.88	0.88	0.88	0.87	0.88	0.89	41.4	41.6	41.5	41.3	41.5	41.8
age<30	0.92	0.90	0.90	0.88	0.90	0.92	41.6	41.9	41.9	41.6	41.9	42.2
30<=age<50	0.92	0.93	0.93	0.92	0.93	0.94	42.2	42.2	42.1	41.9	42.1	42.3
50<=age<60	0.89	0.89	0.89	0.88	0.89	0.91	42.1	41.6	41.6	41.4	41.6	41.8
age>=60	0.74	0.73	0.73	0.70	0.73	0.76	40.3	40.5	40.4	40.1	40.4	40.8
no qualification	0.85	0.86	0.87	0.85	0.87	0.88	42.3	41.6	41.6	41.3	41.6	41.9
vocational	0.91	0.91	0.91	0.90	0.91	0.92	42.1	41.9	41.9	41.7	41.9	42.1
certificate	0.90	0.89	0.90	0.88	0.90	0.91	41.7	41.8	41.8	41.5	41.8	42.0
bachelor & post-grad	0.91	0.91	0.91	0.89	0.91	0.92	41.9	41.9	41.9	41.6	41.9	42.2
capital city	0.89	0.91	0.91	0.90	0.91	0.92	41.7	42.0	41.9	41.7	41.9	42.1
not capital city	0.90	0.89	0.89	0.88	0.89	0.90	42.2	41.8	41.7	41.5	41.7	41.9
age youngest kid 0	0.91	0.90	0.90	0.87	0.90	0.92	41.8	42.3	42.3	42.0	42.3	42.7
age youngest kid 1 to 3	0.91	0.91	0.91	0.89	0.91	0.92	42.1	42.3	42.2	41.9	42.2	42.5
age youngest kid 4 to 5	0.90	0.91	0.91	0.88	0.91	0.93	42.2	42.0	41.9	41.5	41.9	42.4
age youngest kid 6 to 9	0.92	0.94	0.94	0.92	0.94	0.95	42.9	42.3	42.3	41.9	42.3	42.7
age partner<30	0.91	0.91	0.91	0.89	0.91	0.92	41.5	42.0	42.0	41.7	42.0	42.2
30<=age partner<50	0.92	0.93	0.93	0.92	0.93	0.93	42.3	42.1	42.0	41.8	42.1	42.3
50<=age partner<60	0.86	0.85	0.86	0.84	0.86	0.87	41.7	41.3	41.3	41.1	41.3	41.5
age partner>=60	0.73	0.72	0.73	0.70	0.73	0.76	39.2	40.8	40.8	40.5	40.8	41.1
partner no qualification	0.85	0.86	0.86	0.84	0.86	0.88	42.4	41.9	41.8	41.5	41.8	42.1
partner vocational	0.90	0.90	0.90	0.89	0.90	0.91	41.7	41.8	41.8	41.5	41.8	42.0
partner certificate	0.90	0.90	0.90	0.89	0.90	0.91	42.0	42.0	41.9	41.7	41.9	42.1
partner bac &post-grad	0.91	0.91	0.91	0.90	0.91	0.92	41.8	41.8	41.7	41.5	41.7	42.0

(1) The predicted is the point estimate using estimated coefficients of the utility equation.

(2) The mean is the mean predicted labour supply using 1000 draws from the distribution of the coefficient estimates.

Table A.10 – Actual and predicted hours of work of partnered women by characteristic

	Probability of working						Expected hours of workers					
				Confidence interval						Confidence interval		
Sub-sample	Act	Pred (1)	Mean (2)	5th pc	Med	95th pc	Act	Pred (1)	Mean (2)	5th pc	Med	95th pc
whole sample	0.72	0.72	0.73	0.72	0.73	0.74	33.9	32.9	32.8	32.5	32.9	33.2
kids	0.64	0.64	0.64	0.62	0.64	0.65	31.0	30.5	30.5	30.0	30.5	30.9
no kids	0.82	0.82	0.83	0.81	0.83	0.84	36.6	35.6	35.6	35.2	35.6	36.0
age<30	0.68	0.71	0.71	0.70	0.71	0.73	37.0	33.6	33.6	33.0	33.6	34.1
30<=age<50	0.71	0.71	0.71	0.70	0.71	0.72	33.2	32.1	32.1	31.7	32.1	32.4
50<=age<60	0.80	0.79	0.79	0.77	0.79	0.80	34.3	34.3	34.2	33.8	34.2	34.6
age>=60	0.67	0.67	0.67	0.65	0.67	0.70	32.7	33.1	33.1	32.5	33.1	33.6
no qualification	0.64	0.65	0.65	0.62	0.65	0.67	32.9	31.5	31.4	30.8	31.4	32.0
vocational	0.75	0.74	0.74	0.72	0.74	0.76	33.9	33.2	33.2	32.7	33.2	33.6
certificate	0.70	0.70	0.70	0.68	0.70	0.71	33.0	32.2	32.2	31.7	32.2	32.6
bachelor & post-grad	0.77	0.78	0.78	0.77	0.78	0.79	35.3	34.0	34.0	33.6	34.0	34.4
capital city	0.71	0.71	0.71	0.70	0.71	0.73	35.2	33.0	32.9	32.6	32.9	33.3
not capital city	0.73	0.73	0.73	0.72	0.73	0.75	32.9	32.8	32.8	32.4	32.8	33.1
age youngest kid 0	0.36	0.37	0.37	0.33	0.37	0.41	30.7	28.9	28.9	27.4	28.9	30.4
age youngest kid 1 to 3	0.53	0.54	0.54	0.51	0.54	0.57	29.3	28.1	28.1	27.2	28.1	28.9
age youngest kid 4 to 5	0.67	0.67	0.68	0.63	0.68	0.72	29.7	29.0	29.0	27.7	29.0	30.3
age youngest kid 6 to 9	0.72	0.72	0.72	0.69	0.72	0.75	29.9	29.6	29.5	28.5	29.5	30.5
age partner<30	0.68	0.71	0.71	0.70	0.71	0.73	36.9	33.4	33.4	32.9	33.4	33.9
30<=age partner<50	0.73	0.72	0.72	0.71	0.72	0.74	33.2	32.3	32.3	31.9	32.3	32.7
50<=age partner<60	0.78	0.77	0.77	0.75	0.77	0.79	33.8	34.2	34.2	33.7	34.2	34.6
age partner>=60	0.57	0.56	0.56	0.51	0.56	0.61	31.3	31.0	31.0	30.0	31.0	31.9
partner no qualification	0.72	0.72	0.72	0.69	0.72	0.74	33.6	33.0	32.9	32.4	32.9	33.5
partner vocational	0.75	0.74	0.74	0.73	0.74	0.76	33.7	33.1	33.1	32.7	33.1	33.5
partner certificate	0.72	0.72	0.73	0.71	0.73	0.74	34.4	33.1	33.0	32.6	33.1	33.5
partner bac& post-grad	0.70	0.71	0.71	0.69	0.71	0.73	33.8	32.4	32.3	31.9	32.3	32.8

(1) The predicted is the point estimate using estimated coefficients of the utility equation.

(2) The mean is the mean predicted labour supply using 1000 draws from the distribution of the coefficient estimates.

Table A.11 – Actual and predicted hours of work of single men by characteristic

	Probability of working						Expected hours of workers					
				Confidence interval						Confidence interval		
Sub-sample	Act	Pred (1)	Mean (2)	5th pc	Med	95th pc	Act	Pred (1)	Mean (2)	5th pc	Med	95th pc
whole sample	0.83	0.83	0.80	0.69	0.82	0.86	40.3	40.2	39.1	35.2	39.8	40.8
age<30	0.84	0.84	0.80	0.66	0.82	0.86	39.1	38.9	37.7	33.4	38.4	39.5
30<=age<50	0.87	0.87	0.85	0.77	0.86	0.90	41.4	41.6	40.7	37.1	41.2	42.2
50<=age<60	0.79	0.79	0.77	0.67	0.78	0.85	42.1	41.7	40.8	37.4	41.4	42.4
age>=60	0.63	0.61	0.60	0.46	0.61	0.74	39.7	40.5	39.5	35.6	39.9	41.5
no qualification	0.75	0.75	0.73	0.62	0.74	0.81	40.7	40.4	39.4	35.8	39.9	41.3
vocational	0.86	0.86	0.84	0.74	0.86	0.90	41.1	41.0	40.0	36.2	40.6	41.7
certificate	0.83	0.82	0.79	0.67	0.81	0.86	39.8	39.7	38.6	34.6	39.3	40.4
bachelor & post-grad	0.87	0.86	0.84	0.72	0.86	0.90	40.1	40.0	38.9	34.8	39.5	40.7
capital city	0.81	0.81	0.78	0.64	0.80	0.85	39.9	40.2	39.0	34.9	39.7	40.7
not capital city	0.85	0.84	0.82	0.73	0.84	0.88	40.6	40.2	39.2	35.5	39.9	40.8
lives with parents	0.78	0.78	0.74	0.59	0.76	0.82	38.6	38.4	37.2	32.8	37.9	39.3
does not live with parents	0.85	0.85	0.83	0.73	0.84	0.88	40.9	40.9	39.9	36.2	40.5	41.5

(1) The predicted is the point estimate using estimated coefficients of the utility equation.

(2) The mean is the mean predicted labour supply using 1000 draws from the distribution of the coefficient estimates.

Table A.12 – Actual and predicted hours of work of single women by characteristic

	Probability of working						Expected hours of workers					
				Confidence interval						Confidence interval		
Sub-sample	Act	Pred (1)	Mean (2)	5th pc	Med	95th pc	Act	Pred (1)	Mean (2)	5th pc	Med	95th pc
whole sample	0.83	0.83	0.83	0.82	0.83	0.85	37.2	36.4	36.3	35.9	36.3	36.7
age<30	0.83	0.82	0.83	0.81	0.83	0.85	36.2	35.9	35.9	35.2	35.9	36.5
30<=age<50	0.88	0.89	0.90	0.88	0.90	0.91	39.4	38.9	38.8	38.2	38.8	39.4
50<=age<60	0.82	0.82	0.82	0.80	0.82	0.85	37.1	35.8	35.8	35.1	35.8	36.4
age>=60	0.70	0.71	0.72	0.67	0.72	0.75	33.8	32.3	32.2	30.9	32.2	33.3
no qualification	0.68	0.67	0.68	0.63	0.68	0.72	35.6	34.9	34.8	33.6	34.8	36.0
vocational	0.86	0.86	0.86	0.84	0.86	0.89	37.2	36.4	36.3	35.5	36.3	37.1
certificate	0.82	0.82	0.82	0.80	0.82	0.84	36.3	35.8	35.8	35.1	35.8	36.4
bachelor & post-grad	0.89	0.90	0.90	0.88	0.90	0.92	38.6	37.7	37.6	36.9	37.6	38.2
capital city	0.82	0.82	0.82	0.81	0.82	0.84	37.9	37.0	36.9	36.5	36.9	37.3
not capital city	0.84	0.84	0.84	0.83	0.84	0.86	36.5	35.9	35.8	35.3	35.8	36.3
lives with parents	0.82	0.84	0.84	0.82	0.84	0.86	35.1	35.2	35.1	34.0	35.1	36.0
does not live with parents	0.83	0.83	0.83	0.82	0.83	0.85	37.7	36.7	36.6	36.2	36.6	37.0

(1) The predicted is the point estimate using estimated coefficients of the utility equation.

(2) The mean is the mean predicted labour supply using 1000 draws from the distribution of the coefficient estimates.

Table A.13 – Actual and predicted hours of work of single parents by characteristic

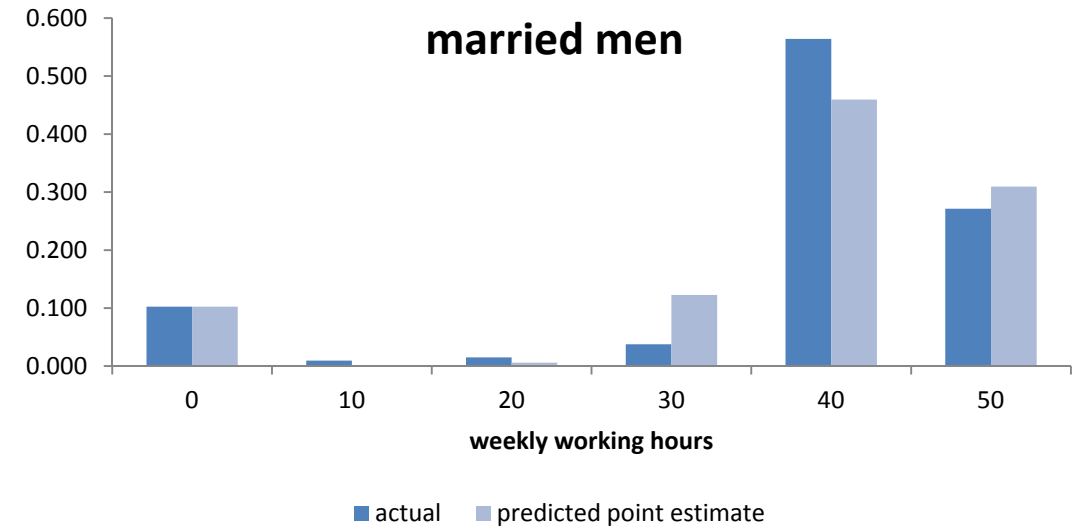
	Probability of working						Expected hours of workers					
				Confidence interval						Confidence interval		
Sub-sample	Act	Pred (1)	Mean (2)	5th pc	Med	95th pc	Act	Pred (1)	Mean (2)	5th pc	Med	95th pc
whole sample	0.55	0.56	0.60	0.56	0.59	0.67	32.3	28.8	28.7	27.9	28.7	29.6
age<30	0.33	0.31	0.36	0.30	0.35	0.46	25.1	23.5	23.6	21.9	23.6	25.5
30<=age<50	0.61	0.62	0.66	0.62	0.65	0.74	33.0	30.0	29.9	29.0	29.9	30.8
50<=age<60	0.72	0.72	0.75	0.70	0.75	0.81	35.9	33.0	32.9	31.3	32.9	34.4
age>=60	0.50	0.50	0.54	0.36	0.53	0.76	35.0	29.8	29.8	25.8	29.8	33.7
no qualification	0.37	0.38	0.44	0.36	0.43	0.54	30.0	26.3	26.3	24.2	26.3	28.3
vocational	0.67	0.67	0.71	0.65	0.70	0.78	34.1	31.7	31.6	30.2	31.6	33.0
certificate	0.51	0.50	0.55	0.50	0.54	0.62	30.5	27.3	27.4	26.3	27.3	28.5
bachelor & post-grad	0.72	0.74	0.77	0.72	0.77	0.83	34.5	31.3	31.2	29.8	31.3	32.6
capital city	0.52	0.52	0.57	0.52	0.56	0.65	34.5	29.2	29.2	28.4	29.2	30.0
not capital city	0.58	0.58	0.62	0.58	0.62	0.69	30.7	28.4	28.4	27.5	28.4	29.3
age youngest kid 0	0.23	0.23	0.29	0.20	0.27	0.46	25.0	20.3	20.6	16.0	20.3	26.4
age youngest kid 1 to 3	0.34	0.36	0.41	0.34	0.39	0.55	28.9	24.0	24.1	21.4	24.1	26.8
age youngest kid 4 to 5	0.50	0.51	0.54	0.47	0.54	0.64	28.5	25.9	26.0	23.6	25.9	28.5
age youngest kid 6 to 9	0.55	0.55	0.63	0.53	0.60	0.82	31.1	29.6	29.5	27.4	29.5	31.4
male	0.65	0.66	0.72	0.64	0.71	0.86	42.0	39.6	39.4	36.7	39.5	41.9
female	0.54	0.54	0.58	0.54	0.57	0.65	30.4	27.0	27.0	26.2	27.0	27.9
one child	0.60	0.59	0.63	0.59	0.62	0.70	33.8	30.6	30.5	29.6	30.5	31.5
two or more children	0.50	0.51	0.56	0.51	0.55	0.64	30.1	26.5	26.5	25.4	26.5	27.7
lives with parents	0.38	0.38	0.43	0.35	0.43	0.53	31.2	26.1	26.1	24.2	26.0	28.3
does not live with parents	0.56	0.57	0.61	0.57	0.60	0.68	32.3	28.9	28.9	28.1	28.9	29.8

(1) The predicted is the point estimate using estimated coefficients of the utility equation.

(2) The mean is the mean predicted labour supply using 1000 draws from the distribution of the coefficient estimates.

Appendix B – Predicted labour supply distributions

Figure B.1 – Actual and expected labour supply of partnered men and women



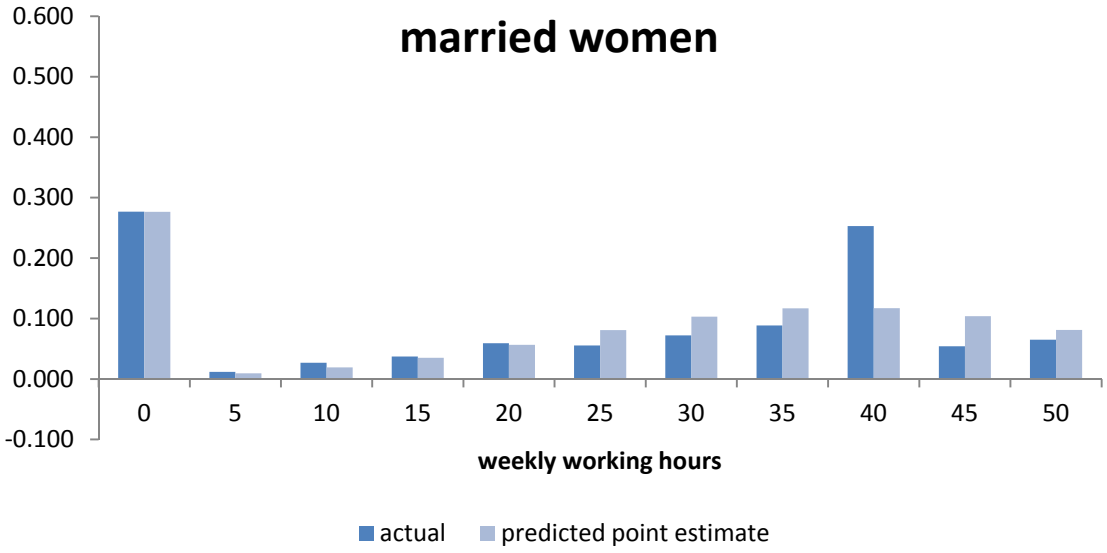


Figure B.2 – Actual and expected labour supply of singles and single parents