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WAGE EQUATION ESTIMATES FOR MICROSIMULATION MODELLING IN NEW ZEALAND

Christopher Ball[*] & Gulnara Huseynli[†]

ABSTRACT

This paper updates wage equation estimates for New Zealand using pooled annual cross-section data from 2006/07 to 2016/17. Building on previous work estimating wage equations for New Zealand we improve the wage measure and the study population definition, present results comparing the unweighted estimates to those derived using the sample weights, and present results incorporating a correction for heteroscedasticity in the selection equation.

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1 INTRODUCTION

This paper provides wage estimates used in labour supply microsimulation modelling to impute wages for individuals who were not working during the sample period. The content of this paper draws on well-established methodology so we focus on describing the variables derived, describing the exclusions which define the final study population used in our analysis and presenting the updated wage equation estimates.

This paper updates the wage equation estimates for New Zealand presented in Nolan, (2018), Mercante and Mok, (2014) and Kalb and Scutella, (2004), to which we refer the interested reader for more information about wage estimates in New Zealand. We have access to more detailed data which were not available for the earlier work,[1] and we use the new data to improve the wage measure and the criteria used to construct the final analysis population. We also compare the unweighted estimates to those derived using the sample weights, and present results incorporating a correction for heteroscedasticity in the selection equation.

The rest of this paper is structured as follows. Section 2 describes the data, the variables used and the final population used to estimate the wage equations. Section 3 presents the key results, with the detailed estimates available in Appendix A. Section 4 concludes.

2 DATA

2.1 *Source data*

The broad description of the Household Economic Survey data presented in this subsection follows Ball and Ormsby, (2017). Each year, Statistics New Zealand conducts the Household Economic Survey (HES), which collects, among other things, information on household expenditure, individual income and individual benefit receipt. The interview period runs from 1 July through to 30 June each year, with people asked about income and benefit receipt during the last 12 months.[2] Typically, there are about 5,500-7,000 adults per HES year, except for HES 2014/15 where there are 11,000 adults.

[1] Nolan, (2018) provided wage estimates from 1988 to 2013 using data available on a consistent basis over 25 years. The more detailed data used in this report is only available from 2007 onwards.

[2] Often, Statistics New Zealand and others refer to 'HES' as the triannual expenditure survey and 'HES (Income)' as the shortened income survey in the intervening years. Since we do not (and cannot) analyse expenditure data in this paper, we use 'HES' to refer to both 'HES' and 'HES (Income)' surveys.

2.2 *Demographic groups*

Previous work in the New Zealand context such as Mercante and Mok, (2014) used five family types:[3] Single Men, Single Women, Couple Men, Couple Women and Sole Parents (including both male and female sole parents). We expand to seven population groups by splitting the couples into Couple Men with Children, Couple Men without Children, Couple Women with Children, Couple Women without Children.[4] The number of individuals remaining in the final regressions by demographic group are presented in Table 1.

Table 1: Demographic Groups - Counts

Family Type	Individuals	Individuals Participating
Couple Men	4,670	4,110
Couple Parent Men	5,190	4,740
Couple Parent Women	5,210	3,380
Couple Women	4,700	3,780
Single Men	4,870	3,930
Single Women	4,480	3,640
Sole Parents	2,410	1,350

The companion data tables to this paper provide a breakdown of key variables for each of the seven demographic groups considered against wages, participation and hours worked in the primary job.

2.3 *Exclusion criteria*

This analysis pools the data across all the HES years from 2006/07 to 2016/17. Our study population is defined by the following exclusions:[5]

- Any family with income or age imputation.
- Any individual aged 65 or older as at interview date. Families with dependent children under 15 are retained (unlike families with any member aged 65 or over), although the dependent children are removed from the estimation.
- Any individual with a primary job which meets the exclusion criteria outlined in Table 2.
- Any family with an individual receiving a disability related payment.

[3] A family in this context refers to a group of people living together with one adult principal, possibly one adult spouse, and any number of dependent children (including zero). There may be multiple families within a household, which is defined as all of the individuals living at the same address. The family groups listed here are exhaustive within the family definition used for this analysis.

[4] There are not enough single male parents to meaningfully split Sole Parents for this analysis.

[5] The family is excluded if any adult meets at least one of the criteria unless otherwise specified.

- Any individual with a wage rate for their primary job less than $5 per hour or more than $350 per hour.
- Any individual not reporting a highest qualification.
- Any individual with a primary job not reporting either an industry or occupation code.

There are overlaps between the various exclusion criteria which leave a final sample size of 31,530 adults. More information on the variables and definitions used to define the study population can be found in Table 2.

3 RESULTS

To assess the impact of adjusting for heteroscedasticity and using sample weights we have presented 4 versions of the regression coefficients for each demographic group in Appendix A. Plots comparing the actual wages to the imputed wages for the employed and unemployed are presented in Appendix B. Model 1 has no adjustment for heteroscedasticity in the selection equation and does not use the sample weights. Model 2 has no adjustment for heteroscedasticity in the selection equation but does use the sample weights. Model 3 adjusts for heteroscedasticity in the selection equation but does not use the sample weights. Model 4 adjusts for heteroscedasticity in the selection equation and uses the sample weights.

The variables which enter as significant in the heteroscedastic part of the probit model are not consistent across the demographic groups. Within the heteroscedastic variance equation age only shows as significant for single women, ethnic indicators such as Maori and Asian are significant in multiple demographic groups and other variables such as highest qualification and age of youngest child are significant for at most one demographic group.[6] *A priori* we may have expected to see a more consistent set of variables with statistically significant heteroscedasticity. However with this particular data set this does not appear to be the case.

By comparing models 1 and 2 or by comparing models 3 and 4 we can assess the impact of using the sample weights. Typically the largest changes are seen in the ethnicity and region variables, which makes sense as these variables are explicitly used as benchmarks for the sample weights. As stated in Statistics, (2001):

> Integrated weighting improves the robustness and accuracy of survey estimates. It also reduces the effect of bias in estimates resulting from undercoverage, as well as reducing the level of sampling error for benchmark variables.

[6] To minimise overfitting possible regression variables were removed if they were not significant. The heteroscedastic probit model in particular is sensitive to overfitting, and in cases where including a variable in the variance term significantly affected the p-value of the corresponding linear term we removed the variable from the variance equation to maintain comparability across the four models.

Table 2: Variable definitions

Variable	Definition
Age	Age as reported in HES. Families consisting of at least one individual with age imputation are removed.
Highest Qualification	Highest qualification as reported in HES, coded into the following groups: No Qualification (code 0), Level 1 to 3 (1, 10, 11), Level 4 (2), Level 5 or 6 (4), Bachelor Degree (5), Postgraduate Degree (6, 7, 8) and Other (9). Families with adult respondents without an education code are removed.
Ethnicity	Multiple response ethnicity as reported in HES survey, coded into the following (potentially overlapping) groups: European, Maori, Pasifika, Asian, MELAA (Middle Eastern, Latin American or African) and Other. All respondents report at least one ethnicity.
Region	The region of New Zealand where the household is located, broken into the following categories: Auckland, Wellington, North Island exc Auckland and Wellington, Canterbury and South Island exc Canterbury. Regions are mutually exclusive and exhaustive of the target population for HES.
Other household income	Household level income not from salary/wages, self-employment, government benefits, investments (NZHEC breakdown starts with 1.3, 1.4, 4.1, 4.2, 5.1, or 6.1). Truncated to be between $0 and $100,000 *after* adjusting for CPI movements.
Number of parents	Number of parents for the given individual who live in the same household from the HES relationship matrix data. Can take values 0, 1 or 2.
Unemployment rate	Official unemployment rate by quarter by 5 year age band by gender published by Statistics New Zealand.
Primary job	Defined as the wage/salary job, if present, for an individual with the most hours, or in the case of a tie the job with the highest income (or the job reported first in the case of subsequent ties). Individuals (and their families) are excluded if they have a job with non-positive hours, more than 366 days covered, more than 168 hours worked per week, time off work more than half the total time observed in job, or any income record with self-employment earnings or with employer code indicating self-employment.
Industry	Industry as reported in HES for the primary job. Industry grouping “Other" is defined as raw industry codes B, C, D, I, J, L, N, Q, R, S, or T. Industry grouping “Other 2" is defined as raw industry codes A, G or H. Industry grouping were defined to ensure stability and comparability of the regression methods.
Occupation	Occupation as reported in HES for the primary job. Occupation grouping “Other" is defined as raw occupations Labourers, Service Workers, Admin. Workers, Machinery Operators. Occupation grouping were defined to ensure stability and comparability of the regression methods.
Number of jobs	Number of distinct wage/salary job identifiers for each individual. This may be less than the number of distinct job records as the same job identifier can have multiple records.
Partner	Partner as determined by Treasury’s tax and welfare microsimulation modelling.
Youngest child age	Age of the youngest child in the family, with family defined by Treasury’s tax and welfare microsimulation modelling.
Number of dependent children	Number of dependent children in the family, with both dependent and family defined by Treasury’s tax and welfare microsimulation modelling.
Wage Rate	Defined for each individual as: `7*Amount/((Days_Covered - Days_Off)*Job_Hours)`, where the income amount is for the days covered by the job and hours are weekly (hence the multiple of 7). The wage rate is coded as missing if no primary job record. Wage rates are adjusted for movements in the CPI to be comparable across years.

By comparing models 1 and 3 or models 2 and 4 we can assess the impact of adjusting for heteroscedasticity. Within the selection equation the regular regression coefficients almost always have the same sign and significance, indicating that correcting for heteroscedasticity *with the selected variables* does not dramatically alter the non-variance terms. Similarly, the wage equation (which differs only in the inverse Mill's ratio) is likewise stable aside from the inverse Mill's ratio.

The sole-parent regression coeffcients are sensitive to the variables included, and in particular the inverse Mill's ratio can change both sign and significance. With the specification presented in these results the inverse Mill's ratio for sole-parents is positive, although dropping either the age of the youngest child or the number of dependents lead to a significant negative inverse Mill's ratio. Part of the explanation may be the sample size for this group, which is noticeably smaller than the other six demographic groups. Some caution is advised in the interpretation of the sole-parent regression results.

These results suggest that the methodological improvements to the wage measure and the refinement of the study population produce sensible wage equation estimates. Our results, where comparable, are also broadly similar to the wage equation estimates in Nolan, (2018), Mercante and Mok, (2014) and Kalb and Scutella, (2004) - although this is to be expected as all four papers use the Household Economic Survey as the source data.

4 CONCLUSION

This paper has presented updated wage equation estimates for New Zealand. In addition, the paper has incorporated methodological improvements including: an improved measure of wages, a refined study population, the use of sample weights to derive estimates and adjusting the participation equation for heteroscedasticity. These improvements have produced sensible wage equation estimates, although there is some concern with the sensitivity of the sole parent estimates.

We strongly recommend using the sample weights in the wage equation estimates, and indeed for most applications of the Household Economic Survey. For this particular work it leads to significantly different estimates for variables such as ethnicity, which makes sense since one of the objectives of the sample weights is to adjust for under-coverage of certain groups. Adjusting for heteroscedasticity, however, is less compelling. We would have expected that certain variables such as age would consistently appear as significant in the variance equation, but in most cases the significance and even direction of the variance coefficients was difficult to reconcile with economic theory. There is very little in this paper to suggest that adjusting for heteroscedasticity would improve wage equation estimates, at least within the specifications we have considered.

This work should prove useful for those estimating labour supply responses using microsimulation models in New Zealand. However, there are further improvements which could be investigated. With access to the administrative data in the

Integrated Data Infrastructure managed by Stats New Zealand it would be useful to test the accuracy of the imputed wage equations. Potentially this would allow for estimating the wage equations from actual data for the currently unobserved non-participants, which could lead to subsequent improvements in labour supply microsimulation models which are dependent on these wage equation estimates.

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HOUSEHOLD ECONOMICS SURVEY DATA DISCLAIMER

Access to the data used in this study was provided by Statistics New Zealand under conditions designed to give effect to the security and confidentiality provisions of the Statistics Act 1975. The results presented in this study are the work of the authors, not Statistics NZ or the author's respective institutes.

A REGRESSION OUTPUT

A.1 *Single males*

Table 3: Single males: participation equation

	Model 1		Model 2		Model 3		Model 4	
Variable	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
(Age/10)	0.6760	0.1497***	0.7284	0.1736***	0.6633	0.1375***	0.6446	0.1522***
$(Age/10)^2$	-0.1007	0.0174***	-0.1063	0.0202***	-0.0977	0.0161***	-0.0952	0.0179***
Highest Qualification								
Bachelor Degree	0.4331	0.0888***	0.4385	0.1026***	0.3979	0.0781***	0.3760	0.0860***
Level 1 to 3	0.1846	0.0612**	0.1805	0.0711*	0.1818	0.0583**	0.1750	0.0654**
Level 4	0.3311	0.0772***	0.3093	0.0881***	0.3104	0.0738***	0.2971	0.0811***
Level 5 or 6	0.3281	0.0903***	0.3255	0.1071**	0.3134	0.0799***	0.2938	0.0898***
Other	0.2505	0.1343	0.1967	0.1491	0.1023	0.2257	-0.0928	0.1426
Postgraduate Degree	0.3724	0.1049***	0.4411	0.1214***	0.3444	0.0910***	0.3845	0.0991***
European	0.2531	0.0686***	0.1684	0.0838*	0.2316	0.0661***	0.1455	0.0713*
Maori	-0.3040	0.0658***	-0.2876	0.0790***	-0.3121	0.0629***	-0.2912	0.0708***
Pasifika	-0.1063	0.0930	-0.2055	0.1126	-0.1208	0.0887	-0.2103	0.0985*
Asian	0.1198	0.0960	0.0210	0.1122	-0.3422	0.1073***	-0.4660	0.1083***
Region								
Canterbury	0.2163	0.0715**	0.2051	0.0799**	0.2346	0.0634***	0.2195	0.0662***
North Island exc Auck/Well	-0.1413	0.0606*	-0.1019	0.0670	-0.0986	0.0547	-0.0477	0.0565
South Island exc Canterbury	0.1108	0.0770	0.1089	0.0851	0.1311	0.0705	0.1354	0.0727
Wellington	-0.0557	0.0686	-0.0378	0.0756	-0.0342	0.0614	-0.0066	0.0630
Other Household Income	-0.0066	0.0014***	-0.0064	0.0016***	-0.0059	0.0011***	-0.0056	0.0013***
Number Of Parents	-0.1238	0.0325***	-0.1292	0.0381***	-0.1202	0.0287***	-0.1262	0.0306***
Unemployment Rate	-0.0090	0.0062	-0.0021	0.0072	-0.0066	0.0057	-0.0026	0.0062
Constant	-0.2503	0.3313	-0.3343	0.3833	-0.2671	0.3040	-0.2006	0.3341
Variance terms								
Other Qualification					-0.1777	0.2904	-0.5768	0.2375*
Asian					-0.6571	0.1619***	-0.7672	0.1843***

Notes: Model 1 - unweighted model without heteroskedastic probit model. Model 2 - weighted model without heteroskedastic probit model. Model 3 - unweighted model with heteroskedastic probit model. Model 4 - weighted model with heteroskedastic probit model. Significance codes: * - $p < 0.1$, ** - $p < 0.05$, *** - $p < 0.01$.

Table 4: Single males: wage equation

	Model 1		Model 2		Model 3		Model 4	
Variable	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
(Age/10)	0.2616	0.0425***	0.2444	0.0458***	0.2245	0.0403***	0.2262	0.0396***
$(Age/10)^2$	-0.0247	0.0059***	-0.0218	0.0063***	-0.0196	0.0055***	-0.0192	0.0054***
Highest Qualification								
Bachelor Degree	0.1598	0.0283***	0.1485	0.0310***	0.1433	0.0262***	0.1439	0.0272***
Level 1 to 3	0.0635	0.0173***	0.0551	0.0191**	0.0549	0.0175**	0.0509	0.0185**
Level 4	0.0995	0.0234***	0.0811	0.0252***	0.0854	0.0227***	0.0740	0.0237**
Level 5 or 6	0.1020	0.0243***	0.0792	0.0263**	0.0881	0.0224***	0.0742	0.0235**
Other	0.1096	0.0382**	0.1347	0.0488**	0.1018	0.0368**	0.1467	0.0489**
Postgraduate Degree	0.2851	0.0347***	0.2622	0.0372***	0.2704	0.0330***	0.2568	0.0336***
European	0.0813	0.0157***	0.0938	0.0160***	0.0671	0.0204***	0.0774	0.0192***
Maori	0.0204	0.0204	0.0382	0.0206	0.0336	0.0188	0.0395	0.0188*
Region								
Canterbury	-0.0463	0.0180**	-0.0569	0.0194**	-0.0554	0.0179**	-0.0631	0.0186***
North Island exc Auck/Well	-0.0929	0.0159***	-0.0888	0.0170***	-0.0879	0.0155***	-0.0894	0.0170***
South Island exc Canterbury	-0.0621	0.0178***	-0.0692	0.0200***	-0.0676	0.0180***	-0.0745	0.0200***
Wellington	-0.0263	0.0168	-0.0247	0.0178	-0.0245	0.0167	-0.0260	0.0178
Industry								
Construction	0.0001	0.0160	-0.0021	0.0164	0.0003	0.0160	-0.0017	0.0164
Education	-0.0178	0.0349	-0.0544	0.0474	-0.0178	0.0349	-0.0554	0.0474
Finance	0.2764	0.0353***	0.2716	0.0417***	0.2767	0.0353***	0.2724	0.0417***
Other 2	-0.1123	0.0141***	-0.1139	0.0165***	-0.1119	0.0142***	-0.1123	0.0167***
Professional Services	0.0338	0.0253	0.0133	0.0261	0.0338	0.0253	0.0129	0.0261
Public Administration	0.1155	0.0241***	0.0942	0.0258***	0.1167	0.0241***	0.0945	0.0258***
Wholesale Trade	-0.0178	0.0202	-0.0171	0.0221	-0.0183	0.0202	-0.0169	0.0220
Occupation								
Manager	0.2067	0.0195***	0.1934	0.0214***	0.2072	0.0195***	0.1937	0.0213***
Professional	0.2747	0.0220***	0.2689	0.0254***	0.2752	0.0219***	0.2694	0.0254***
Sales Workers	0.0343	0.0178	0.0530	0.0208*	0.0342	0.0178	0.0532	0.0208**
Technicians	0.0954	0.0137***	0.1029	0.0150***	0.0954	0.0137***	0.1041	0.0150***
Lives with Parents	-0.0718	0.0157***	-0.0690	0.0175***	-0.0628	0.0157***	-0.0625	0.0167***
Year	0.0058	0.0018***	0.0042	0.0020*	0.0058	0.0018***	0.0044	0.0020*
Inverse Mills Ratio	0.0502	0.0963	-0.0592	0.1051	-0.0593	0.0954	-0.1256	0.0855
Constant	2.2222	0.1078***	2.3022	0.1164***	2.3322	0.1109***	2.3679	0.1032***

Notes: Model 1 - unweighted model without heteroskedastic probit model. Model 2 - weighted model without heteroskedastic probit model. Model 3 - unweighted model with heteroskedastic probit model. Model 4 - weighted model with heteroskedastic probit model. Significance codes: * - $p < 0.1$, ** - $p < 0.05$, *** - $p < 0.01$.

A.2 *Single females*

Table 5: Single females: participation equation

	Model 1		Model 2		Model 3		Model 4	
Variable	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
(Age/10)	0.7357	0.1123***	0.7081	0.1313***	1.3156	0.2801***	1.4532	0.3589***
$(Age/10)^2$	-0.1010	0.0138***	-0.0981	0.0161***	-0.1621	0.0309***	-0.1766	0.0397***
Highest Qualification								
Bachelor Degree	0.7651	0.0863***	0.7607	0.0982***	1.2299	0.2192***	1.3225	0.2554***
Level 1 to 3	0.3826	0.0668***	0.3761	0.0757***	0.6372	0.1378***	0.6929	0.1640***
Level 4	0.5456	0.1056***	0.6928	0.1218***	0.8830	0.2038***	1.2087	0.2721***
Level 5 or 6	0.5542	0.0883***	0.5230	0.1049***	0.8989	0.1879***	0.8922	0.2207***
Other	0.5359	0.1240***	0.6388	0.1342***	0.9150	0.2533***	1.2229	0.3232***
Postgraduate Degree	0.7746	0.1031***	0.7589	0.1279***	1.2280	0.2366***	1.3227	0.2846***
European	0.3988	0.0542***	0.4674	0.0611***	0.6084	0.1093***	0.7598	0.1369***
Maori	-0.2188	0.0649***	-0.2085	0.0746**	-0.3539	0.1108***	-0.3713	0.1396**
Region								
Canterbury	0.3115	0.0751***	0.3282	0.0826***	0.4925	0.1356***	0.5578	0.1636***
North Island exc Auck/Well	0.1134	0.0629	0.0683	0.0725	0.1768	0.0983	0.1068	0.1236
South Island exc Canterbury	0.0302	0.0781	0.0586	0.0892	0.1048	0.1292	0.1960	0.1662
Wellington	0.1678	0.0723*	0.1680	0.0833*	0.2475	0.1142*	0.2334	0.1410
Other Household Income	-0.0061	0.0014***	-0.0071	0.0016***	-0.0092	0.0024***	-0.0118	0.0032***
Lives with Parents	-0.1190	0.0664	-0.1033	0.0764	-0.1480	0.0932	-0.1372	0.1143
Constant	-0.9216	0.2180***	-0.9234	0.2524***	-2.0545	0.5368***	-2.3736	0.6707***
Variance terms								
(Age/10)					0.1141	0.0371**	0.1414	0.0429***

Notes: Model 1 - unweighted model without heteroskedastic probit model. Model 2 - weighted model without heteroskedastic probit model. Model 3 - unweighted model with heteroskedastic probit model. Model 4 - weighted model with heteroskedastic probit model. Significance codes: * - $p < 0.1$, ** - $p < 0.05$, *** - $p < 0.01$.

Table 6: Single females: wage equation

	Model 1		Model 2		Model 3		Model 4	
Variable	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
(Age/10)	0.2999	0.0409***	0.3250	0.0393***	0.3338	0.0349***	0.3555	0.0341***
$(Age/10)^2$	-0.0314	0.0055***	-0.0346	0.0052***	-0.0352	0.0043***	-0.0379	0.0042***
Highest Qualification								
Bachelor Degree	0.2100	0.0394***	0.1774	0.0373***	0.2450	0.0319***	0.2099	0.0301***
Level 1 to 3	0.1340	0.0251***	0.1185	0.0247***	0.1590	0.0219***	0.1418	0.0216***
Level 4	0.1503	0.0371***	0.1350	0.0376***	0.1803	0.0311***	0.1656	0.0300***
Level 5 or 6	0.1724	0.0331***	0.1494	0.0332***	0.2026	0.0279***	0.1758	0.0281***
Other	0.1766	0.0394***	0.1723	0.0425***	0.2072	0.0360***	0.2026	0.0377***
Postgraduate Degree	0.3198	0.0415***	0.2804	0.0405***	0.3525	0.0333***	0.3106	0.0327***
European	0.0535	0.0279	0.0552	0.0287	0.0735	0.0250**	0.0769	0.0252**
Maori	-0.0195	0.0187	-0.0365	0.0199	-0.0313	0.0176	-0.0468	0.0195*
Pasifika	-0.1219	0.0249***	-0.1135	0.0278***	-0.1202	0.0249***	-0.1105	0.0278***
Asian	-0.0564	0.0255*	-0.0441	0.0254	-0.0476	0.0257	-0.0338	0.0256
MELAA	-0.0487	0.0520	-0.0305	0.0551	-0.0409	0.0521	-0.0207	0.0552
Other Ethnicity	-0.0336	0.0353	-0.0538	0.0388	-0.0293	0.0353	-0.0472	0.0387
Region								
Canterbury	-0.1148	0.0199***	-0.1117	0.0207***	-0.1064	0.0169***	-0.1054	0.0176***
North Island exc Auck/Well	-0.1122	0.0150***	-0.0991	0.0151***	-0.1084	0.0145***	-0.0978	0.0149***
South Island exc Canterbury	-0.1098	0.0174***	-0.0949	0.0193***	-0.1071	0.0174***	-0.0918	0.0193***
Wellington	-0.0340	0.0178	-0.0310	0.0179	-0.0295	0.0170	-0.0288	0.0173
Industry								
Construction	0.0877	0.0325**	0.1212	0.0358***	0.0887	0.0326**	0.1225	0.0360***
Education	0.0080	0.0190	0.0094	0.0217	0.0079	0.0190	0.0095	0.0217
Finance	0.2515	0.0249***	0.2688	0.0247***	0.2516	0.0249***	0.2692	0.0247***
Other 2	-0.0842	0.0133***	-0.0888	0.0140***	-0.0839	0.0133***	-0.0882	0.0139***
Professional Services	0.0943	0.0223***	0.0854	0.0224***	0.0945	0.0223***	0.0859	0.0224***
Public Administration	0.1460	0.0204***	0.1350	0.0225***	0.1454	0.0204***	0.1346	0.0225***
Wholesale Trade	0.0496	0.0241*	0.0444	0.0290	0.0498	0.0240*	0.0445	0.0289
Occupation								
Manager	0.2365	0.0173***	0.2238	0.0185***	0.2352	0.0173***	0.2223	0.0185***
Professional	0.2290	0.0159***	0.2320	0.0175***	0.2277	0.0159***	0.2303	0.0175***
Sales Workers	-0.0007	0.0155	-0.0069	0.0162	-0.0018	0.0155	-0.0080	0.0162
Technicians	0.0308	0.0201	0.0426	0.0217*	0.0299	0.0201	0.0419	0.0217
Lives with Parents	-0.0408	0.0153**	-0.0316	0.0157*	-0.0431	0.0148**	-0.0328	0.0154*
Inverse Mills Ratio	0.0715	0.1126	0.0624	0.0997	0.1698	0.0714*	0.1505	0.0586**
Constant	2.2116	0.1344***	2.1824	0.1253***	2.0957	0.1009***	2.0763	0.0917***

Notes: Model 1 - unweighted model without heteroskedastic probit model. Model 2 - weighted model without heteroskedastic probit model. Model 3 - unweighted model with heteroskedastic probit model. Model 4 - weighted model with heteroskedastic probit model. Significance codes: * - $p < 0.1$, ** - $p < 0.05$, *** - $p < 0.01$.

A.3 *Couple males*

Table 7: Couple males: participation equation

	Model 1		Model 2		Model 3		Model 4	
Variable	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
(Age/10)	0.8313	0.1723***	0.8279	0.2398***	0.8286	0.1823***	0.7813	0.2267***
$(Age/10)^2$	-0.1136	0.0192***	-0.1119	0.0263***	-0.1149	0.0204***	-0.1089	0.0251***
Highest Qualification								
Bachelor Degree	0.1648	0.1020	0.2142	0.1230	0.1392	0.1075	0.1877	0.1266
Level 1 to 3	0.1272	0.0799	0.1312	0.0924	0.1178	0.0839	0.1199	0.0961
Level 4	0.2353	0.0835**	0.1855	0.1015	0.2363	0.0872**	0.1964	0.1041
Level 5 or 6	0.2147	0.0972*	0.2620	0.1114*	0.2105	0.1024*	0.2640	0.1155*
Other	0.1480	0.1264	0.1861	0.1551	0.1336	0.1327	0.1717	0.1595
Postgraduate Degree	0.3901	0.1120***	0.4700	0.1292***	0.3871	0.1191***	0.4642	0.1356***
Asian	-0.3910	0.0846***	-0.4876	0.0994***	-0.4150	0.0861***	-0.5214	0.1028***
Region								
Canterbury	0.4321	0.0893***	0.3955	0.0985***	0.4426	0.0938***	0.3925	0.1057***
North Island exc Auck/Well	0.0726	0.0710	0.1106	0.0823	0.0835	0.0748	0.1209	0.0846
South Island exc Canterbury	0.1671	0.0853*	0.1976	0.0977*	0.1567	0.0896	0.1807	0.1002
Wellington	0.0847	0.0805	0.1101	0.0911	0.0813	0.0841	0.1070	0.0936
Other Household Income	-0.0101	0.0012***	-0.0085	0.0013***	-0.0097	0.0013***	-0.0080	0.0016***
Lives with Parents	-0.5170	0.2031*	-0.3989	0.2363	-0.5735	0.2275*	-0.4397	0.2396
Partner Wage Band (Hourly)								
$15 to $30	0.5292	0.0611***	0.5811	0.0714***	0.5430	0.0636***	0.6050	0.0742***
$30 to $50	0.4488	0.0832***	0.4758	0.0980***	0.4488	0.0864***	0.4797	0.1007***
$50 to $75	0.6833	0.2045***	0.6153	0.2738*	0.6780	0.2248**	0.6010	0.2833*
Less than $15	0.7615	0.1139***	0.7439	0.1404***	0.7837	0.1202***	0.7758	0.1450***
More than $75	-0.1666	0.2375	-0.1278	0.2548	-0.2120	0.2694	-0.1607	0.2738
Constant	-0.5064	0.3684	-0.6216	0.5303	-0.4239	0.3917	-0.4384	0.4932
Variance terms								
Maori					0.1711	0.0781*	0.2074	0.0957*
Other Household Income					0.0036	0.0031	0.0027	0.0031

Notes: Model 1 - unweighted model without heteroskedastic probit model. Model 2 - weighted model without heteroskedastic probit model. Model 3 - unweighted model with heteroskedastic probit model. Model 4 - weighted model with heteroskedastic probit model. Significance codes: * - $p < 0.1$, ** - $p < 0.05$, *** - $p < 0.01$.

Table 8: Couple males: wage equation

	Model 1		Model 2		Model 3		Model 4	
Variable	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
(Age/10)	0.4224	0.0397***	0.4553	0.0482***	0.4241	0.0396***	0.4536	0.0478***
$(Age/10)^2$	-0.0433	0.0047***	-0.0472	0.0057***	-0.0437	0.0047***	-0.0472	0.0057***
Highest Qualification								
Bachelor Degree	0.2463	0.0272***	0.2391	0.0350***	0.2443	0.0271***	0.2367	0.0350***
Level 1 to 3	0.0558	0.0198**	0.0624	0.0274*	0.0552	0.0198**	0.0616	0.0274*
Level 4	0.1008	0.0202***	0.1065	0.0267***	0.1009	0.0202***	0.1073	0.0267***
Level 5 or 6	0.1541	0.0237***	0.1509	0.0310***	0.1540	0.0236***	0.1511	0.0310***
Other	0.1772	0.0391***	0.1939	0.0470***	0.1761	0.0390***	0.1924	0.0469***
Postgraduate Degree	0.3498	0.0306***	0.3441	0.0391***	0.3496	0.0305***	0.3437	0.0390***
European	0.0330	0.0289	0.0644	0.0460	0.0331	0.0289	0.0645	0.0460
Maori	-0.0585	0.0246*	-0.0265	0.0318	-0.0585	0.0246*	-0.0263	0.0317
Pasifika	-0.1353	0.0366***	-0.1209	0.0487*	-0.1353	0.0366***	-0.1207	0.0487*
Asian	-0.2588	0.0352***	-0.2377	0.0534***	-0.2609	0.0352***	-0.2410	0.0535***
MELAA	-0.0947	0.0655	-0.0683	0.0895	-0.0946	0.0655	-0.0683	0.0895
Other Ethnicity	0.0162	0.0416	0.0572	0.0511	0.0162	0.0416	0.0573	0.0511
Region								
Canterbury	-0.0723	0.0200***	-0.0618	0.0233**	-0.0713	0.0200***	-0.0615	0.0232**
North Island exc Auck/Well	-0.1256	0.0174***	-0.1248	0.0221***	-0.1244	0.0174***	-0.1234	0.0221***
South Island exc Canterbury	-0.1281	0.0202***	-0.1277	0.0227***	-0.1283	0.0202***	-0.1284	0.0227***
Wellington	-0.0591	0.0181***	-0.0734	0.0211***	-0.0591	0.0181***	-0.0734	0.0211***
Industry								
Construction	-0.0094	0.0187	-0.0295	0.0251	-0.0094	0.0187	-0.0294	0.0251
Education	-0.0865	0.0264***	-0.0731	0.0295*	-0.0864	0.0264***	-0.0731	0.0295*
Finance	0.2839	0.0399***	0.3000	0.0421***	0.2838	0.0399***	0.2997	0.0421***
Other 2	-0.1782	0.0190***	-0.1718	0.0235***	-0.1781	0.0190***	-0.1716	0.0234***
Professional Services	0.1414	0.0248***	0.1452	0.0266***	0.1415	0.0248***	0.1453	0.0266***
Public Administration	0.1785	0.0204***	0.1579	0.0225***	0.1786	0.0204***	0.1581	0.0225***
Wholesale Trade	0.0076	0.0212	0.0003	0.0230	0.0076	0.0212	0.0005	0.0230
Occupation								
Manager	0.3173	0.0195***	0.3163	0.0269***	0.3172	0.0195***	0.3163	0.0269***
Professional	0.3127	0.0201***	0.3185	0.0234***	0.3125	0.0201***	0.3186	0.0234***
Sales Workers	0.0298	0.0260	0.0376	0.0280	0.0297	0.0260	0.0376	0.0280
Technicians	0.1101	0.0159***	0.1221	0.0195***	0.1102	0.0159***	0.1222	0.0195***
Year	0.0136	0.0018***	0.0140	0.0023***	0.0136	0.0018***	0.0140	0.0023***
Inverse Mills Ratio	0.2564	0.0678***	0.2760	0.0755***	0.2678	0.0690***	0.2870	0.0763***
Constant	1.9138	0.0965***	1.8035	0.1284***	1.9137	0.0960***	1.8125	0.1267***

Notes: Model 1 - unweighted model without heteroskedastic probit model. Model 2 - weighted model without heteroskedastic probit model. Model 3 - unweighted model with heteroskedastic probit model. Model 4 - weighted model with heteroskedastic probit model. Significance codes: * - $p < 0.1$, ** - $p < 0.05$, *** - $p < 0.01$.

A.4 *Couple parent males*

Table 9: Couple parent males: participation equation

	Model 1		Model 2		Model 3		Model 4	
Variable	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
(Age/10)	1.0949	0.2019***	1.2694	0.2448***	1.0323	0.2186***	1.2186	0.2488***
$(Age/10)^2$	-0.1538	0.0244***	-0.1725	0.0297***	-0.1489	0.0262***	-0.1690	0.0300***
Highest Qualification								
Bachelor Degree	0.5511	0.1008***	0.4875	0.1090***	0.5164	0.1040***	0.4465	0.1141***
Level 1 to 3	0.1618	0.0774*	0.1323	0.0839	0.1459	0.0811	0.1145	0.0889
Level 4	0.2732	0.0872**	0.2553	0.0932**	0.2636	0.0902**	0.2401	0.0986*
Level 5 or 6	0.4690	0.1088***	0.3291	0.1272**	0.4545	0.1119***	0.3099	0.1312*
Other	0.3388	0.1461*	0.2660	0.1597	0.3523	0.1513*	0.2671	0.1665
Postgraduate Degree	0.5117	0.1071***	0.4731	0.1209***	0.4831	0.1115***	0.4435	0.1232***
European	0.4019	0.0539***	0.3747	0.0580***	0.3813	0.0558***	0.3548	0.0609***
Other Household Income	-0.0085	0.0015***	-0.0086	0.0018***	-0.0086	0.0016***	-0.0087	0.0018***
Age of Youngest Child	0.0225	0.0067***	0.0184	0.0086*	0.0239	0.0074***	0.0196	0.0084*
Partner Wage Band (Hourly)								
$15 to $30	0.0966	0.0625	0.0998	0.0733	0.0991	0.0654	0.1054	0.0744
$30 to $50	0.0911	0.0877	0.1171	0.1054	0.0916	0.0913	0.1196	0.1058
$50 to $75	-0.1558	0.1609	-0.2723	0.1884	-0.1555	0.1662	-0.2743	0.1892
Less than $15	0.1165	0.1026	0.0901	0.1158	0.1119	0.1065	0.0870	0.1194
More than $75	-0.4546	0.2214*	-0.4454	0.2504	-0.4636	0.2221*	-0.4550	0.2518
Constant	-1.0927	0.4032**	-1.3917	0.4876**	-0.8706	0.4458	-1.1924	0.5037*
Variance terms								
Maori					0.1799	0.0670**	0.1740	0.0741*

Notes: Model 1 - unweighted model without heteroskedastic probit model. Model 2 - weighted model without heteroskedastic probit model. Model 3 - unweighted model with heteroskedastic probit model. Model 4 - weighted model with heteroskedastic probit model. Significance codes: * - $p < 0.1$, ** - $p < 0.05$, *** - $p < 0.01$.

Table 10: Couple parent males: wage equation

	Model 1		Model 2		Model 3		Model 4	
Variable	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
(Age/10)	0.5528	0.0631***	0.5807	0.0754***	0.5308	0.0613***	0.5579	0.0731***
$(Age/10)^2$	-0.0623	0.0079***	-0.0665	0.0094***	-0.0598	0.0077***	-0.0640	0.0092***
Highest Qualification								
Bachelor Degree	0.3545	0.0287***	0.3784	0.0305***	0.3450	0.0280***	0.3683	0.0297***
Level 1 to 3	0.0911	0.0189***	0.1001	0.0210***	0.0867	0.0187***	0.0957	0.0208***
Level 4	0.1242	0.0219***	0.1320	0.0250***	0.1192	0.0217***	0.1265	0.0247***
Level 5 or 6	0.2497	0.0266***	0.2526	0.0275***	0.2427	0.0262***	0.2461	0.0271***
Other	0.2437	0.0385***	0.2384	0.0399***	0.2409	0.0385***	0.2350	0.0398***
Postgraduate Degree	0.4363	0.0306***	0.4486	0.0324***	0.4279	0.0301***	0.4400	0.0319***
European	0.1756	0.0251***	0.1879	0.0270***	0.1679	0.0246***	0.1804	0.0264***
Maori	-0.0023	0.0212	0.0155	0.0231	-0.0024	0.0212	0.0155	0.0231
Pasifika	-0.1322	0.0261***	-0.1284	0.0281***	-0.1324	0.0261***	-0.1286	0.0281***
Asian	-0.1504	0.0263***	-0.1384	0.0288***	-0.1522	0.0263***	-0.1401	0.0287***
MELAA	-0.0587	0.0604	-0.0969	0.0781	-0.0594	0.0605	-0.0976	0.0782
Other Ethnicity	0.0373	0.0368	0.0693	0.0421	0.0368	0.0367	0.0686	0.0421
Region								
Canterbury	-0.0912	0.0173***	-0.0874	0.0195***	-0.0913	0.0173***	-0.0874	0.0195***
North Island exc Auck/Well	-0.1313	0.0158***	-0.1263	0.0176***	-0.1315	0.0158***	-0.1265	0.0176***
South Island exc Canterbury	-0.1162	0.0206***	-0.1100	0.0231***	-0.1162	0.0206***	-0.1100	0.0231***
Wellington	0.0038	0.0170	0.0081	0.0183	0.0039	0.0170	0.0082	0.0183
Industry								
Construction	-0.0281	0.0172	-0.0297	0.0204	-0.0281	0.0172	-0.0298	0.0204
Education	-0.1445	0.0252***	-0.1395	0.0265***	-0.1444	0.0252***	-0.1394	0.0265***
Finance	0.2021	0.0331***	0.1984	0.0364***	0.2023	0.0331***	0.1986	0.0365***
Other 2	-0.2294	0.0189***	-0.2395	0.0226***	-0.2296	0.0189***	-0.2396	0.0226***
Professional Services	0.1196	0.0228***	0.0932	0.0248***	0.1198	0.0228***	0.0933	0.0248***
Public Administration	0.1313	0.0189***	0.1203	0.0207***	0.1313	0.0189***	0.1201	0.0207***
Wholesale Trade	-0.0077	0.0217	0.0060	0.0224	-0.0078	0.0217	0.0060	0.0224
Occupation								
Manager	0.3031	0.0170***	0.2930	0.0197***	0.3033	0.0170***	0.2932	0.0197***
Professional	0.2479	0.0193***	0.2423	0.0216***	0.2482	0.0193***	0.2425	0.0216***
Sales Workers	0.0729	0.0279**	0.0473	0.0319	0.0731	0.0279**	0.0475	0.0319
Technicians	0.0611	0.0155***	0.0572	0.0175***	0.0613	0.0155***	0.0573	0.0175***
Year	0.0091	0.0018***	0.0085	0.0020***	0.0092	0.0018***	0.0085	0.0020***
Inverse Mills Ratio	0.5178	0.1123***	0.5671	0.1253***	0.4925	0.1124***	0.5438	0.1247***
Constant	1.6206	0.1483***	1.5609	0.1747***	1.6860	0.1418***	1.6289	0.1667***

Notes: Model 1 - unweighted model without heteroskedastic probit model. Model 2 - weighted model without heteroskedastic probit model. Model 3 - unweighted model with heteroskedastic probit model. Model 4 - weighted model with heteroskedastic probit model. Significance codes: * - $p < 0.1$, ** - $p < 0.05$, *** - $p < 0.01$.

A.5 *Couple females*

Table 11: Couple females: participation equation

	Model 1		Model 2		Model 3		Model 4	
Variable	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
(Age/10)	1.0015	0.1413***	1.0327	0.1611***	1.0450	0.1434***	1.0740	0.1622***
$(Age/10)^2$	-0.1358	0.0165***	-0.1427	0.0187***	-0.1416	0.0168***	-0.1476	0.0189***
Highest Qualification								
Bachelor Degree	0.6350	0.0874***	0.5361	0.1084***	0.6638	0.0893***	0.5575	0.1120***
Level 1 to 3	0.2897	0.0644***	0.2565	0.0762***	0.3117	0.0671***	0.2728	0.0775***
Level 4	0.2588	0.1053*	0.2762	0.1238*	0.2617	0.1094*	0.2730	0.1248*
Level 5 or 6	0.4649	0.0801***	0.4472	0.0971***	0.4943	0.0843***	0.4728	0.0984***
Other	0.4901	0.1106***	0.4566	0.1288***	0.4997	0.1100***	0.4594	0.1300***
Postgraduate Degree	0.6329	0.0940***	0.6203	0.1097***	0.6829	0.1024***	0.6553	0.1149***
European	0.5104	0.0570***	0.4594	0.0665***	0.5339	0.0587***	0.4632	0.0660***
Other Ethnicity	0.4273	0.1510**	0.4533	0.1880*	0.4889	0.1636**	0.5125	0.1981**
Region								
Canterbury	0.1124	0.0732	0.1292	0.0845	0.1051	0.0728	0.1184	0.0849
North Island exc Auck/Well	-0.0080	0.0623	0.0180	0.0722	-0.0110	0.0620	0.0161	0.0704
South Island exc Canterbury	0.1088	0.0751	0.1257	0.0858	0.1053	0.0753	0.1275	0.0848
Wellington	0.1320	0.0727	0.1806	0.0858*	0.5072	0.2301*	0.5943	0.2607*
Other Household Income	-0.0048	0.0011***	-0.0041	0.0013**	-0.0050	0.0012***	-0.0041	0.0014**
Partner Wage Band (Hourly)								
$15 to $30	0.6653	0.0663***	0.6833	0.0758***	0.6875	0.0694***	0.6936	0.0789***
$30 to $50	0.4631	0.0742***	0.5160	0.0870***	0.4982	0.0784***	0.5463	0.0929***
$50 to $75	0.1436	0.1059	0.1832	0.1309	0.1381	0.1107	0.1684	0.1375
Less than $15	0.6796	0.1069***	0.7080	0.1195***	0.6822	0.1083***	0.6958	0.1219***
More than $75	0.0779	0.1634	0.1549	0.1985	0.0626	0.1718	0.1455	0.2052
Constant	-1.8639	0.2919***	-1.8578	0.3376***	-1.9885	0.2968***	-1.9719	0.3386***
Variance terms								
Maori					-0.1135	0.0999	-0.1942	0.1017
Wellington					0.3441	0.1595*	0.3663	0.1718*

Notes: Model 1 - unweighted model without heteroskedastic probit model. Model 2 - weighted model without heteroskedastic probit model. Model 3 - unweighted model with heteroskedastic probit model. Model 4 - weighted model with heteroskedastic probit model. Significance codes: * - $p < 0.1$, ** - $p < 0.05$, *** - $p < 0.01$.

Table 12: Couple females: wage equation

	Model 1		Model 2		Model 3		Model 4	
Variable	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
(Age/10)	0.3914	0.0395***	0.4124	0.0486***	0.3863	0.0395***	0.4082	0.0487***
$(Age/10)^2$	-0.0455	0.0050***	-0.0477	0.0062***	-0.0447	0.0050***	-0.0470	0.0062***
Highest Qualification								
Bachelor Degree	0.2995	0.0237***	0.2858	0.0257***	0.2961	0.0236***	0.2839	0.0256***
Level 1 to 3	0.1165	0.0164***	0.1070	0.0181***	0.1166	0.0165***	0.1071	0.0183***
Level 4	0.1650	0.0242***	0.1448	0.0332***	0.1630	0.0242***	0.1428	0.0330***
Level 5 or 6	0.2150	0.0237***	0.2044	0.0267***	0.2140	0.0237***	0.2039	0.0269***
Other	0.1670	0.0272***	0.1491	0.0309***	0.1633	0.0270***	0.1458	0.0308***
Postgraduate Degree	0.3654	0.0270***	0.3513	0.0317***	0.3635	0.0269***	0.3495	0.0316***
European	0.1350	0.0286***	0.1295	0.0337***	0.1318	0.0286***	0.1257	0.0335***
Maori	-0.0277	0.0223	-0.0090	0.0255	-0.0276	0.0224	-0.0089	0.0255
Pasifika	-0.0572	0.0335	-0.0758	0.0399	-0.0561	0.0335	-0.0755	0.0400
Asian	-0.1120	0.0318***	-0.0931	0.0375*	-0.1112	0.0318***	-0.0924	0.0375*
MELAA	0.0728	0.0755	0.0609	0.0849	0.0725	0.0756	0.0609	0.0847
Other Ethnicity	0.1340	0.0488**	0.1511	0.0559**	0.1370	0.0489**	0.1540	0.0560**
Region								
Canterbury	-0.1074	0.0175***	-0.0985	0.0206***	-0.1089	0.0175***	-0.1003	0.0206***
North Island exc Auck/Well	-0.1144	0.0156***	-0.1049	0.0183***	-0.1153	0.0156***	-0.1057	0.0183***
South Island exc Canterbury	-0.1185	0.0170***	-0.1078	0.0185***	-0.1200	0.0170***	-0.1085	0.0185***
Wellington	-0.0419	0.0170*	-0.0320	0.0185	-0.0072	0.0178	0.0018	0.0203
Industry								
Construction	0.1233	0.0401**	0.1066	0.0383**	0.1236	0.0401**	0.1071	0.0384**
Education	-0.0304	0.0197	-0.0356	0.0225	-0.0295	0.0197	-0.0350	0.0225
Finance	0.2237	0.0233***	0.2113	0.0280***	0.2243	0.0234***	0.2119	0.0281***
Other 2	-0.1505	0.0161***	-0.1504	0.0183***	-0.1503	0.0161***	-0.1504	0.0183***
Professional Services	0.1614	0.0217***	0.1551	0.0284***	0.1603	0.0217***	0.1544	0.0284***
Public Administration	0.1883	0.0183***	0.1800	0.0213***	0.1885	0.0183***	0.1802	0.0214***
Wholesale Trade	0.0179	0.0242	0.0332	0.0297	0.0177	0.0243	0.0331	0.0298
Occupation								
Manager	0.2807	0.0194***	0.2912	0.0220***	0.2808	0.0194***	0.2914	0.0220***
Professional	0.2264	0.0165***	0.2334	0.0197***	0.2267	0.0165***	0.2336	0.0197***
Sales Workers	0.0338	0.0198	0.0263	0.0237	0.0336	0.0198	0.0262	0.0237
Technicians	0.0155	0.0253	-0.0019	0.0371	0.0154	0.0253	-0.0017	0.0371
Inverse Mills Ratio	0.3556	0.0526***	0.3248	0.0644***	0.3388	0.0520***	0.3105	0.0641***
Constant	1.9518	0.0927***	1.9171	0.1159***	1.9663	0.0928***	1.9274	0.1167***

Notes: Model 1 - unweighted model without heteroskedastic probit model. Model 2 - weighted model without heteroskedastic probit model. Model 3 - unweighted model with heteroskedastic probit model. Model 4 - weighted model with heteroskedastic probit model. Significance codes: * - $p < 0.1$, ** - $p < 0.05$, *** - $p < 0.01$.

A.6 *Couple parent females*

Table 13: Couple parent females: participation equation

	Model 1		Model 2		Model 3		Model 4	
Variable	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
(Age/10)	1.6081	0.1897***	1.6525	0.2234***	1.3672	0.2441***	1.4601	0.2631***
$(Age/10)^2$	-0.2161	0.0246***	-0.2230	0.0292***	-0.1903	0.0337***	-0.2029	0.0364***
Highest Qualification								
Bachelor Degree	0.5306	0.0769***	0.5034	0.0878***	0.4595	0.1086***	0.4104	0.1193***
Level 1 to 3	0.2262	0.0659***	0.2314	0.0771**	0.2083	0.0886*	0.2196	0.1012*
Level 4	0.2137	0.0918*	0.2083	0.1056*	0.2565	0.1191*	0.2259	0.1280
Level 5 or 6	0.4016	0.0792***	0.3979	0.0917***	0.3726	0.1095***	0.3451	0.1212**
Other	0.3640	0.1087***	0.3582	0.1271**	0.5096	0.1855**	0.4990	0.2028*
Postgraduate Degree	0.5864	0.0858***	0.6415	0.0962***	0.4882	0.1171***	0.4835	0.1311***
Asian	-0.3145	0.0555***	-0.3426	0.0639***	-0.1833	0.0788*	-0.1598	0.0889
MELAA	-0.7424	0.1961***	-0.7026	0.2354**	-0.6190	0.2099**	-0.5728	0.2157**
Partner Wage Band (Hourly)								
$15 to $30	0.1383	0.0699*	0.1398	0.0861	0.0574	0.0740	0.0475	0.0801
$30 to $50	0.0855	0.0755	0.0750	0.0917	-0.0211	0.0795	-0.0348	0.0857
$50 to $75	-0.2686	0.0944**	-0.3118	0.1135**	-0.3283	0.1061**	-0.3623	0.1144**
Less than $15	0.0630	0.1002	0.0813	0.1160	0.0619	0.1061	0.0590	0.1103
More than $75	-0.4054	0.1308**	-0.3771	0.1499*	-0.5122	0.1508***	-0.4891	0.1583**
Age of Youngest Child	0.0970	0.0056***	0.0954	0.0069***	0.1492	0.0216***	0.1383	0.0231***
Number of Dependents	-0.1188	0.0209***	-0.1354	0.0239***	-0.1267	0.0244***	-0.1338	0.0262***
Constant	-3.1564	0.3479***	-3.1880	0.4086***	-2.6787	0.4439***	-2.8000	0.4839***
Variance terms								
Highest Qualification								
Bachelor Degree					-0.4790	0.1411***	-0.5499	0.1593***
Level 1 to 3					-0.3309	0.1221**	-0.3453	0.1407*
Level 4					-0.1449	0.1744	-0.2334	0.1924
Level 5 or 6					-0.3674	0.1409**	-0.4153	0.1639*
Other					-0.0180	0.2262	-0.0474	0.2548
Postgraduate Degree					-0.4784	0.1522**	-0.5737	0.1681***
Asian					0.4176	0.1207***	0.5301	0.1465***
Age of Youngest Child					0.0542	0.0091***	0.0501	0.0102***

Notes: Model 1 - unweighted model without heteroskedastic probit model. Model 2 - weighted model without heteroskedastic probit model. Model 3 - unweighted model with heteroskedastic probit model. Model 4 - weighted model with heteroskedastic probit model. Significance codes: * - $p < 0.1$, ** - $p < 0.05$, *** - $p < 0.01$.

Table 14: Couple parent females: wage equation

	Model 1		Model 2		Model 3		Model 4	
Variable	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
(Age/10)	0.7433	0.0974***	0.8227	0.1060***	0.5903	0.0786***	0.7073	0.0887***
$(Age/10)^2$	-0.0883	0.0125***	-0.0993	0.0137***	-0.0685	0.0100***	-0.0845	0.0114***
Highest Qualification								
Bachelor Degree	0.4155	0.0345***	0.4004	0.0392***	0.3627	0.0295***	0.3520	0.0352***
Level 1 to 3	0.1611	0.0219***	0.1556	0.0269***	0.1405	0.0207***	0.1409	0.0260***
Level 4	0.1716	0.0293***	0.1669	0.0330***	0.1643	0.0286***	0.1595	0.0324***
Level 5 or 6	0.2870	0.0300***	0.2915	0.0343***	0.2515	0.0272***	0.2582	0.0320***
Other	0.2642	0.0413***	0.2395	0.0426***	0.2681	0.0414***	0.2553	0.0434***
Postgraduate Degree	0.5263	0.0382***	0.5325	0.0427***	0.4672	0.0329***	0.4652	0.0371***
European	0.1259	0.0257***	0.1386	0.0285***	0.1257	0.0257***	0.1391	0.0285***
Maori	0.0242	0.0236	0.0311	0.0271	0.0238	0.0236	0.0312	0.0270
Pasifika	-0.0418	0.0273	-0.0277	0.0325	-0.0428	0.0274	-0.0258	0.0326
Asian	-0.1480	0.0322***	-0.1326	0.0357***	-0.0960	0.0303**	-0.0659	0.0338
MELAA	-0.3235	0.0785***	-0.2531	0.0797**	-0.2410	0.0748***	-0.1830	0.0769*
Other Ethnicity	0.0892	0.0481	0.1009	0.0535	0.0907	0.0483	0.1041	0.0538
Region								
Canterbury	-0.0556	0.0191**	-0.0374	0.0215	-0.0589	0.0191**	-0.0396	0.0215
North Island exc Auck/Well	-0.0944	0.0178***	-0.0932	0.0192***	-0.0961	0.0177***	-0.0932	0.0191***
South Island exc Canterbury	-0.0854	0.0232***	-0.0721	0.0250**	-0.0858	0.0232***	-0.0708	0.0251**
Wellington	-0.0136	0.0193	-0.0063	0.0205	-0.0121	0.0193	-0.0040	0.0205
Industry								
Construction	0.1699	0.0551**	0.1685	0.0557**	0.1680	0.0550**	0.1691	0.0553**
Education	-0.1003	0.0185***	-0.1051	0.0202***	-0.0981	0.0185***	-0.1024	0.0202***
Finance	0.2247	0.0275***	0.2067	0.0337***	0.2256	0.0275***	0.2081	0.0335***
Other 2	-0.1681	0.0187***	-0.1732	0.0223***	-0.1679	0.0186***	-0.1731	0.0222***
Professional Services	0.1856	0.0319***	0.1929	0.0355***	0.1878	0.0318***	0.1957	0.0355***
Public Administration	0.1975	0.0243***	0.1938	0.0255***	0.1963	0.0241***	0.1935	0.0252***
Wholesale Trade	0.0543	0.0288	0.0298	0.0287	0.0523	0.0286	0.0261	0.0284
Occupation								
Manager	0.3204	0.0242***	0.3256	0.0280***	0.3200	0.0242***	0.3265	0.0279***
Professional	0.2824	0.0186***	0.2619	0.0210***	0.2801	0.0186***	0.2615	0.0210***
Sales Workers	0.0077	0.0215	-0.0093	0.0220	0.0093	0.0213	-0.0057	0.0219
Technicians	0.0882	0.0281**	0.0933	0.0316**	0.0899	0.0280***	0.0960	0.0315**
Age of Youngest Child	0.0159	0.0041***	0.0172	0.0043***	0.0207	0.0042***	0.0243	0.0046***
Number of Dependents	-0.0594	0.0096***	-0.0696	0.0111***	-0.0498	0.0088***	-0.0603	0.0104***
Inverse Mills Ratio	0.6370	0.0870***	0.6705	0.0919***	0.5862	0.0725***	0.6702	0.0822***
Constant	0.9381	0.2438***	0.7901	0.2635**	1.2594	0.1921***	0.9889	0.2199***

Notes: Model 1 - unweighted model without heteroskedastic probit model. Model 2 - weighted model without heteroskedastic probit model. Model 3 - unweighted model with heteroskedastic probit model. Model 4 - weighted model with heteroskedastic probit model. Significance codes: * - $p < 0.1$, ** - $p < 0.05$, *** - $p < 0.01$.

A.7 *Sole Parents*

Table 15: Sole parents: participation equation

	Model 1		Model 2		Model 3		Model 4	
Variable	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
(Age/10)	1.1036	0.2154***	1.1829	0.2386***	0.7261	0.1822***	0.6981	0.1975***
$(Age/10)^2$	-0.1316	0.0273***	-0.1342	0.0305***	-0.0864	0.0227***	-0.0794	0.0236***
Highest Qualification								
Bachelor Degree	0.9354	0.1154***	0.9156	0.1379***	0.6332	0.1292***	0.5385	0.1493***
Level 1 to 3	0.4028	0.0743***	0.3850	0.0872***	0.2642	0.0690***	0.2203	0.0752**
Level 4	0.5841	0.1050***	0.5452	0.1182***	0.3916	0.0999***	0.3125	0.1107**
Level 5 or 6	0.6906	0.1083***	0.6500	0.1326***	0.4492	0.1098***	0.3750	0.1217**
Other	0.3200	0.1443*	0.3177	0.1549*	0.1987	0.1013*	0.1740	0.1053
Postgraduate Degree	1.2153	0.1659***	1.1974	0.1916***	0.8070	0.1825***	0.6920	0.2105***
European	0.3309	0.0643***	0.3393	0.0748***	0.2259	0.0566***	0.2034	0.0625***
Pasifika	0.2415	0.0966*	0.1913	0.1105	0.1592	0.0664*	0.1088	0.0662
Region								
Canterbury	0.2217	0.0967*	0.1507	0.1084	0.1643	0.0683*	0.1144	0.0658
North Island exc Auck/Well	0.1194	0.0755	0.0618	0.0849	0.0865	0.0519	0.0451	0.0508
South Island exc Canterbury	0.3707	0.1011***	0.3182	0.1123**	0.2532	0.0783***	0.1954	0.0781*
Wellington	0.1484	0.0920	0.1265	0.1057	0.0950	0.0637	0.0720	0.0635
Other Household Income	-0.0075	0.0020***	-0.0064	0.0028*	-0.0052	0.0017**	-0.0042	0.0017*
Age of Youngest Child	0.0698	0.0080***	0.0603	0.0097***	0.0489	0.0087***	0.0373	0.0094***
Number of Dependents	-0.1021	0.0316***	-0.1144	0.0345***	-0.0702	0.0235**	-0.0673	0.0248**
Constant	-3.1496	0.3929***	-3.2824	0.4361***	-2.0940	0.4164***	-1.9401	0.4827***
Variance terms								
Female					-0.4168	0.1633*	-0.5546	0.2319*
Pasifika					-0.1531	0.1468	-0.2021	0.1673

Notes: Model 1 - unweighted model without heteroskedastic probit model. Model 2 - weighted model without heteroskedastic probit model. Model 3 - unweighted model with heteroskedastic probit model. Model 4 - weighted model with heteroskedastic probit model. Significance codes: * - $p < 0.1$, ** - $p < 0.05$, *** - $p < 0.01$.

Table 16: Sole parents: wage equation

	Model 1		Model 2		Model 3		Model 4	
Variable	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Female	-0.0970	0.0308**	-0.1024	0.0339**	-0.0986	0.0308***	-0.1045	0.0339**
(Age/10)	0.3135	0.1277*	0.3391	0.1442*	0.3212	0.1396*	0.3232	0.1554*
$(Age/10)^2$	-0.0331	0.0152*	-0.0348	0.0169*	-0.0341	0.0167*	-0.0331	0.0183
Highest Qualification								
Bachelor Degree	0.6132	0.0838***	0.5629	0.0860***	0.6463	0.0996***	0.5772	0.1014***
Level 1 to 3	0.2145	0.0440***	0.1807	0.0458***	0.2211	0.0485***	0.1784	0.0497***
Level 4	0.2801	0.0673***	0.2336	0.0667***	0.2955	0.0764***	0.2333	0.0736**
Level 5 or 6	0.3387	0.0693***	0.2794	0.0697***	0.3533	0.0786***	0.2827	0.0790***
Other	0.2996	0.0574***	0.2742	0.0612***	0.2971	0.0592***	0.2659	0.0632***
Postgraduate Degree	0.7767	0.0983***	0.6921	0.1004***	0.8232	0.1190***	0.7196	0.1212***
European	0.1001	0.0401*	0.0986	0.0412*	0.1104	0.0444*	0.1030	0.0454*
Maori	-0.0365	0.0297	-0.0434	0.0320	-0.0359	0.0297	-0.0429	0.0320
Pasifika	0.0059	0.0454	-0.0284	0.0465	0.0122	0.0474	-0.0281	0.0476
Asian	-0.1859	0.0403***	-0.1792	0.0419***	-0.1894	0.0405***	-0.1844	0.0421***
MELAA	0.0467	0.0959	-0.0287	0.0902	0.0473	0.0967	-0.0319	0.0911
Other Ethnicity	-0.0581	0.0530	-0.0484	0.0686	-0.0596	0.0531	-0.0495	0.0687
Region								
Canterbury	-0.0384	0.0411	-0.0790	0.0438	-0.0239	0.0445	-0.0643	0.0473
North Island exc Auck/Well	-0.0569	0.0298	-0.0827	0.0306**	-0.0492	0.0318	-0.0773	0.0320*
South Island exc Canterbury	-0.0041	0.0417	-0.0323	0.0423	0.0134	0.0482	-0.0195	0.0487
Wellington	0.0427	0.0343	0.0185	0.0364	0.0458	0.0351	0.0192	0.0374
Industry								
Construction	0.0803	0.0534	0.0565	0.0593	0.0789	0.0532	0.0543	0.0591
Education	-0.0449	0.0314	-0.0403	0.0341	-0.0462	0.0314	-0.0430	0.0341
Finance	0.2479	0.0442***	0.2514	0.0493***	0.2475	0.0444***	0.2515	0.0496***
Other 2	-0.1092	0.0236***	-0.1188	0.0273***	-0.1104	0.0236***	-0.1195	0.0274***
Professional Services	0.2728	0.0480***	0.3046	0.0486***	0.2706	0.0480***	0.3023	0.0486***
Public Administration	0.1488	0.0462***	0.1561	0.0414***	0.1490	0.0464***	0.1547	0.0417***
Wholesale Trade	0.0272	0.0445	0.0331	0.0510	0.0261	0.0445	0.0310	0.0511
Occupation								
Manager	0.2846	0.0376***	0.2759	0.0373***	0.2841	0.0376***	0.2745	0.0375***
Professional	0.1634	0.0325***	0.1768	0.0345***	0.1640	0.0325***	0.1790	0.0346***
Sales Workers	-0.0092	0.0321	-0.0045	0.0358	-0.0085	0.0321	-0.0038	0.0358
Technicians	0.0365	0.0343	0.0040	0.0426	0.0367	0.0342	0.0039	0.0427
Age of Youngest Child	0.0196	0.0065**	0.0177	0.0061**	0.0232	0.0081**	0.0199	0.0075**
Number of Dependents	-0.0508	0.0180**	-0.0472	0.0182**	-0.0546	0.0191**	-0.0484	0.0192*
Inverse Mills Ratio	0.5088	0.1438***	0.4947	0.1478***	0.8015	0.2526**	0.8347	0.2925**
Constant	1.6437	0.4267***	1.6505	0.4621***	1.3651	0.5530*	1.4030	0.6130*

Notes: Model 1 - unweighted model without heteroskedastic probit model. Model 2 - weighted model without heteroskedastic probit model. Model 3 - unweighted model with heteroskedastic probit model. Model 4 - weighted model with heteroskedastic probit model. Significance codes: * - $p < 0.1$, ** - $p < 0.05$, *** - $p < 0.01$.

B IMPUTED WAGE CHARACTERISTICS

This appendix presents comparisons of actual and imputed wages by family type in Table 17 and comparisons between the actual and imputed wage distributions in figures 1 to 7. The figures show a violin plot, with the range of the black lines showing the 5th and 95th percentiles, the black box showing the inter-quartile range and the white dot showing the median. The gray outline shows a mirrored kernel density estimate of the underlying distribution (comparable to a smoothed histogram).

For the imputed wage estimates for those not participating we have also imputed industry and occupation. For each family type this is done using a multinomial logit model with similar covariates as the wage equation.[7] The imputed industry and occupation were chosen to be the respective category with the maximum probabilty.[8]

Table 17: Summary measures comparing actual and imputed wages by family type

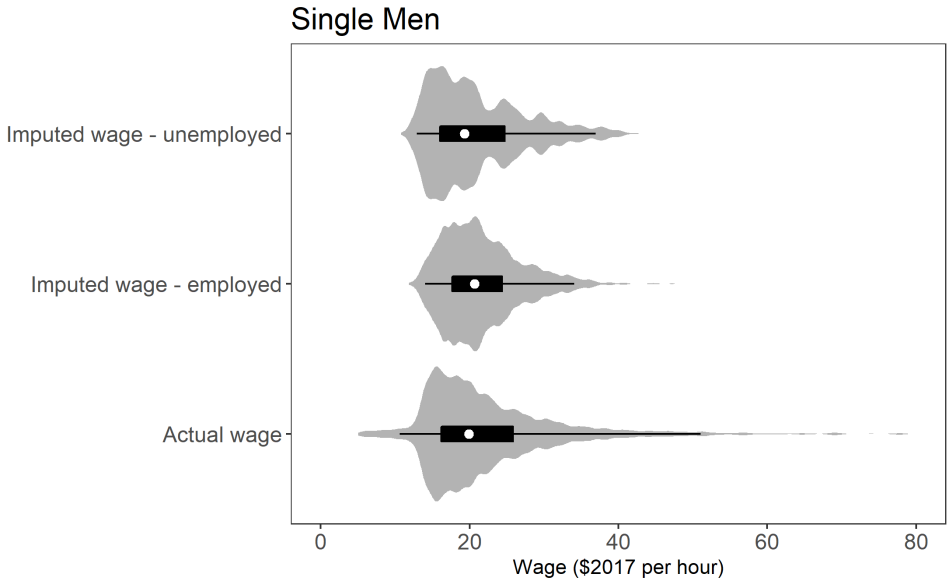
Participation	Family Type	Avg Wage	Avg Est. Wage	Median Wage	Median Est. Wage	Count	Weight
0	Couple Men		28.66		25.84	560	299,000
0	Couple Parent Men		26.41		24.35	450	218,000
0	Couple Parent Women		26.71		25.11	1,830	877,000
0	Couple Women		24.46		23.86	920	483,000
0	Single Men		20.93		19.32	940	490,000
0	Single Women		21.11		20.65	840	412,000
0	Sole Parents		20.49		18.81	1,060	479,000
1	Couple Men	30.19	27.86	25.62	26.10	4,110	1,999,000
1	Couple Parent Men	31.27	29.00	26.49	26.90	4,740	2,293,000
1	Couple Parent Women	27.06	25.15	22.88	23.95	3,380	1,639,000
1	Couple Women	25.35	23.99	22.39	22.90	3,780	1,819,000
1	Single Men	22.86	21.55	19.89	20.67	3,930	2,093,000
1	Single Women	22.84	21.81	20.29	21.02	3,640	1,753,000
1	Sole Parents	24.24	22.62	20.41	20.53	1,350	548,000

[7] The inverse Mill's ratio is also used in the estimation of the multinomial logit model.

[8] Oversampling was also used to ensure that the most frequent category did not dominate the industry and occupation imputation. This had very little impact on goodness-of-fit measures or out-of-sample prediction performance.

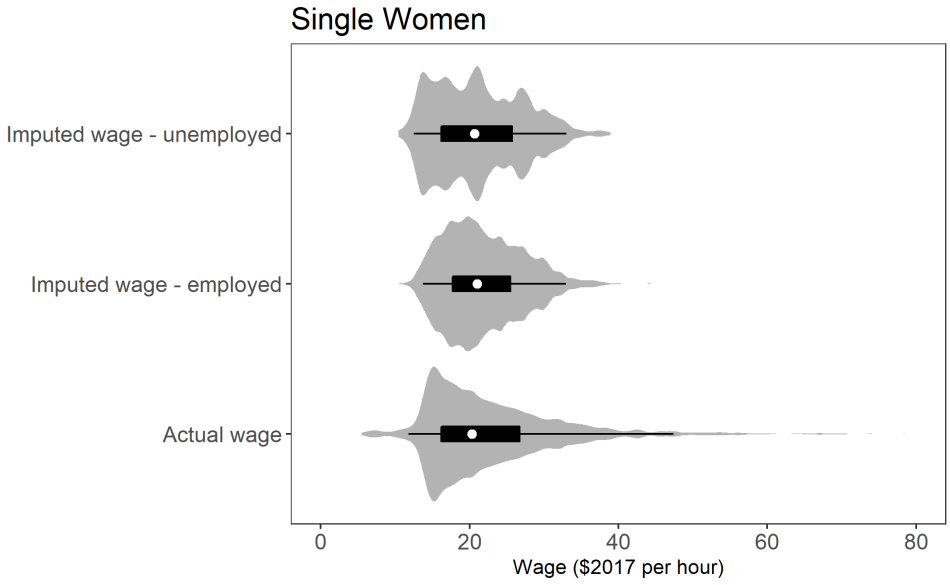
B.1 *Single males*

Figure 1: Comparison of wage distributions - Single Males



B.2 *Single females*

Figure 2: Comparison of wage distributions - Single Females



B.3 *Couple males*

Figure 3: Comparison of wage distributions - Couple Males

B.4 *Couple parent males*

Figure 4: Comparison of wage distributions - Couple parent males

B.5 *Couple females*

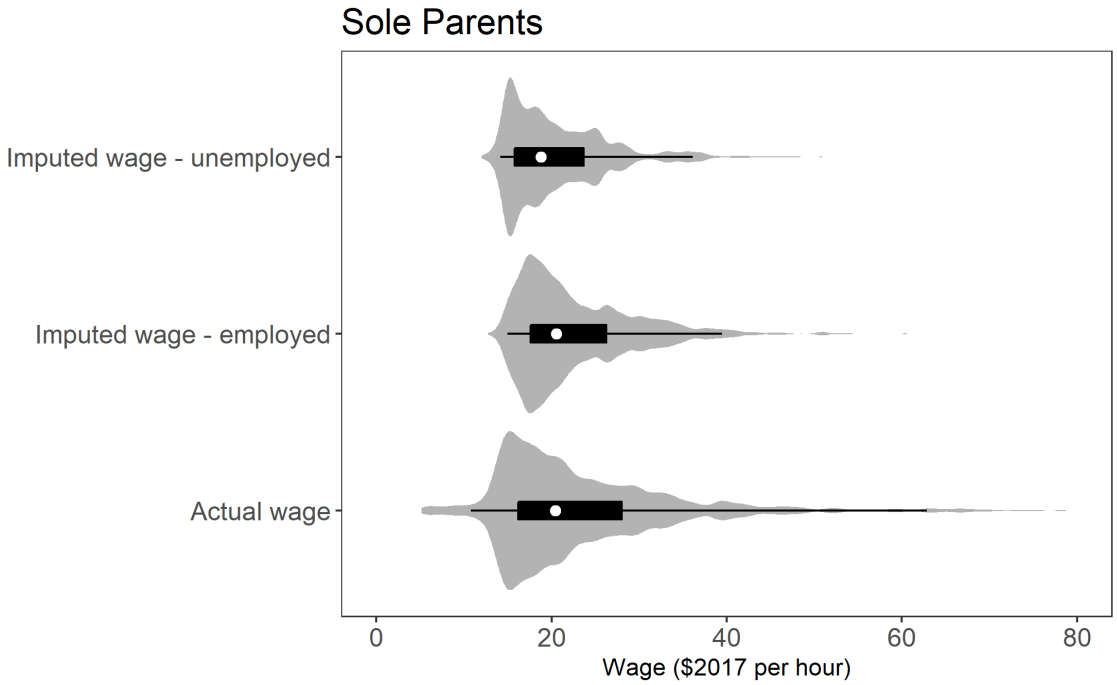
Figure 5: Comparison of wage distributions - Couple females

B.6 *Couple parent females*

Figure 6: Comparison of wage distributions - Couple parent males

B.7 *Sole Parents*

Figure 7: Comparison of wage distributions - Sole Parents



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