Final Report

Full-time work and single mothers

Sung-Hee Jeon, Roger Wilkins and Yin King Fok

Melbourne Institute of Applied Economic and Social Research

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Executive Summary

This project uses Waves 1 to 5 (2001 to 2005) of the Household, Income and Labour Dynamics in Australia (HILDA) Survey to examine the rate and determinants of female sole parent progression from part-time work to full-time work, with a particular focus on the extent to which part-time employment either helps or hinders a progression to full-time employment, and how this depends on characteristics such as the number and ages of dependent children. The analysis consists of both descriptive analysis and econometric analysis of female sole parents' labour market participation.

Descriptive analysis

The descriptive analysis uses the HILDA data to present information on the characteristics of sole parent families, labour market activity of single mothers, and longitudinal information on the frequency and nature of labour market transitions. As well as using information on labour force status at the time of interview for each wave, the longitudinal descriptive analysis makes use of the 'work calendar' available in the HILDA data. In each wave, the work calendar provides details on labour force status in each third of (at least) the 12 months immediately preceding the date of interview. This provides a complete picture of labour force status transitions over the period spanned by the HILDA data and also provides information on the extent to which the econometric analysis captures these transitions when only using data on labour force status at the time of the survey. Note, however, that the work calendar does not distinguish part-time employment from full-time employment.

We find transitions between non-employment and employment are not frequent, with sole parents averaging 1.3 transitions over the full five years of the first five waves of the HILDA Survey, and just over half of sole parents making no transitions over the period. There is, however, clear evidence that moves from non-employment to part-time employment, and from part-time employment to full-time employment, are the most frequent of the labour force status transition paths of single mothers. This is true whether the time-frame over which transitions are examined is one year (as in Table 8), three years (Table 9) or four years (Tables 9 and 10). This suggests part-time work is something of a stepping stone from non-employment to full-time employment.

However, we note that Table 11 shows that, of those not in the labour force in Wave 1, only 10 per cent were in full-time employment in Wave 5, compared with 36 per cent in part-time

employment. It is not known from the descriptive analysis what proportion of those in part-time employment in Wave 5 will ultimately make the transition to full-time employment. The descriptive analysis is therefore somewhat inconclusive as to the magnitude of the stepping-stone phenomenon, which in part motivates the econometric analysis. Nonetheless, the conclusion we draw from descriptive analysis is that there is a primary facie case for the view that part-time employment does have a stepping stone function for single mothers.

Econometric analysis

We estimate dynamic panel multinomial logit models of three labour force states: not employed, employed part-time, and employed full-time. This allows, within an integrated framework that controls for unobserved heterogeneity[1], investigation of whether part-time work represents a stepping stone to full-time employment, as well as investigation of the effects associated with ageing of children and other time-varying and time-invariant personal and household characteristics. As a prelude to this full model, we also estimate a pooled multinomial logit model, followed by a panel multinomial logit model. Neither of these models allows consideration of the stepping stone hypothesis, but they assist interpretation of the full model results, in particular showing the effects on inferences of allowing for unobserved heterogeneity and dynamic (time-dependent) processes.

Estimates of the effects of labour force status in previous years ('lagged' labour force status) on current labour force status show there are strong persistence effects in sole mothers' labour market behaviour, but nonetheless suggest that part-time employment does to some extent serve as a stepping stone to full-time employment. This is true for those with the youngest child aged under 12 years and those with the youngest child over 16 years of age. Specifically, having been working part-time in the previous wave significantly increases the probability of full-time employment in the current wave for single mothers with youngest children in these age categories. The point estimates imply part-time employment in the previous wave increases the probability of full-time employment in the current wave by between 3 and 4 percentage points if the youngest child is under 6 years of age, by between 2 and 4 percentage points if the youngest child is aged 6 to 11 years, and by between 6 and 9 percentage points if the youngest child is aged 16 years or over. No evidence of a stepping-

[1] Unobserved heterogeneity refers to differences in characteristics across persons in the sample that are unobserved but which affect labour force status, for example, an individual's innate motivation and ability.

stone function of part-time employment is found for single mothers with the youngest child in the 12-15 years age range.

We also find:

- negative effects on the probability of part-time employment associated with non-English speaking background migrant status and indigenous status;
- positive effects on the probability of full-time employment of bachelor's degree attainment;
- negative effects of disability on the probability of full-time employment;
- positive effects of a greater history of employment on both part-time and full-time employment probabilities;
- the probability of employment is decreasing in the number of dependent children and increasing in the age of the youngest child; and
- an *absence* of significant effects for duration of sole parent status, experience of difficulties obtaining suitable child care, and non-labour, non-welfare income.

Additional econometric analysis is undertaken in which we make use of the work calendar. We estimate a random effects Tobit model of the proportion of the year (up to the date of interview) the respondent was employed. This analysis considers the determination and evolution over time of full-year employment outcomes as opposed to employment outcomes at the time of interview. This model does not, however, allow investigation of the role of part-time work in facilitating transitions to full-time employment.

We find 'time in employment' is significantly lower for NESB immigrants and indigenous Australians, is increasing in educational attainment, is lower for persons with a disability, in poor health or living with a disabled person, is decreasing in the number of dependent children, increasing in the age of the youngest child and higher for those paying off a mortgage. Duration as a sole parent, child care difficulties and partner status do not appear to affect the proportion of the year employed. These estimated effects are broadly similar to those obtained in the static panel logit.

1 Introduction and motivation

This project uses Waves 1 to 5 (2001 to 2005) of the Household, Income and Labour Dynamics in Australia (HILDA) Survey to examine the rate and determinants of female sole parent progression from part-time work to full-time work. Primary emphasis is on examining single mothers with school age children, and investigating how much they increase their paid work as their children age.

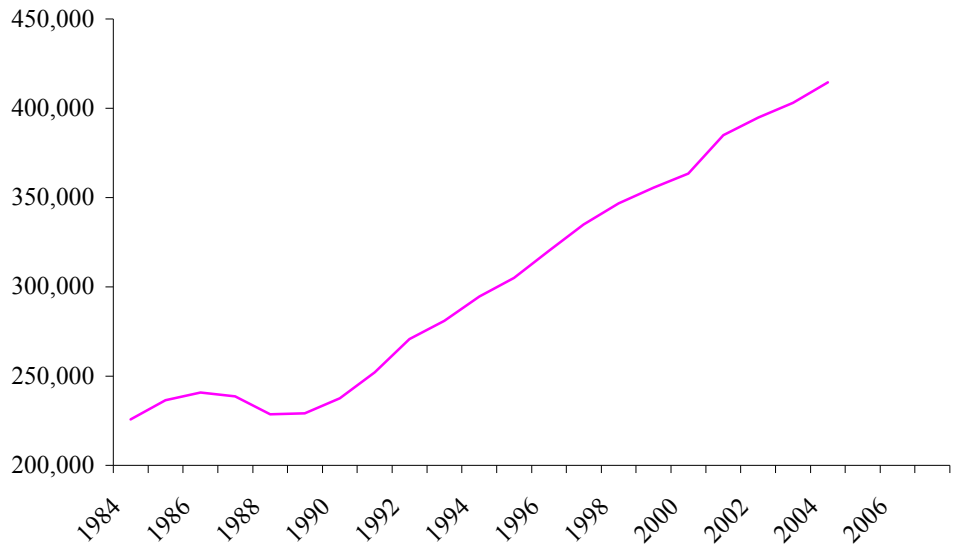
The analysis involves investigation of the determinants of the transitions to full-time employment, with a particular focus on the extent to which part-time employment either helps or hinders a progression to full-time employment, and how this depends on characteristics such as the number and ages of dependent children, location, and parent attributes such as age, educational attainment, work experience, the timing of separation from partner, and re-partnering. A key question concerns how the effect of part-time employment on transitions to full-time employment depends on the movements of dependent children into different schooling levels, especially entry to primary school and secondary school.

The aim of the Government's policies for principal carer parents is to encourage employment and reduce welfare dependency to the extent that caring responsibilities for dependent children allow. The issue has taken on increasing importance over time, as the number of sole parent families has grown, producing corresponding growth in the number of Parenting Payment Single recipients (Figure 1). This study contributes to our understanding of the circumstances in which sole parents are able to make transitions from lower levels of employment to higher levels of employment while meeting their caring responsibilities. More generally, the project provides information on the determinants of the individual labour market behaviour of PPS recipients and other sole parents and how this changes as their children age.

The focus on transitions from part-time work to full-time work stems from the uncertainty, in both an empirical and a normative sense, surrounding the role of part-time or intermittent work in fostering participation and reducing welfare dependency by parents of young children. Empirically, part-time work may be a valuable means for mothers of keeping in touch with the labour market until circumstances permit or encourage fuller participation. On the other hand, it is possible that allowing people to comfortably combine part-time work and benefits keeps them on income support payments longer than they otherwise would be. Normatively, we may think such a combination desirable in itself, regardless of any further

transition to full-time employment, as a means of allowing mothers to satisfy their caring responsibilities while maintaining adequate incomes. Alternatively, we may feel that such a situation is much less desirable than that of full-time employment, and so can only justify it if it does in practice act as a 'stepping stone'.

Figure 1: Number of female Parenting Payment Single recipients, June each year



Source: FaCSIA (2006) 'Income support customers: a statistical overview 2004,' Statistical Paper No. 3.

This project can only shed light on the first question. However, the normative issue cannot be settled unless we know what the empirical effects of policy are. This knowledge is thus a necessary but not sufficient requirement for future decisions on the 'welfare to work' agenda, especially those such as changes to income tests and mutual obligations where part time work can be expected to play a role. In addition to assisting *ex ante* decision making, the project provides essential baseline data for *ex post* evaluation of policies subsequent to the 2001-2005 period examined that set out to influence these transitions, including the July 2006 Welfare-to-Work reforms.

The plan of the report is as follows. In Section 2, we summarise the relevant Australian and overseas research on single mother labour market outcomes. Section 3 describes our approach and data. Section 4 presents results of descriptive analysis, including describing the extent and nature of single mother labour force status transitions. In Section 5, we undertake econometric analysis of the determinants of labour force status, placing primary emphasis on ascertaining the role of part-time employment in facilitating transitions from non-employment to full-time

employment. In Section 6, the work calendar is employed to estimate panel Tobit models of the proportion of the survey year the sole parent was employed. Section 7 concludes.

2 Previous research

No previous Australian research has expressly examined, using longitudinal data, the progression to full-time work of sole parents. There has, however, been some research into the nature and determinants of labour market activity of sole parents more generally. Barrett and Cobb-Clark (2001) evaluate a randomised trial of a program targeting parenting payment recipients, finding that attendance at an interview to discuss job market plans leads to increased plans to undertake education and participate in employment. They also find that the effects of the interview do not depend on whether attendance is voluntary or compulsory. Barrett (2002) uses Centrelink administrative data on sole parents to model durations on the sole parent pension (later Parenting Payment Single). Exit rates are found to be lower, and therefore spell durations higher, for females, relatively younger and older sole parents, those with little attachment to the labour market and those living in regions where the effective public housing subsidy was greatest.

Gregory et al (2003) likewise draw on administrative data on sole parents, considering the impact of the July 2000 tax and welfare reforms on take-up of welfare and employment. They conclude that the reduction in taper rates actually increased the number of sole parents on welfare, because more sole parents were eligible for partial payment at a given level of earnings. Cai et al (2005) also evaluate the effects of the July 2000 tax and welfare reforms, but use ABS income survey data and employ both quasi-experimental evaluation and microsimulation modelling techniques. They find significant positive effects on labour supply, a finding not exactly contradicting but nonetheless seemingly somewhat at odds with Gregory et al (2003), who focus on welfare receipt. In a similar vein, Doiron (2004) draws on the ABS income surveys in 1986 and 1990 to evaluate the effects of welfare reform in 1987 on sole parent labour supply using quasi-experimental evaluation methods. The reforms narrowed the definition of a dependent child for the purposes of sole parent pension eligibility, increased the income test 'free area', introduced a $1,000 earnings credit (much like the current Working Credit program) and abolished the separate income test for rent assistance. She finds large positive effects on labour force participation, but negative effects on the number of hours worked by those already employed.

Gray et al (2002) use the 1996 census to investigate the factors underlying the lower rates of employment of sole parent females compared with partnered mothers. They find that the same characteristics that are associated with lower employment rates of partnered mothers are associated with lower employment rates for single mothers, but the effects associated with these characteristics are larger for sole parent females, and more sole parents have these characteristics than do partnered mothers. Gray et al (2003) take a longer view than the other studies, examining labour force status of both single and coupled mothers over the period 1983 to 2002. They show that part-time employment grew substantially for single mothers, but the rate of full-time employment remained unchanged. By contrast, there was a significant increase in both part-time and full-time employment for partnered mothers. Baxter (2005a, 2005b) uses the data from the Negotiating the Life Course Surveys to examine mothers' employment transitions following the birth of first child, actually finding *higher* employment rates for sole parents one year after childbirth.

Internationally, recent research has primarily been concerned with the evaluation of the effects of in-work benefits on single mothers' labour supply. This is particularly the case for the US, where significant changes in welfare and social policies to encourage work by single mothers occurred in the 1980s and 1990s. Meyer and Rosenbaum (2001), using the Current Population Survey (CPS), suggest a large share of the increase in work by single mothers during 1984-1996 in US can be attributed to the Earned Income Tax Credit (EITC). They find most of the EITC policies increased hours worked. Eissa et al (2007) examine the effect of a series of US tax reforms in 1986, 1990, 1993 and 2001 on the labour supply and welfare (wellbeing) of single mothers, also using data from the CPS. They find the tax reforms created substantial welfare gains for single mothers and that almost all of the gain is generated along the participation margin – that is, increasing labour force participation of single mothers rather than increasing hours worked by single mothers already working.

UK studies evaluating the Working Families' Tax Credit (WFTC) have obtained similar results to the US studies of EITC. Using the British Household Panel Survey (BHPS), Francesconi and van der Klaauw (2007) find that the reform of WFTC in 1999 substantially increased the employment rate of single mothers, via lowering the rate of exit from employment as well as increasing the rate of entry into employment relative to single women without children. The effect was found to be biggest for mothers with one preschool child. Their findings also suggest that the generous child care credit component of the reform played a key role in increasing single mothers' employment. Blundell et al (2005), also using the

BHPS, find the reform in 1999 led to a significant increase in single mothers' hours of work compared to two earlier tax and benefit reforms in the 1990s. The also find that the increase in hours was primarily driven by women moving into higher-hours jobs rather than increasing hours worked in existing jobs.

Gonzalez (2004) examines cross country variation in single mothers' labour market participation using the Luxembourg Income Study. Differences in demographic characteristics and variation in the expected in-work income to out-of-work income ratio (essentially equivalent to the welfare replacement rate in many countries) are found to explain much of the variation in single mother employment rates across 15 western countries. Higher in-work benefits in particular are found to encourage employment of single mothers.

An issue increasingly receiving attention in economics research, that has high relevance to single mothers, is child care provision. Using the 1997 National Survey of America's Families, Tekin (2007) estimates for US single mothers the effects of both child care prices and single mother wages on part-time and full-time employment choices and paid child care usage. He find both a lower child care price and a higher full time wage rate lead to an increase in employment of single mothers and an increase the use of paid child care. The study suggests that a child care subsidy is more cost effective than a wage subsidy to generate additional hours of work for single mothers. A Swedish study by Andren (2003) likewise finds that a decrease in child care cost increases labour supply of single mothers. It is found that the increase in hours worked is driven more by increased hours of existing workers than by growth in employment participation. For the US, Connelly and Kimmel 2003 and Han and Waldfogel 2001 find that child care costs have a lager effect on employment for single mothers than for married mothers. Connelly and Kimmel (2003), using the Survey of Income and Program Participation (SIPP), further find that full-time employment is more elastic with respect to changes in child care price than part-time employment for both single and married mothers.

Wolfe and Hill (1995) suggest, based on data from SIPP, that the health of single mothers and their children is an important determinant of their decision to work. Using the Families and Children Study (FACS) and the BHPS, Paull (2007) examines the relationships between partnership transitions and changes in both labour force participation and weekly hours of work across different type of mothers, as well as drawing comparisons with childless women. The study suggests that partnership transitions are unlikely to be an important factor in explaining the substantial differences in work behaviour between mothers. However, the strong association

between separations and unusually high rates of work exit is observed only for mothers, suggesting that separations are a period of disruption specific to the movement into lone parenthood. The findings also suggest that single mothers who find a new partner are more likely to be working prior to becoming partnered than are mothers who remain single.

International research considering the role of part-time work for single mothers as a stepping stone to full-time work appears to be very limited. Bell et al (2007) review a variety of UK studies in order to find evidence on the potential of mini-jobs, defined to be jobs of fewer than 16 hours per week, to be stepping stones to longer hours of work for UK lone mothers. Their review suggests that the evidence on the stepping-stone role of mini-jobs is inconclusive. Studies that do not address sole parents directly, but instead have the more generic focus of female labour supply, include Blank (1998) and Buddelmeyer et al (2005). Blank (1998), examining the period 1976 to 1989, estimates that about 20% of women in the US use part-time jobs as transitory jobs before moving into full-time work. Buddelmeyer et al (2005), using the European Community Household Panel for the period 1994 to 1999, suggest that the probability of remaining in part-time work (defined as fewer than 30 hours per week) is considerably higher among women in the EU than among women in the US. They suggest that Europeans more frequently view part-time jobs as (relatively) permanent jobs.

3 Data and approach

The study draws on Waves 1 to 5 of the HILDA Survey.[2] The analysis consists of descriptive analysis and econometric analysis of female sole parents' labour market participation, particularly focusing on transitions between non-employment, part-time employment and full-time employment. A single mother is defined to be a woman living with one or more of her own dependent children and not living with a partner. A child living with his or her mother is defined to dependent if under 15 years of age or if aged 15-24 years and in full-time study (and not employed full-time or living with a partner or a child of his or her own). These definitions are consistent with the ABS approach to defining sole parent families.

Labour force status is the key outcome of interest for this study. In common with the ABS Labour Force Survey, used to produce official employment and unemployment statistics, the

[2] Wave 6 data became available in early February 2008, which was too late for inclusion in this study, for which much of the analysis had already been conducted by that point in time. An advantage of restriction to Waves 1-5 is that the entire period pre-dates the Welfare to Work reforms implemented in July 2006, thereby providing valid pre-reform baseline evidence.

HILDA Survey does not directly ask respondents their labour force status. Instead, labour force status is derived from a number of questions on labour market activity. These questions establish first whether a respondent is employed, then the number of hours worked per week for those employed (which determines full-time/part-time status) and finally, for those not employed, whether the respondent is seeking and available for work (which determines whether the respondent is unemployed or out of the labour force).

The descriptive analysis uses the HILDA data to present information on the characteristics of sole parent families, labour market activity of sole parents, and longitudinal information on the frequency and nature of labour market transitions. As well as using information on labour force status at the time of interview for each wave, the longitudinal descriptive analysis makes use of the 'work calendar' available in the HILDA data. In each wave, the work calendar provides details on labour force status in each third of (at least) the 12 months immediately preceding the date of interview. This provides a complete picture of labour force status transitions over the period spanned by the HILDA data and also provides information on the extent to which the econometric analysis captures these transitions when only using data on labour force status at the time of the survey. Note, however, that the work calendar does not distinguish part-time employment from full-time employment.

The econometric analysis seeks to answer the questions posed in the introduction on the determinants of transitions to full-time employment by sole parents. To this end, we estimate dynamic panel multinomial logit models of three labour force states: not employed, employed part-time, and employed full-time. This allows, within an integrated framework that controls for unobserved heterogeneity, investigation of whether part-time work represents a stepping stone to full-time employment as well as the effects associated with ageing of children, and the effects associated with other time-varying and time-invariant personal and household characteristics.[3] As a prelude to this full model, we also estimate a pooled multinomial logit model, followed by a panel multinomial logit model. Neither of these models allows consideration of the stepping stone hypothesis, but they assist interpretation of the full model results, in particular showing the effects on inferences of allowing for unobserved heterogeneity and dynamic (time-dependent) processes. Full details on the econometric methods for the multinomial logit models are provided in Section 5.

[3] Alternative model specifications were tested but we restrict reporting to the core specification because it contains the most appropriate variable inclusions and few sensitivities to various inclusions and exclusions were evident.

Additional econometric analysis is undertaken in Section 6, in which we make use of the work calendar. We estimate a panel Tobit model of the proportion of the year (up to the date of interview) the respondent was employed. This analysis considers the determination and evolution over time of full-year employment outcomes as opposed to employment outcomes at the time of interview, the focus of the Section-5 analysis. It recognises that employment over the course of the year is of greater relevance than employment at a particular point in time. The limitations of this approach include the inability to consider transitions between full-time employment, part-time employment and non-work states – both because the work calendar does not distinguish between part-time and full-time employment and because the dependent variable is continuous (between zero and one).

Sample sizes are given in Table A1 in the Appendix. The sample for the descriptive analysis varies depending on the nature of the analysis. Cross-sectional results relate to persons who are single mothers at the time of interview, while the longitudinal results are for a balanced panel of persons who were single mothers in Wave 1. The sample sizes for the cross-sectional analysis range between 491 and 523, and the sample size for the longitudinal analysis is 355.

Alternative sample selection rules for the longitudinal analysis are of course available. Perhaps the most compelling alternative approach is to select persons who were single mothers in all of the waves relevant to the particular analysis. For example, when examining Wave 1-Wave 2 transitions, all those who were single mothers in both of these waves could be included; whereas for examination of transitions across all five waves, those who were single mothers in all five waves would be included in the sample. The decision to instead examine those who were single mothers in Wave 1, irrespective of their subsequent family status, was motivated by a desire to keep the group under study constant across all of the analysis. This ensures that differences in patterns across waves or across different time-spans actually reflect differences in time-period or time-span, rather than differences in the composition of the sample across the individual pieces of analysis. A more restrictive version of this approach would be to restrict to those who were single mothers in all five waves, but this unduly limits the sample size.

The sample for the econometric analysis comprises the 456 individuals who responded to the survey in all five waves and were sole parents in at least one of the waves. Clearly, this inclusive approach results in observations in which the respondent is not a sole parent, most commonly because she is living with a partner. We address this issue by including a partner status variable in the estimating equations, and interacting this with the variables for the

number and ages of dependent children.[4] That is, we retain in the estimation sample sole parents who were at some staged partnered and include partner status as an explanatory factor for labour force status. Alternative approaches would be to exclude observations where a person is not a sole parent in that particular wave or exclude from the sample altogether persons who are not sole parents for the entire five waves. Neither approach is preferable to the approach we take, because each introduces selection (or censoring) into the sample on a characteristic (essentially, propensity to be partnered) that is unlikely to be random with respect to labour force status. Our approach is also consistent with that taken by other studies (e.g., Francesconi and van der Klaauw 2007).

To provide an indication of the potential nature and magnitude of the problem with respect to sole parent partnering, the top panel of Table 1 considers changes in partner status for those who were single mothers in Wave 1. We see that partnering is a significant phenomenon over the five year period. For example, 20 per cent of single mothers in Wave 1 were partnered in Wave 5. Accounting for partnering is therefore important; but equally, it is important not to exclude those who partner, or those periods in which they are partnered, because it has the potential to cause severe sample selection biases. This adds support to the chosen strategy of including all those ever observed to be sole parents, retaining them in periods in which they are partnered, but including partner status as an explanatory variable and interacting it with other characteristics.

The second panel of Table 1 shows partner status transitions for women who meet the sample inclusion criterion for the econometric models of ever being observed to be single mothers in the five waves of the survey. For this group, 30 per cent were partnered in Wave 1, falling to 19 per cent in Waves 4 and 5. To complete the picture of partner status transitions of mothers, we also present in the bottom panel of Table 1 information on transitions by mothers who were partnered in Wave 1. We see that over 8 per cent of these mothers were single by Wave 5.

[4] In principle, all covariates should be interacted with partner status and dependent children status, but – as we discuss in Section 5 – the econometric estimation software available restricts the number of covariates that can be included. In any case, it is in practice not necessary to include interactions with other variables. Most sample members are sole parents for most or all of the five waves, so the estimates for uninteracted variables can reasonably be interpreted as capturing effects of those variables for sole parents.

Table 1: Marital status of mothers by wave (balanced panel) (%)

	Legally Married	De facto	Single
A. Single mothers in Wave 1			
Wave 1	0.00	0.00	100.00
Wave 2	3.10	6.76	90.14
Wave 3	4.23	10.14	85.63
Wave 4	6.76	9.86	83.38
Wave 5	9.58	10.42	80.00
Mothers who had ever been single			
Wave 1	21.73	8.29	69.98
Wave 2	15.10	10.13	74.77
Wave 3	12.71	9.76	77.53
Wave 4	9.94	9.21	80.85
Wave 5	8.84	9.94	81.22
Coupled mothers in Wave 1			
Wave 1	89.97	10.03	0.00
Wave 2	87.68	8.19	4.13
Wave 3	86.42	7.36	6.22
Wave 4	85.20	7.46	7.33
Wave 5	84.46	7.19	8.35

Note: Sample A comprises a balanced panel of 360 women who were single mothers in Wave 1. Sample B comprises a balanced panel of 563 women who were observed to be single mothers in any of the five waves. Sample C comprises a balanced panel of 1585 women who were partnered mothers in Wave 1.

4 Descriptive analysis

4.1 Basic facts

We begin by providing descriptive cross-sectional information. Table 2 describes the demographic characteristics of single mothers compared with partnered mothers in Waves 1, 3 and 5. While there are some differences in the characteristics of single mothers compared with partnered mothers, it is also clear that single mothers are not drastically different in characteristics from partnered mothers. The biggest difference is that the rate of income support receipt of single mothers is in excess of 60%, compared with less than 15% for partnered mothers. Also notable is that single mothers have a more dispersed age distribution than partnered mothers, with greater proportions aged in their twenties and their forties, and a lower proportion in their thirties. Relative to single mothers, partnered mothers also tend to have more dependent children, and the age of the youngest child tends to be lower (which possibly reflects the fact that many single mothers were originally partnered and so were in the partnered category when the youngest was very young).

Table 2: Demographic attributes of single mothers compared with partnered mothers

	Single mothers			Partnered mothers		
	Wave 1	Wave 3	Wave 5	Wave 1	Wave 3	Wave 5
Age group						
15-19	1.53	2.03	2.04	0.46	0.37	0.44
20-24	8.60	5.69	8.55	2.51	2.71	3.13
25-29	15.87	11.79	9.57	9.87	9.07	7.74
30-39	31.93	31.91	33.60	46.80	42.76	41.95
40-49	42.07	48.58	46.23	40.36	45.09	46.73
50 and above	1.53	2.03	2.04	0.46	0.37	0.44
Mean age	36.78	38.61	38.06	37.91	38.49	38.89
Education						
Year 10 and below	35.56	30.28	26.48	27.51	22.81	20.32
Year 11-12	22.94	21.75	21.18	28.43	27.48	25.43
Certificate	26.58	30.89	35.44	21.89	24.56	25.97
Degree+	14.91	17.07	16.70	22.03	25.04	28.28
Undetermined	0.00	0.00	0.20	0.14	0.11	0.00
Number of dependent children						
1	48.69	48.02	47.52	31.47	30.70	31.57
2	31.53	34.72	35.64	42.36	43.50	44.21
3 or more	19.78	17.26	16.83	26.16	25.80	24.21
Mean no. of dependent children	1.83	1.77	1.79	2.07	2.06	2.03
Age of youngest dependent child						
Less than 6	38.43	33.74	34.42	46.53	44.19	43.44
6-11	30.98	31.50	30.75	28.66	29.07	28.39
12-15	16.83	18.90	20.37	14.44	14.22	16.36
16 and above	11.66	13.62	11.41	9.46	10.98	9.83
Undetermined	2.10	2.24	3.05	0.91	1.54	1.98
Mean age of youngest	7.89	8.53	8.18	7.05	7.22	7.27
IS recipient	68.64	62.20	61.91	14.76	11.14	11.59
Location						
Major city	62.33	60.78	58.45	61.33	61.01	60.96
Inner regional	24.67	23.98	27.09	24.13	25.41	26.19
Outer regional	13.00	15.24	14.46	14.53	13.58	12.85
ESB immigrant	8.99	8.74	8.55	9.78	8.81	8.40
NESB immigrant	15.68	13.21	12.22	16.27	14.96	14.50
Duration of sole parent status*						
Less than 1 yr	7.65	3.46	4.48			
1 yr	6.88	9.15	3.87			
2 yr	5.35	6.91	5.30			
3-4 yrs	10.13	8.13	11.20			
5-10 yrs	17.02	20.53	16.90			
More than 10 yrs	13.38	14.02	12.22			
Undetermined	39.59	37.80	46.03			
Mean duration	6.33	6.82	6.91			
Number of Observations	523	492	491	2,188	1,885	1,821

Note: * Length of time elapsed since last partnered or without dependent children

Table 3 compares (cross-sectional) labour market outcomes of single mothers and partnered mothers. Full-time employment rates are similar for the two groups, but the rate of part-time employment is considerably higher for partnered mothers. Both the proportions unemployed and out of the labour force are higher for single mothers. Mean annual labour income is correspondingly somewhat lower for single mothers: in Wave 5, for example, it is $17,500 compared with $21,000 for partnered mothers.

Table 3: Labour market outcomes of single mothers compared partnered mothers

	Single mothers			Partnered mothers		
	Wave 1	Wave 3	Wave 5	Wave 1	Wave 3	Wave 5
All persons						
Number of Observations	523	492	491	2,188	1,885	1,821
Labour force status						
Full time	21.61	25.00	23.63	23.90	24.83	26.41
Part time	27.92	29.67	31.98	39.21	39.15	42.72
Unemployed	6.12	6.30	6.52	2.61	2.28	2.25
Not in labour force	44.36	39.02	37.88	34.28	33.74	28.61
Casual employee	14.72	14.63	13.44	15.68	13.74	13.95
Proportion of life employed	0.58 (0.013)	0.60 (0.014)	0.58 (0.014)	0.67 (0.006)	0.68 (0.006)	0.69 (0.006)
Proportion of life unemployed	0.06 (0.006)	0.05 (0.006)	0.07 (0.006)	0.02 (0.002)	0.03 (0.002)	0.03 (0.002)
Proportion of life out of labour force	0.36 (0.013)	0.35 (0.013)	0.35 (0.013)	0.31 (0.006)	0.29 (0.006)	0.28 (0.006)
Annual labour income	14,345.25 (922.83)	16,865.97 (1019.06)	17,545.60 (986.07)	17,912.75 (475.85)	18,682.84 (509.87)	20,940.52 (551.10)
Part-time workers						
Hrs worked	18.49 (0.714)	20.20 (0.718)	20.61 (0.628)	18.68 (0.284)	18.79 (0.295)	18.57 (0.298)
Hourly wage (2005$)	17.43 (0.837)	19.51 (0.767)	20.11 (0.836)	24.17 (0.825)	23.39 (0.649)	26.42 (1.653)
Full-time workers						
Hrs worked	41.20 (0.529)	44.02 (1.076)	42.74 (0.771)	42.92 (0.429)	42.85 (0.420)	42.54 (0.405)
Hourly wage (2005$)	19.70 (0.763)	21.41 (0.902)	21.04 (0.822)	20.03 (0.383)	20.73 (0.417)	21.86 (0.442)

Note: Standard errors in parentheses. 'Proportion of life' variables refer to the period since leaving full-time education for the first time.

The patterns evident at a point in time appear to also hold over the longer term, as indicated by the average proportion of time since leaving full-time education spent employed, unemployed and out of the labour force. Partnered mothers on average spent 10% more of their time working than single mothers. Mean hourly wages of full-time workers are similar for single and partnered mothers, but among part-timers, mean hourly wages are substantially higher for partnered mothers.

Tables 4 and 5 examine single-mother labour force status by number of dependent children and age of youngest child, respectively. As might be expected, the rate of employment – particularly full-time employment – is decreasing in the number of dependent children and the

rate of non-participation in the labour force is increasing in the number of dependent children. The likelihood of full-time employment is also increasing in the age of the youngest child, rising from under 14% when the youngest child is under 6 years of age to in excess of 37% when the youngest child is over 16 years of age. This pattern is not so clearly evident for part-time employment. While, consistent with the full-time employment rate, the part-time employment rate is generally lowest for single mothers with a dependent child under 6 years of age, there is then a substantial increase in the rate of part-time employment for those with the youngest child in the 6-11 years age range, after which there is no consistent pattern in the rate of part-time employment as the age of the youngest child increases.

Table 4: Labour force status of single mothers by number of dependent children (%)

	Wave 1			Wave 3			Wave 5		
	1 child	2 children	3+ children	1 child	2 children	3+ children	1 child	2 children	3+ children
Full-time	28.17	19.76	8.65	32.49	20.93	12.05	27.54	23.70	12.20
Part-time	31.35	25.15	24.04	29.54	31.40	26.51	31.78	34.10	28.05
Unemployed	7.94	4.79	3.85	5.06	6.40	9.64	6.36	6.94	6.10
Not in LF	32.54	50.30	63.46	32.91	41.28	51.81	34.32	35.26	53.66

Table 5: Labour force status of single mothers by age of youngest child (%)

	Wave 1				Wave 3				Wave 5			
	<6 years	6-11 years	12-15 years	16+ years	<6 years	6-11 years	12-15 years	16+ years	<6 years	6-11 years	12-15 years	16+ years
Full-time	9.45	22.84	32.95	42.62	13.25	21.29	34.41	50.75	10.65	21.19	42.00	37.50
Part-time	22.39	35.19	29.55	26.23	22.89	37.42	38.71	16.42	23.08	40.40	31.00	37.50
Unemployed	8.46	2.47	4.55	11.48	7.83	7.74	4.30	2.99	4.14	9.93	8.00	1.79
Not in LF	59.70	39.51	32.95	19.67	56.02	33.55	22.58	29.85	62.13	28.48	19.00	23.21

4.2 Patterns of labour market activity over time

We now turn to describing longitudinal patterns of labour market activity. This provides information on the extent and nature of labour force status transitions made by single mothers, and provides preliminary evidence on the extent to which part-time employment promotes or inhibits movements into full-time employment.

Table 6 draws on the 'work calendar' collected by the HILDA Survey to examine the distribution of the number of transitions between work and non-work in the 12 months preceding the survey interview. The work calendar obtains at least 12 months of data on

whether the respondent was in employment and/or full-time education in each third of each month. Hence, in total, 36 periods of data are used for each individual in a given wave.

Table 6: Number of single mother transitions between work and non-work in the preceding 12 month period – Based on work calendar

	Mean	10^{th} percentile	50^{th} percentile	90^{th} percentile	Mean | at least 1 transition	Percentage that had at least 1 transition	Sample size
Wave 1	0.2	0	0	1	1.6	15.2	501
Wave 2	0.3	0	0	1	1.5	18.7	471
Wave 3	0.3	0	0	1	1.5	17.4	483
Wave 4	0.3	0	0	1	1.5	17.7	474
Wave 5	0.3	0	0	1	1.6	22.2	483

Table 6 supplement: Occurrence of missing periods in work calendar

	Proportion that had at least 1 period of missing data (%)	Mean no. of periods missing among those with at least 1 period missing
Wave 1	47.78	5
Wave 2	5.71	13
Wave 3	5.75	12
Wave 4	4.61	12
Wave 5	5.97	10

Note: 36 periods in a 12-month window.

The calendar does not distinguish part-time employment from full-time employment, nor unemployment from non-participation in the labour force, so only transitions between work and non-work can be considered. However, its key advantage is that all transitions between work and non-work should, in principle, be captured. Use of information on labour force status at the time of interview (the primary focus of the study) will potentially miss some transitions. For example, a person who is employed at the time of the Wave-1 interview, moves out of employment shortly after the interview, and then moves back into employment shortly before the Wave-2 interview, will have made two transitions, neither of which will be picked up by comparing labour force status at the time of the Wave-1 interview with labour force status at the time of the Wave-2 interview. The work calendar will therefore provide information on the number of transitions that are missed by only considering labour force status at the time of interview (although, as noted, it cannot identify movements between part-time and full-time employment, and between unemployment and non-participation).

Using the calendar, a transition between work and non-work is defined to occur when a person is employed for the whole of one period and is not employed for the whole of the next period, or vice versa. We address missing calendar data by excluding individuals missing data for more than nine periods, which translates to more than one-quarter of the 36 periods

required for a complete 12-month history. The Table 6 Supplement provides information on the prevalence of missing data.

The strong impression from Table 6 is that transitions between work and non-work are not particularly common. The proportion making at least one transition in the preceding 12 months ranged from 15 per cent in Wave 1 to 22 per cent in Wave 5. Among those that made a transition, the mean number of transitions was approximately 1.5.

Table 7 provides essentially the same information as Table 6, except that it uses all five waves of the HILDA Survey as the observation window and restricts analysis to a sample of individuals who are interviewed in all 5 waves (a 'balanced panel'). As in Table 6, the information on transitions comes from the work calendar. It shows that just under half of these individuals made at least 1 transition between work and non-work during the five years. The mean number of transitions is, at 1.3, still not high.

Table 7: Number of transitions between work and non-work for single mothers across the entire 5 waves of HILDA – Based on work calendars of a balanced panel

Mean	25th percentile	50th percentile	75th percentile	Percentage that had at least 1 transition
1.3	0	0	2	48.4

Note: Sample size=355

In Table 8, we present descriptive statistics on labour force status transitions from one wave to the next, using the information on labour force status at the time of interview. As discussed earlier, this approach potentially misses some transitions, but it allows us to examine transitions between four labour force states rather than two.[5] The table provides the percentage breakdown of all possible transition pathways between each pair of successive waves. Each panel corresponds to a wave-pair, with the main diagonal actually capturing non-transitions, and transitions captured by the remaining estimates. For each wave-pair, the numbers add up to 100. Thus, for example, the top panel indicates that 18 per cent of single mothers were employed full-time in both Waves 1 and 2, while 3.5 per cent moved from part-time employment in Wave 1 to full-time employment in Wave 2, compared with 1.5% moving from full-time employment to part-time employment.

[5] Note also that it is this information that is used for the econometric modelling.

Table 8: Short-term transitions in labour force status (% in each transition combination)

		Labour force status in Wave *t + 1*			
		Full-time	Part-time	Unemployed	Not in labour force
Labour force status in Wave t		*Wave 1 – Wave 2 transitions*			
	Full time	18.06	1.54	0.66	0.44
	Part time	3.52	24.01	0.88	1.76
	Unemployed	0.44	1.32	1.32	2.42
	Not in Labour Force	0.88	5.07	3.74	33.92
		Wave 2 – Wave 3 transitions			
	Full time	18.83	3.59	0.45	1.79
	Part time	4.71	20.85	1.35	4.04
	Unemployed	0.67	1.57	1.57	3.14
	Not in Labour Force	1.35	3.81	2.69	29.60
		Wave 3 – Wave 4 transitions			
	Full time	19.59	1.35	0.90	1.35
	Part time	3.83	22.97	1.13	3.60
	Unemployed	0.68	2.25	1.35	3.38
	Not in Labour Force	1.58	2.93	3.83	29.28
		Wave 4 – Wave 5 transitions			
	Full time	18.10	2.49	0.68	1.13
	Part time	3.39	22.17	0.68	3.62
	Unemployed	0.68	2.26	2.26	2.26
	Not in Labour Force	2.04	6.33	2.94	28.96

Note: Table uses labour force status at the time of interview to identify transitions. Each panel adds up to 100%.

Consistent with the findings from the work calendar, there is a high degree of persistence in labour force status evident: the numbers on the main diagonal are clearly the largest. Adding up the estimates for transitions between work and non-work, we find that the proportion making a transition from one wave to the next was 12 per cent between Waves 1 and 2, 15 per cent between Waves 2 and 3 and between Waves 3 and 4, and 17 per cent between Waves 4 and 5. Comparison with the estimates obtained from the work calendar (Table 6) implies that approximately 80 per cent of the transitions (between work and non-work) are captured by examining labour force status at the time of interview.

Despite the high persistence in labour force status, some notable features of transition paths are evident in Table 8 (in which transitions are given by statistics off the main diagonal). Two of the consistently most-popular transition paths are from non-participation to part-time employment, and from part-time employment to full-time employment. For example, 5.1 per cent of sole parents in Wave 1 made the transition from out of the labour force in Wave 1 to part-time work in Wave 2, and 3.5 per cent made the transition from part-time work to full-time work. Also notable is that part-time employment is the main destination for those exiting full-time employment – for example, amounting to 1.5 per cent of all Wave-1 sole parents – while there is little flow from full-time employment to non-participation, but a sizeable flow

from part-time employment to non-participation. It therefore seems that part-time employment does indeed play some kind of intermediate stepping stone function between non-employment and full-time employment – more commonly *from* non-employment *to* full-time employment than in the reverse direction.

Table 9 provides essentially the same information as Table 8, except that it examines three- and four-year transitions – that is, it compares labour force status in one year with labour force status three years later, and with labour force status four years later. As might be expected, greater mobility in labour force status is evident, but the general patterns evident in Table 8 for the most part still hold. The main qualitative exception is that the transition from unemployment to full-time employment is as common as the transition from unemployment to part-time employment when the longer observation window is employed. This is consistent with part-time employment playing a stepping stone role, since – as Table 8 indicates – many of those who made the transition from unemployment in Wave *t* to full-time employment in Wave *t+3* or Wave *t+4* did so via part-time employment in the intervening waves.

Table 9: Medium-term transitions in labour force status (% in each transition combination)

		Labour force status in Wave *t + 3 (or Wave t + 4)*			
		Full-time	Part-time	Unemployed	Not in labour force
		Wave 1 – Wave 4 transitions			
	Full time	14.61	2.47	0.90	3.37
	Part time	7.19	17.75	0.90	5.17
	Unemployed	1.12	1.57	0.67	1.57
	Not in Labour Force	2.92	7.19	4.94	27.64
Labour		*Wave 2 – Wave 5 transitions*			
force	Full time	13.69	4.87	0.46	3.25
status	Part time	7.66	17.87	0.70	4.41
in	Unemployed	1.39	1.16	1.16	3.94
Wave t	Not in Labour Force	2.09	9.05	3.94	24.36
		Wave 1 – Wave 5 transitions			
	Full time	12.13	4.12	0.00	3.43
	Part time	9.15	16.25	1.14	4.81
	Unemployed	1.37	1.37	0.46	2.52
	Not in Labour Force	2.97	11.21	4.81	24.26

Note: Table uses labour force status at the time of interview to identify transitions. Each panel adds up to 100%.

Table 10 presents, for each *initial* (Wave-1) labour force state, the proportion in each labour force state in Wave 5. It allows us to examine 'where people end up' given each starting position. For example, in the first row we see that 62 per cent of the 79 single parents employed full-time in Wave 1 were also employed full-time in Wave 5, while 21 per cent were employed part-time and 17 per cent were not in the labour force in Wave 5. It simply

reproduces the information in the bottom panel of Table 9, but with each row summing to 100 rather than the entire panel summing to 100. It shows a relatively high transition rate from part-time employment to full-time employment and from not in the labour force to part-time employment. Both of these patterns are consistent with part-time employment serving as an intermediate step between non-participation and full-time employment.

Table 10: Wave-5 labour force status – By initial (Wave-1) labour force status (%)

	Wave-5 LF status					No. of obs.
	Full time	Part time	Unemployed	Not in LF	Total	
Initial (Wave-1) LF status						
Full time	61.63	20.93	0.00	17.44	100.00	79
Part time	29.20	51.82	3.65	15.33	100.00	110
Unemployed	24.00	24.00	8.00	44.00	100.00	18
Not in Labour Force	6.88	25.93	11.11	56.08	100.00	148

Note: Table uses labour force status at the time of interview to identify transitions.

Table 11 shows, for each initial labour force status group, the proportion who ever subsequently switched to other categories. This allows for within-five-year transitions that are not evident from simply comparing the Wave-1 and Wave-5 labour force status outcomes. Note that a person could have as many as four transitions over the five waves and so could, in principle, appear in all three of the columns corresponding to labour force states other than the Wave-1 state. That is, it is theoretically possible for a row to sum to 300. The table further emphasises the importance of movements from part-time employment to full-time employment and from non-participation to part-time employment, but it also identifies several other notable aspects of single mother labour force transitions.

First, it suggests that unemployment is a common destination, at least as an intermediate destination, for those who start out as non-participants. Second, a high proportion (29 per cent) of part-time workers in Wave 1 moved to non-participation at some stage of the next four Waves. Third, a high proportion (25 per cent) of full-time workers in Wave 1 moved to part-time employment in the subsequent four Waves. Finally, it is evident from adding up the estimates in each row of the table that subsequent mobility across labour force states is greatest for those unemployed in Wave 1 and lowest for those employed full-time in Wave 1.

Table 11: Proportion making a transition to each labour force state – By initial (Wave-1) labour force status (balanced panel) (%)

	Destination LF status				No. of obs.
	Full time	Part time	Unemployed	Not in LF	
Initial (Wave 1) LF status					
Full time	-	25.32	2.53	10.13	79
Part time	41.82	-	10.91	29.09	110
Unemployed	38.89	61.11	-	50.00	18
Not in Labour Force	10.14	35.81	27.03	-	148

Note: Table uses labour force status at the time of interview to identify transitions.

Table 12 presents a variation on Table 11 in which only the *first* transition is considered. The numbers obtained are of course smaller than obtained in Table 11, but inferences are not substantially affected. The main insight is that, when restricting to the first transition, the transitions from non-participation to unemployment and to part-time employment become relatively more important, and those from non-participation to full-time employment become relatively less important. As with the evidence presented in Tables 8-11, this is consistent with a 'stepping stones' view of transitions from non-participation to full-time employment via part-time employment. The conclusion to be drawn from the longitudinal descriptive analysis is that there is a prima facie case for this view of the role of part-time employment for single mothers.

Table 12: Proportion making a transition to each labour force state as their *first* transition – By initial (Wave-1) labour force status (balanced panel) (%)

	First transition destination				No. of obs.
	Full time	Part time	Unemployed	Not in LF	
Initial (Wave 1) LF status					
Full time	-	21.52	1.27	7.59	79
Part time	33.64	-	3.64	25.45	110
Unemployed	22.22	38.89	-	33.33	18
Not in Labour Force	4.73	25.68	21.62	-	148

Note: Table uses labour force status at the time of interview to identify transitions.

5 Econometric models of labour force status

We estimate models of the determinants of sole mother labour force status, distinguishing three labour force states: full-time employed, part-time employed, and not employed. We begin with a simple pooled multinomial logit model that essentially treats the data as a cross-section, then estimate panel models that allow for unobserved individual effects – that is, effects of unobserved characteristics that affect labour force status, such as innate ability and

motivation.[6] The first of the panel models is 'static' in the sense that past labour force status is assumed not to impact on current labour force status. We then go on to estimate dynamic panel models that allow for such path dependencies. These are our main models which allow investigation of the 'stepping stones' hypothesis. The pooled and static panel models are primarily reported to assist interpretation of the main results.

The included explanatory variables are constrained in number by the limited sample size of 456 in total across the five waves. More constraining, however, is that the econometric software used to estimate the dynamic panel logit models, *Limdep*, has a 100-parameter limit for estimation of these models. When modelling three outcomes, as is the case in this study, the 100-parameter limit translates to an upper limit of 50 explanatory variables. Given this constraint, the explanatory variables included in all of the estimated models are as follows:

1. Age dummy variables. The following age categories (in years) are distinguished: 15-24 (omitted dummy); 25-29; 30-34; 35-39; 40-44; 45 and over. It is not clear ex ante how labour force status of sole parent females depends on age. For females overall there are clear age patterns in non-employment, part-time employment and full-time employment. However, these patterns may not apply to sole parent females, for a number of reasons. To give but one reason, overall employment participation patterns for females in large part reflect child-bearing patterns, but the sole parent group is selected on the basis that these females have in fact given birth, and so for that reason alone would be expected to have a different age profile for labour force participation.
2. Immigrant and indigenous status. Three dummy variables: non-indigenous native-born (omitted dummy); immigrant from the UK, USA, Canada, New Zealand or South Africa (ESB immigrant); and indigenous or immigrant from any other country (NESB immigrant). NESB immigrants and indigenous persons generally experience greater disadvantage than other members of the community and would therefore be expected to

[6] The pooled model treats the five waves as one big cross-sectional data set, with five times as many observations as are found in a single wave. It does not allow for 'dependencies' between observations for the one individual, whereas the panel models do allow for them. For example, a pooled model implicitly assumes that a person with high (unobserved) innate ability in one wave is no more likely than any other person to have high innate ability in the next wave. The panel models, by contrast, allow for the more realistic scenario that unobserved characteristics such as innate ability are correlated over time (in the case of random effects models) or even fixed over time (in the case of fixed effects models).

have lower rates of employment. They are combined together because of the very small number of indigenous sole parents in our sample.

3. Educational attainment. Four dummy variables for highest educational attainment: year 10 or below (omitted dummy); year 11 or 12, certificate or diploma; bachelor's degree or higher. Employment participation – and particularly full-time employment – is expected to be strongly ordered by educational attainment.

4. Health and disability. Three dummy variables are included:

   (i) Has a long-term health condition that restricts work. This is a measure of disability that is expected to be associated with reduced employment participation.

   (ii) Resides in a household in which at least one member has a disability. Adverse labour supply effects may be associated with the presence of another person with a disability because of the caring needs of that person.

   (iii) Is in poor health. This is a dummy variable based on self-assessed health, and is equal to one if the respondent declares she is in poor health and is equal to zero otherwise. This question is administered by a self-completion questionnaire (SCQ) rather than by interview. A proportion of respondents to the interview – approximately 8 per cent – do not return the SCQ, which means this variable is missing for some of our respondents. Rather than exclude these individuals from our sample, further diminishing our sample size, we set the 'poor health' dummy equal to zero and include a dummy set equal to one for these sample members.

5. Dependent children. A key focus of the study is on how the transition to full-time employment, in particular from part-time employment, is affected by the number and ages of dependent children. We include two sets of variables to capture these effects:

   (i) Three dummy variables for number of dependent children: 1 dependent child (omitted dummy); 2 dependent children; 3 or more dependent children. The a priori expectation is that labour supply is decreasing in the number of dependent children, because of the increase in care requirements associated with an increase in the number of dependent children.

   (ii) Five dummy variables for age in years of youngest dependent child: less than 1, between 1 and 5 (omitted dummy); 6 to 11; 12 to 15; and 16 or older. As children age, care requirements tend to decrease and correspondingly labour supply is

likely to increase. It is difficult to determine the appropriate 'age of youngest child' categories for the dummies. As noted, sample size and the econometric software do not support a large number of categories. Typically, the critical ages in labour supply research are thought to be zero (i.e., the first year after birth) and the ages of commencement of primary school and secondary school. Participation within the first 12 months of childbirth is likely to be particularly low – lower even than when the child is aged 1-5 years – while the transitions to primary school and to high school are potential triggers for increased labour market participation. However, also relevant to decisions in the current context are welfare eligibility rules. In the post-July 2006 period for which the analysis is intended to provide a reference point, 6, 8 and 16 appear to be the main significant thresholds for the age of the youngest child. Once the youngest child reaches 6 years of age, participation requirements commence. At 8 years of age, a PPS recipient who commenced on PPS after 30 June 2006 is placed on Newstart Allowance. At 16 years of age, eligibility for PPS ceases. Combining the school commencement ages and administrative age thresholds, and recognising constraints imposed by the sample size and the econometric software on the number of age categories that can be distinguished, we settled on the five categories listed. The main limitation of these categories is that the effect of the youngest child reaching 8 years of age is not separately identified from the effect of the youngest child reaching 6 years of age.

Clearly, alternative approaches to capturing the effects of dependent children could have been taken. For example, variables for the number of children in each age range could have been employed. However, this would have led to either substantially more variables, or imposition of assumptions on the functional form of the relationship between dependent children numbers on each age range and employment participation. We settled on the above two sets of variables as capturing the most pertinent dimensions of number and ages of dependent children for the purposes of modelling employment participation.

6. Partner status. We include a dummy variable equal to one if partnered to account for the effects of partnering on employment participation. This is necessitated by our retention in the sample of persons who at some stage were partnered. The dependent children variables are interacted with the partner status dummy to isolate the effects of dependent children specific to sole parents.

7. Duration in years of sole parent status. The HILDA Survey asks respondents about past relationships, including the year of separation from the respondent's last husband. We use this information to construct a measure of length of time the respondent has been a sole parent. However, for nearly half of respondents we are unable to ascertain sole parent duration, because many were never married (e.g., were in de facto relationships) and because some respondents provide insufficient or inconsistent information. As with health status, we set sole parent duration equal to zero and create a dummy variable equal to one for the respondents for whom sole parent duration is unknown.

8. Employment history. A derived variable is supplied in the HILDA Survey unit record data which gives the proportion of time the respondent has been employed since leaving full-time education for the first time. Work history is likely to be an important factor in influencing current propensity to seek and obtain employment. We therefore include this variable in our models.

9. Degree of difficulty with child care in the last 12 months. Households containing dependent children under 15 years of age are asked to rate from 0 to 10 the degree of difficulty they have experienced in the preceding twelve months in obtaining child care. Eleven different aspects of access to child care are rated, covering cost, quality, proximity, timing and other aspects of suitability. We aggregate responses to these questions, creating a variable that can in principle range between 0 for no difficulties to 110 for extreme difficulty with all aspects. Greater difficulty with child care would be expected to lead to lower employment participation, but potential endogeneity exists, since those who are employed face greater need for child care and therefore may be more likely to experience difficulties. The empirical association is therefore uncertain ex ante.

10. Own home and paying off mortgage (dummy). Home-owners who have outstanding mortgage commitments are likely to have higher labour supply than both renters, because they are ineligible for rent assistance, and outright owners, because their effective income (after housing expenses) is lower for a given cash (e.g., welfare) income.

11. Region of residence. A dummy variable equal to one if the respondent resides in a major city, as defined by the Accessibility/Remoteness Index of Australia for the 2001 Census. Persons in major cities are likely to have greater access to employment and therefore may have greater labour supply.

12. Non-labour, non-welfare, non-own-business income. This primarily comprises child support income and investment income. It measures income that does not depend on labour supply, and would be expected to be negatively associated with employment participation.

13. 'Time' dummies. We include year/wave dummies to account for year effects. For example, improvements in labour market conditions that occurred between 2001 and 2005 are likely to have increased employment of single mothers.

5.1 Pooled multinomial logit model

Methods

The theoretical framework of the multinomial logit model has each individual *i* faced with *J* different choices at time *t*. The individual receives a certain level of utility at each choice alternative and chooses the alternative that maximizes her utility. The current study assumes that each individual chooses between three employment states: not employed ($y=1$), working part time ($y=2$), and working full time ($y=3$).[7]

The pooled multinomial logit model treats each wave for each sample member as an independent observation, such that the total number of independent observations is equal to five times the number of sample members. The employment state of a sole parent is modelled as a logit probability function of explanatory factors *X*. Formally,

$$\begin{aligned} \Pr(y=1) &= \frac{1}{1+\sum_{k=2}^{3} e^{\mathbf{X}\boldsymbol{\beta}_k}} \\ \Pr(y=j) &= \frac{e^{\mathbf{X}\boldsymbol{\beta}_j}}{1+\sum_{k=2}^{3} e^{\mathbf{X}\boldsymbol{\beta}_k}}, \quad j=2,3 \end{aligned} \tag{1}$$

where y is equal to 1 if not employed, 2 if employed part-time and 3 if employed full-time. β_j is a vector of parameters, which are normalised to zero for the 'not employed' outcome (the base category) to achieve identification.

[7] The 'not employed' category combines unemployment with non-participation in the labour force because sample sizes are not sufficient to support distinguishing unemployment as a separate category. Of course, an unemployed sole parent has arguably not made the *choice* to be not working, but this does not affect the validity of the econometric model or the interpretation of the results.

Logit coefficient estimates are not readily interpretable, as the model is non-linear and the effects of individual explanatory variables on the outcome variable depend on the values of the explanatory variables at which they are evaluated. Consequently, rather than report coefficient estimates, 'mean marginal effects' of the explanatory variables are reported.

The marginal effect of continuous explanatory variable x_m on the probability outcome j occurs for a person with characteristics $\mathbf{x}^i$ is given by:

$$ME^i_{j,m} = \frac{\partial \Pr\left(y = j \mid \mathbf{x}^i\right)}{\partial x^i_m} = \Pr\left(y = j \mid \mathbf{x}^i\right)\left[\beta_{m,j} - \sum_{k=1}^{3} \beta_{m,k} \Pr\left(y = k \mid \mathbf{x}^i\right)\right] \quad (2)$$

while the *mean* marginal effect is given by:

$$MME_{j,m} = \left(1/N\right)\sum_{i=1}^{N} ME^i_{j,m} \quad (3)$$

where $MME_{j,m}$ is the mean marginal effect of variable x_m on the predicted probability $\Pr\left(y = j \mid x\right)$, and the summation is over the N observations in the sample. This is, as the name suggests, the mean marginal effect of the explanatory variable on the predicted probability a person is in category j, evaluated over all observations in the sample, and holding all other explanatory variables constant at their actual values. Its interpretation is 'the average effect on the probability of outcome j per unit increase in x_m.

For a binary explanatory variable, the marginal effect of explanatory variable x_m on the probability outcome j occurs for a person with characteristics $\mathbf{x}^i$ is given by:

$$ME^i_{j,m} = \Pr\left(y = j \mid \mathbf{x}^i_{-m}, x_m = 1\right) - \Pr\left(y = j \mid \mathbf{x}^i_{-m}, x_m = 0\right) \quad (4)$$

where $\mathbf{x}^i_{-m}$ represents the vector of characteristics of person i for all variables other than x_m. The *mean* marginal effect is as defined by Equation (3). This is obtained by changing the explanatory variable x_k from zero to one for every individual, holding all other explanatory variables at their actual values, and calculating the mean change in the predicted probability.

For the interacted binary variables – partner status, number of dependent children and age of youngest child dummy variables – we also report the 'total' mean marginal effect. This is given by the mean effect on the probability of employment state *j* of changing not only the relevant dummy from zero to one, but also changing it from zero to one in all its interactions.

For example, the total marginal effect of 'partnered' is obtained by changing from zero to one the 'partnered' dummy and changing 'partnered' from zero to one in all its interactions with the number of dependent children and age of youngest child dummy variables.[8]

Note that the mean marginal effect of a variable sums to zero across the 3 possible outcome categories, i.e. $\sum_{j=1}^{3} MME_{j,m} = 0$. This implies that the MME can be inferred for one category if the MMEs are known for the other two categories. We nonetheless report estimated MMEs for all three outcomes.

Results

Table 13 presents mean marginal effects estimates for the pooled multinomial logit model. Stars indicate statistical significance of the underlying coefficient estimates; consequently, statistical significance is not indicated for the 'not employed' category, for which the coefficients are all normalised to zero. As noted, this model does not allow investigation of the role of part-time work in promoting or inhibiting transitions to full-time employment. It also does not take into account unobserved heterogeneity. Results are nonetheless reported to provide a benchmark for the full model and because the model is more familiar and so estimates obtained are more readily understood.

Significant differences in labour force status are evident across a number of characteristics. Many are consistent with prior expectations. Migrants from the main English speaking countries are not substantially different from non-indigenous native-born sole parents, but migrant sole parents from non-English speaking countries and indigenous sole parents are somewhat different. All else equal, they have a 17 percentage point lower probability of part-time employment, which largely flows to a higher probability of non-participation in employment. Sole mothers with higher educational attainment are more likely to be in full time employment. They are slightly less likely to be employed part-time, but mostly the increase in full-time employment probability is via lower non-participation. However, in terms of full-time employment probability, those with a highest qualification of Year 11 or 12 are not substantially different from those who did not progress beyond year 10. Indeed, the primary educational differential is between holders of bachelor's degrees and all others.

[8] Note that the interaction term itself will not change from zero to one if the other variable is zero. For example, if the youngest child is in the 8-11 years category, then the variable 'Partnered & age of youngest 6-7' is zero both before and after 'partnered' is changed from zero to one.

Significant differences are evident by age, but they are not readily interpreted. The highest propensity for full-time employment is found for 15-24 year old single mothers, followed by 25-29 year olds and then 35-39 year olds. Those aged 35-39, 40-44 and 45 and above have similar probabilities of full-time employment, all else equal. Single mothers aged 40-44 have the highest probability of part-time employment, all else equal, but the difference is not statistically significant from the other age categories.

No difference in full-time employment probability by location of residence is evident. Somewhat surprisingly, the probability of part-time employment is 3 per cent lower, and the probability of non-employment 3 per cent higher, for single mothers living in major cities. As expected, a long-term health condition that restricts work is associated with lower employment. Both part-time employment and full-time employment are negatively affected, but predominately the effect is on full-time employment. The presence of another person in the household with a disability only impacts on the likelihood of full-time employment marginally, but does reduce participation in part-time employment substantially. Similarly, poor health is associated with a much-reduced probability of part-time employment, but does not affect full-time employment.

Estimates for the effects of dependent children on participation in full-time employment are consistent with expectations. The probability of full-time employment is monotonically decreasing in the number of dependent children and monotonically increasing in the age of the youngest child. Part-time employment peaks for single mothers with the youngest aged 6-11 years and does not significantly differ by number of dependent children. Despite the quadratic shape of the relationship between age of youngest child and probability of part-time employment (i.e., increasing up to age 6-11 and thereafter decreasing), the full-time employment effects dominate such that, in addition to being monotonically decreasing in the number of dependent children, overall participation in employment is monotonically increasing in the age of the youngest child. The biggest jump in participation in employment occurs when the youngest child moves into the 1-5 years category, while the biggest jump in participation in full-time employment occurs when the youngest child moves into the 16 years and over category. Of course, it should be recalled that these inferences may not be robust to incorporating unobserved heterogeneity.

Table 13a: Pooled multinomial logit model of labour force status – Mean marginal effects estimates

	Full time	Part time	Not employed
Age- 25-29	-6.33%	2.48%	3.86%
Age- 30-34	-15.33%***	6.43%	8.91%
Age- 35-39	-8.32%*	4.24%	4.08%
Age- 40-44	-14.46%**	11.72%	2.74%
Age- 45 and above	-14.67%***	3.83%	10.85%
ESB immigrant	-1.86%	1.42%	0.44%
NESB immigrant or indigenous	3.28%**	-17.33%***	14.05%
Education - Year 11-12	-1.24%	7.17%***	-5.93%
Education - Certificate or diploma	4.69%**	-1.13%	-3.56%
Education - Degree and above	16.17%***	-2.33%***	-13.84%
Long term health condition	-10.77%***	-1.69%***	12.46%
Disability in household	-0.66%*	-7.71%***	8.37%
Poor health	-0.98%	-16.22%**	17.21%
Health missing	10.76%***	-4.62%	-6.15%
No of dependent children - 2	-3.53%**	-0.67%	4.20%
No of dependent children - 3+	-9.13%***	1.37%	7.76%
Age of youngest < 1	-9.06%*	-11.07%**	20.13%
Age of youngest 6-11	9.27%***	6.87%***	-16.14%
Age of youngest 12-15	21.98%***	0.13%***	-22.11%
Age of youngest 16+	35.70%***	-9.93%***	-25.77%
Living in Major City	0.30%	-3.48%**	3.19%
Duration of being sole parent	-0.48%**	0.34%	0.14%
Sole parent duration missing	2.04%	-6.08%**	4.04%
Proportion of life employed	2.47%***	0.58%***	-3.05%
Degree of child care difficulties	0.34%	-0.05%	-0.29%
Degree of child care difficulties missing	-5.77%***	-4.59%***	10.37%
Income	-0.04%	-0.08%	0.12%
Still paying off mortgage	5.24%**	-2.94%	-2.30%
Partnered	-8.94%	15.68%**	-6.74%
Partnered & no of dependent children - 2	8.46%	-8.57%	0.11%
Partnered & no of dependent children - 3+	8.82%	-8.30%	-0.53%
Partnered & age of youngest < 1	-12.36%	8.15%	4.20%
Partnered & age of youngest 6-11	6.77%	-7.54%	0.77%
Partnered & age of youngest 12-15	3.38%	-5.46%	2.08%
Partnered & age of youngest 16+	-8.72%***	-19.41%***	28.13%
Wave 2	-0.86%	3.57%	-2.71%
Wave 3	0.13%	2.39%	-2.52%
Wave 4	1.85%	2.55%	-4.40%
Wave 5	0.87%*	6.54%***	-7.41%

Note: ***, ** and * denote significance of the underlying coefficient estimate at the 1%, 5% and 10% levels, respectively. Sample size: 2280; $\overline{R}^2$: 0.273; Log-likelihood: -1778.713; χ^2: 1334.588.

Table 13b: Pooled multinomial logit model of labour force status – Total mean marginal effects of variables that are interacted with other variables

	Full time	Part time	Not employed
No of dependent children - 2	-2.71%	-1.62%	4.34%
No of dependent children - 3+	-8.75%	0.89%	7.86%
Age of youngest < 1	-9.19%	-10.99%	20.19%
Age of youngest 6-11	9.64%	6.35%	-15.98%
Age of youngest 12-15	22.04%	-0.03%	-22.01%
Age of youngest 16+	31.11%	-9.32%	-21.79%
Partnered	-7.52%	13.64%	-6.12%

The duration of sole parent status does not appear to be an important influence on employment participation; nor do difficulties obtaining suitable child care. Non-labour, non-welfare income is similarly not empirically important (perhaps in part because in practice few single mothers have much of this type of income). By contrast, as has been found for other members of the community (e.g., Wilkins 2006), a greater history of employment is associated with an increased likelihood of current employment, with this effect considerably stronger for full-time employment than part-time employment. Also consistent with expectations, those paying off a mortgage are more likely to be employed full-time than other sole parents – although one suspects that it is more a case of those being employed full-time being in a position to pay off a mortgage (that is, full-time employment status causing home ownership) rather than paying off a mortgage causing an individual to work full-time.

The partner status dummy and its interactions with other variables are included to facilitate identification of the effects for sole parents, without any contamination of estimates from periods when sole parents were partnered. Nonetheless, it is useful to consider the estimates, as summarised by the total mean marginal effects presented in Table 13b.[9] They imply that partnering increases the probability of part-time employment, at the expense of both non-employment and full-time employment. Net, partnering is associated with a 6 percentage point increase in employment participation.

The estimates for the year dummies (Wave 2 to Wave 5) suggest that employment participation increased over the 2001 to 2005 period, although in an uneven fashion. Over the total period, the probability of employment, all else equal, increased by 7.4 percentage points, a very substantial aggregate increase. Most of this growth occurred after 2003 and was in part-time employment.

5.2 Random effects multinomial logit model

Methods

The random effects specification relaxes the assumption of no unobserved heterogeneity, in so doing no longer treating each observation of an individual as independent of all other observations of that individual. Unobserved heterogeneity refers to (time-invariant) characteristics of individuals that affect the outcome of interest but which are not observed in the data. Failure to account for unobserved heterogeneity can lead to biased parameter

[9] Note, however, that most of the partner interaction terms presented in Table 13 are not statistically significant.

estimates. The random effects specification treats the individual-specific effects as a random variable that produces a correlation among the residuals for the same individual, but leaves the residuals independent across individuals.

The utility of choice *j* in time period *t* in a random effects context can be specified as

$$U_{ijt} = \beta_j' X_{it} + \alpha_{ij} + \varepsilon_{ijt} \tag{5}$$

where α_{ij} is time-invariant unobserved heterogeneity across individuals, and ε_{ijt} are independently and identically distributed error terms, assumed to be independent of X_{it} and α_{ij}. As standard in random-effects models, the unobserved heterogeneity α_{ij} is required to be independent of the explanatory variables X_{it}.

The correspondingly modified version of the multinomial logit model given by Equation (1) has the following form:

$$\mathrm{P}(y_{it} = j \mid X_{it}, \alpha_i) = \frac{\exp(\beta_j' X_{it} + \alpha_{ij})}{\sum_{k=1}^{3} \exp(\beta_k' X_{it} + \alpha_{ik})}, \quad i = 1,...,N;\ t = 1,...,5;\ \text{and}\ j = 1,2,3 \tag{6}$$

The probability of making choice j is conditional on X_{it}, which may affect the individual choice (y_{it}), and a (2×1) vector α_i, which is assumed to have a bivariate normal distribution with zero mean and (2×2) variance–covariance matrix Σ_α.[10] Since the choice probabilities must sum to unity, a restriction is needed to ensure model identification. As in the pooled model, the elements of the vector β_1 are set equal to zero. Additionally, for every individual in the sample, the unobserved heterogeneity term for the not employed outcome, α_{i1}, is set equal to zero.

The random effects multinomial logit model, like the pooled cross-sectional multinomial logit model, does not inform us on the role played by part-time work in transitions to full-time work. Results are reported to demonstrate the impact of incorporating unobserved heterogeneity as distinct from allowing for dynamic path dependencies.

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[10] α_{ij} are specified as linear combinations of independent variables assumed to have standard normal distributions, i.e., $\sim N(0,1)$. Therefore, we have a $(J \times 1)$ vector of $\alpha_i = \Gamma \eta_i$, with $\eta_i \sim N(0, I)$, where Γ is the lower triangular parameter matrix to be estimated, and the variance–covariance matrix of α_i is given by $\Sigma_\alpha = \Gamma\Gamma'$.

Results

Treating the estimation sample as the panel that it is and allowing for unobserved individual heterogeneity results in several of the explanatory variables becoming statistically insignificant (Table 14). Point estimates are also generally smaller in magnitude than in the pooled model. Nonetheless, aside from several factors no longer found to exert significant effects on employment outcomes, few qualitative changes are evident. Still evident are the negative effects on part-time employment associated with NESB migrant and indigenous status, the positive effects on full-time employment of degree attainment, the negative effect of own-disability on full-time employment, the negative effect of household disability on part-time employment, the positive effects of a greater history of employment and the effects of dependent children identified in the pooled model. Similarly, no significant effects are found for ESB immigrant status, duration of sole parent status, degree of child care difficulties or non-labour and non-welfare income. Year effects captured by the wave dummies are also similar.

Notable differences between the pooled model and the panel model are found for age, health, region of residence and partner status. Significant differences by age disappear, although the point estimates show qualitatively similar age patterns. Own disability, while retaining its negative impact on full-time employment, does not have any significant effect on part-time employment – which was in any case a relatively small effect in the cross-sectional model. Likewise, poor health is not found to significantly decrease the probability of part-time employment, as it is in the cross-sectional model. The 'partnering' effect – increasing part-time employment and decreasing full-time employment – also largely disappears in the panel model. This suggests this partner variable in the cross-sectional model was picking up unobserved characteristics of people with a greater propensity to be partnered. That is, those sole parents more likely at some stage of the sample period to be partnered were more likely to be employed part-time to begin with (when a sole parent); but this is not picked up by the pooled model because it treats each observation as independent.

Table 14a: Random effects multinomial logit model of labour force status – Mean marginal effects estimates

	Full time	Part time	Not employed
Age- 25-29	-1.00%	-0.28%	1.28%
Age- 30-34	-2.33%	1.62%	0.71%
Age- 35-39	2.80%	-0.65%	-2.15%
Age- 40-44	-1.70%	4.39%	-2.69%
Age- 45 and above	-3.21%	-0.19%	3.40%
ESB immigrant	-1.05%	-0.84%	1.89%
NESB immigrant or indigenous	0.45%	-15.78%***	15.33%
Education - Year 11-12	-4.63%	8.09%*	-3.46%
Education - Certificate or diploma	3.30%	1.12%	-4.43%
Education - Degree and above	15.81%***	0.03%**	-15.84%
Long term health condition	-8.55%***	0.21%	8.35%
Disability in household	-1.54%	-4.87%**	6.41%
Poor health	-5.59%	-3.00%	8.59%
Health missing	4.51%**	0.43%	-4.94%
No of dependent children - 2	-0.60%	-3.73%	4.33%
No of dependent children - 3+	-9.33%***	-1.88%*	11.21%
Age of youngest < 1	-0.81%	-10.31%*	11.12%
Age of youngest 6-11	2.88%***	9.54%***	-12.43%
Age of youngest 12-15	9.55%***	5.69%***	-15.24%
Age of youngest 16+	17.69%***	2.69%***	-20.38%
Living in Major City	3.56%	-5.44%	1.88%
Duration of being sole parent	-0.10%	0.00%	0.10%
Sole parent duration missing	0.62%	-4.14%	3.53%
Proportion of life employed	2.21%***	0.76%***	-2.97%
Degree of child care difficulties	-0.12%	0.37%	-0.25%
Degree of child care difficulties missing	-2.78%**	-4.83%***	7.61%
Income	0.08%	-0.15%	0.07%
Still paying off mortgage	3.77%	-4.10%	0.33%
Partnered	-1.50%	4.70%	-3.20%
Partnered & no of dependent children - 2	4.04%	-3.98%	-0.06%
Partnered & no of dependent children - 3+	5.26%	2.41%	-7.67%
Partnered & age of youngest < 1	-13.50%	3.62%	9.87%
Partnered & age of youngest 6-11	2.81%	-4.58%	1.76%
Partnered & age of youngest 12-15	1.60%	0.33%	-1.94%
Partnered & age of youngest 16+	-9.62%**	-9.84%*	19.46%
Wave 2	0.34%	3.48%*	-3.82%
Wave 3	0.86%	1.89%	-2.75%
Wave 4	4.08%**	0.85%	-4.93%
Wave 5	3.59%***	4.40%***	-7.99%

Note: ***, ** and * denote significance of the underlying coefficient estimate at the 1%, 5% and 10% levels, respectively. Sample size: 2280; $\overline{R}^2$: 0.428; Log-likelihood: -2499.343; χ^2: 2137.763.

Table 14b: Random effects multinomial logit model of labour force status – Total mean marginal effects of variables that are interacted with other variables

	Full time	Part time	Not employed
No of dependent children - 2	-0.20%	-4.15%	4.35%
No of dependent children - 3+	-9.02%	-1.61%	10.63%
Age of youngest < 1	-1.00%	-10.30%	11.30%
Age of youngest 6-11	3.07%	9.21%	-12.28%
Age of youngest 12-15	9.61%	5.71%	-15.31%
Age of youngest 16+	17.50%	2.47%	-19.97%
Partnered	-1.00%	4.16%	-3.16%

5.3 Dynamic random effects multinomial logit model

Methods

A dynamic random effects multinomial model is employed to estimate the effect of part-time employment on transitions to full-time employment. The model accounts for the endogeneity of the initial conditions (explained below), while controlling for differences in observed and unobserved characteristics between individuals (observed and unobserved heterogeneity). To be specific, the approaches suggested by Wooldridge (2005) are implemented to deal with the initial conditions problem. In addition, we relax the Independence of Irrelevant Alternatives (IIA) assumption[11] in the multinomial logit by allowing random effects to be freely correlated across choices.

The utility of choice *j* in time period *t* in a dynamic random effects context can be specified as:

$$U_{ijt} = \beta_j' X_{it} + \gamma_j' y_{it-1} + \alpha_{ij} + \varepsilon_{ijt} \tag{7}$$

where X_{it} is a vector of observed characteristics which vary between individuals and over time, y_{it-1} is a vector of dummy variables indicating a lagged employment state (it may also be interacted with X_{it}), α_{ij} is time-invariant unobserved heterogeneity across individuals, and ε_{ijt} are independently and identically distributed error terms, assumed to be independent of X_{it} and α_{ij}. As is standard in random-effects models, the unobserved heterogeneity α_{ij} is required to be independent of the explanatory variables X_{it}.

The dynamic multinomial logit model is specified as a modification of the random effects multinomial logit model (Gong, van Soest and Villagomez 2000):

$$\mathrm{P}(y_{it} = j \mid X_{it}, y_{it-1}, \alpha_i) = \frac{\exp(\beta_j' X_{it} + \gamma_j' y_{it-1} + \alpha_{ij})}{\sum_{k=1}^{3} \exp(\beta_k' X_{it} + \gamma_l' y_{it-1} + \alpha_{ik})}, \quad i = 1,...,N;\ t = 1,...,5;\ \text{and}\ j = 1,2,3 \tag{8}$$

The probability of choice *j* is as per Equation (6), but with the addition of the explanatory factor, y_{it-1}, which indicates the choice made in period $t-1$. As in the random effects logit model, we normalize $\beta_1 = 0$ and $\alpha_{i1} = 0$.

[11] IIA assumes that relative probabilities for any two alternatives depend only on the attributes of those two alternatives. It implies that adding another alternative or changing the characteristics of the third alternative does not affect the relative odds between alternatives *j* and *k*.

In a dynamic model, the presence of a lagged dependent variable y_{it-1} introduces what is called an initial conditions problem that must be addressed. This is caused by our lack of knowledge of the data-generating process governing the initial observed choice (of labour force status) which depends on previous – unobserved – choices. If the individual initial conditions are correlated with the individual random effect α_i, the estimator will be inconsistent and tend to overestimate coefficient γ (that is, overstate the effect of previous-year employment on current employment). Wooldridge (2005) suggests modelling the distribution of the unobserved effect (α_i) conditional on the initial value of the dependent variable (y_{i1}) and any exogenous explanatory variables:

$$\alpha_i = \lambda y_{i1} + \varphi \bar{x}_i + a_i \tag{9}$$

where $\bar{x}_i$ is the average over the sample period of the observations on the exogenous variables, and a vector of a_i is bivariately normally distributed with mean zero and a variance–covariance matrix Σ_a, independent of $\bar{x}_i$ and the initial condition y_{i1}. Equation (9) is substituted into Equation (8), where the significance of coefficient λ indicates whether accounting for the endogeneity of the initial condition is relevant. In addition, we relax the IIA assumption by accommodating correlations in the random effects α_i across choices, because of the potential for each person's tastes (unobservables) to be correlated across choices.[12]

The model parameters are obtained by maximum likelihood estimation of the random effects model using the NLOGIT program in the econometric software *Limdep*. The marginal effects are simulated probabilities holding all other variables constant.

Added to the explanatory variables included in the earlier logit models are dummy variables for lagged labour force status – specifically, a dummy variable equal to one if the individual was employed full-time in the previous wave and a dummy variable equal to one if the individual was employed part-time in the previous wave. This augmentation necessitates dropping the first wave from the analysis, because there is no 'previous wave' in Wave 1.

[12] Following on from Footnote 10, to allow the random effects to be freely correlated, the $J \times 1$ vector of non-zero αs is written as $\alpha_i = \Gamma \nu_i$ where Γ is the lower triangular parameter matrix to be estimated and ν_i is a standard normally distributed (mean vector 0, covariance matrix I) vector.

Lagged labour force status variables facilitate investigation of whether and to what extent transitions to full-time employment are helped or hindered by part-time employment. For example, a positive mean marginal effect estimate on the probability of full-time employment for the variable 'employed part-time in the previous wave' indicates part-time employment does play a stepping-stone role. The lagged labour force status variables are also interacted with the dependent children dummy variables to investigate how the existence and nature of the 'stepping stone' function of part-time employment depends on the number and ages of dependent children.[13]

Results

Tables 15 and 16 contain the mean marginal effects estimates for the dynamic panel multinomial logit models. Estimates for the contemporaneous (as opposed to lagged) explanatory factors are broadly similar to those obtained in the static random effects specification, albeit tending to be smaller in magnitude. This is to be expected, since we are now accounting for effects of past labour force status. To the extent past labour force status is correlated with other explanatory variables, those variables would previously have been partially picking up effects of past labour force status.

Given the smaller magnitudes of the marginal effects estimates, significance levels of coefficient estimates correspondingly tend to be weaker, particularly for the model that incorporates random effects that are allowed to be correlated across choices. Most notably, differences in part-time and full-time employment probabilities by number of dependent children are no longer significant, while there are no significant differences in full-time employment probabilities by age of youngest child until the youngest child is in the 12-15 years (high school) age category. However, there is in fact a very large jump in the probability of full-time employment once the youngest child enters the 12-15 years age category. Indeed, the mean marginal effect on the full-time employment probability is larger for the 12-15 years category than for the 16 years and over category.

[13] As noted earlier, *Limdep* has a 100 parameter limit for NLOGIT, restricting the number of variables to 50. This constrains the number of interactions between lagged labour force status and other variables that can be included.

Table 15a: Dynamic random effects multinomial logit model of labour force status – With uncorrelated random effects (uncorrelated across choices)

	Full time	Part time	Not employed
Age- 25-29	6.02%	-5.99%	-0.02%
Age- 30-34	0.11%	-4.07%	3.96%
Age- 35-39	1.26%	-3.45%	2.20%
Age- 40-44	-5.45%	3.53%	1.92%
Age- 45 and above	-5.55%	-2.69%	8.24%
ESB immigrant	-2.00%	2.10%	-0.10%
NESB immigrant or indigenous	3.17%	-11.00%***	7.84%
Education - Year 11-12	-1.75%	0.99%	0.75%
Education - Certificate or diploma	5.90%**	-3.83%	-2.08%
Education - Degree and above	8.67%***	0.57%**	-9.23%
Long term health condition	-5.94%**	-1.11%	7.05%
Disability in household	-1.51%	-1.91%	3.42%
Poor health	-11.03%**	-5.47%	16.50%
Health missing	2.32%	2.51%	-4.84%
No of dependent children - 2	-2.02%	0.81%	1.21%
No of dependent children - 3+	-3.26%	0.19%	3.07%
Age of youngest < 1	3.00%	-8.90%	5.90%
Age of youngest 6-11	-1.07%	8.62%**	-7.55%
Age of youngest 12-15	16.99%***	-2.67%**	-14.32%
Age of youngest 16+	11.24%**	1.16%*	-12.40%
Living in major city	4.67%	-7.53%**	2.86%
Duration of being sole parent	-0.02%	-0.12%	0.14%
Sole parent duration missing	1.86%	-3.14%	1.28%
Proportion of life employed	0.86%***	0.24%***	-1.10%
Degree of child care difficulties	0.27%	-0.16%	-0.11%
Degree of child care difficulties missing	-1.80%*	-5.81%**	7.61%
Income	0.09%	-0.07%	-0.02%
Still paying off mortgage	4.36%	-4.85%	0.49%
Partnered	-2.56%	5.46%	-2.90%
Partnered & no of dependent children - 2	3.82%	-4.32%	0.51%
Partnered & no of dependent children - 3+	5.02%	2.42%	-7.44%
Partnered & age of youngest < 1	-18.46%**	-1.71%	20.16%
Partnered & age of youngest 6-11	0.39%	-4.94%	4.56%
Partnered & age of youngest 12-15	-4.30%	0.13%	4.17%
Partnered & age of youngest 16+	-10.93%**	-14.88%**	25.81%
Wave 3	0.03%	-2.45%	2.42%
Wave 4	3.03%	-2.95%	-0.09%
Wave 5	0.87%	1.06%	-1.93%
Employed FT in wave 1	24.05%***	-14.45%	-9.61%
Employed PT in wave 1	0.98%**	14.33%***	-15.31%
Employed FT in previous wave	25.20%***	-1.13%**	-24.07%
Employed PT in previous wave	4.41%***	19.39%***	-23.79%
Employed FT in previous wave & age of youngest 6-11	4.24%***	-5.61%	1.37%
Employed FT in previous wave & age of youngest 12-15	-7.81%	1.23%	6.58%
Employed FT in previous wave & age of youngest 16+	4.14%	5.47%	-9.61%
Employed PT in previous wave & age of youngest 6-11	-0.67%	1.39%	-0.72%
Employed PT in previous wave & age of youngest 12-15	-7.36%	5.07%	2.30%
Employed PT in previous wave & age of youngest 16+	4.11%	10.98%**	-15.09%

Note: ***, ** and * denote significance of the underlying coefficient estimate at the 1%, 5% and 10% levels, respectively. Sample size: 1824; $\overline{R}^2$: 0.499; Log-likelihood: -1002.263; χ^2: 1994.422.

Table 15b: Dynamic random effects multinomial logit model of labour force status – Total mean marginal effects of variables that are interacted with other variables

	Full time	Part time	Not employed
No of dependent children - 2	-1.66%	0.38%	1.28%
No of dependent children - 3+	-3.02%	0.52%	2.50%
Age of youngest < 1	2.78%	-8.96%	6.18%
Age of youngest 6-11	-0.68%	8.06%	-7.38%
Age of youngest 12-15	15.21%	-1.99%	-13.22%
Age of youngest 16+	11.72%	1.53%	-13.25%
Partnered	-2.52%	4.76%	-2.24%
Employed FT in previous wave	25.25%	-1.18%	-24.07%
Employed PT in previous wave	3.74%	20.77%	-24.51%

Turning to our key question, in both Table 15 and Table 16 estimates for lagged labour force status variables show there are strong persistence effects in sole mothers' labour market behaviour.[14] Table 15b shows that, all else equal, those who worked full-time in the previous wave have an average 21 percentage point higher probability of full-time employment in the current wave than those who were employed part-time in the initial wave, and a 25 percentage point higher probability of full-time employment than those who were not employed at all in the previous wave. Those who worked part-time in the previous wave have a 21 percentage point higher probability of part-time employment in the current wave than those not employed in the previous wave, and a 20 percentage point higher probability of working part-time than those employed full-time in previous wave. Estimates in Table 16 similarly show strong and highly significant persistence from one wave to the next.

[14] Note that the estimates for Wave-1 labour force status cannot be interpreted as capturing persistence and/or stepping stone effects. These variables are included in the model to account for initial conditions, and therefore capture more than simply the effects of labour force status in Wave 1.

Table 16a: Dynamic random effects multinomial logit model of labour force status – With correlated random effects (correlated across choices)

	Full time	Part time	Not employed
Age- 25-29	6.12%	-5.98%	-0.14%
Age- 30-34	0.25%	-4.00%	3.75%
Age- 35-39	1.39%	-3.40%	2.01%
Age- 40-44	-5.53%	3.68%	1.84%
Age- 45 and above	-5.60%	-2.71%	8.31%
ESB immigrant	-1.99%	1.77%	0.22%
NESB immigrant or indigenous	2.88%	-11.08%***	8.20%
Education - Year 11-12	-1.67%	0.68%	0.98%
Education - Certificate or diploma	6.14%*	-3.94%	-2.20%
Education - Degree and above	9.04%**	0.62%*	-9.65%
Long term health condition	-6.09%	-1.03%	7.11%
Disability in household	-1.53%	-2.00%	3.53%
Poor health	-10.37%	-5.01%	15.38%
Health missing	2.34%	2.33%	-4.66%
No of dependent children - 2	-2.13%	0.71%	1.42%
No of dependent children - 3+	-3.49%	0.06%	3.43%
Age of youngest < 1	3.79%	-8.81%	5.02%
Age of youngest 6-11	-0.50%	8.52%**	-8.02%
Age of youngest 12-15	17.72%***	-3.31%*	-14.41%
Age of youngest 16+	12.17%*	0.69%	-12.86%
Living in major city	4.59%	-7.34%**	2.76%
Duration of being sole parent	-0.02%	-0.11%	0.13%
Sole parent duration missing	1.67%	-3.05%	1.38%
Proportion of life employed	0.88%***	0.28%***	-1.16%
Degree of child care difficulties	0.28%	-0.21%	-0.07%
Degree of child care difficulties missing	-1.97%	-5.71%**	7.68%
Income	0.09%	-0.07%	-0.02%
Still paying off mortgage	4.31%	-4.76%	0.45%
Partnered	-2.65%	5.27%	-2.63%
Partnered & no of dependent children - 2	3.86%	-4.09%	0.24%
Partnered & no of dependent children - 3+	5.54%	2.60%	-8.13%
Partnered & age of youngest < 1	-18.78%*	-2.49%	21.27%
Partnered & age of youngest 6-11	0.42%	-5.15%	4.72%
Partnered & age of youngest 12-15	-4.03%	0.48%	3.56%
Partnered & age of youngest 16+	-10.49%	-14.53%**	25.01%
Wave 3	0.01%	-2.24%	2.23%
Wave 4	2.96%	-2.66%	-0.29%
Wave 5	0.83%	1.55%	-2.38%
Employed FT in wave 1	26.24%***	-13.20%	-13.04%
Employed PT in wave 1	2.25%**	15.10%***	-17.35%
Employed FT in previous wave	23.08%***	-3.42%	-19.66%
Employed PT in previous wave	3.14%**	18.18%***	-21.31%
Employed FT in previous wave & age of youngest 6-11	3.77%	-5.05%	1.28%
Employed FT in previous wave & age of youngest 12-15	-8.15%	1.39%	6.76%
Employed FT in previous wave & age of youngest 16+	3.49%	6.69%	-10.19%
Employed PT in previous wave & age of youngest 6-11	-1.07%	1.34%	-0.28%
Employed PT in previous wave & age of youngest 12-15	-7.73%	5.19%	2.53%
Employed PT in previous wave & age of youngest 16+	3.26%	11.43%	-14.69%

Note: ***, ** and * denote significance of the underlying coefficient estimate at the 1%, 5% and 10% levels, respectively. Sample size: 1824; $\overline{R}^2$: 0.499; Log-likelihood: -1999.474; χ^2: 1996.496.

Table 16b: Dynamic random effects multinomial logit model of labour force status – Total mean marginal effects of variables that are interacted with other variables

	Full time	Part time	Not employed
No of dependent children - 2	-1.76%	0.31%	1.45%
No of dependent children - 3+	-3.22%	0.41%	2.81%
Age of youngest < 1	3.57%	-8.88%	5.31%
Age of youngest 6-11	-0.22%	7.97%	-7.76%
Age of youngest 12-15	15.92%	-2.60%	-13.32%
Age of youngest 16+	12.57%	1.15%	-13.73%
Partnered	-2.58%	4.62%	-2.04%
Employed FT in previous wave	22.97%	-3.34%	-19.63%
Employed PT in previous wave	2.27%	19.57%	-21.83%

The point estimates in Tables 15 and 16 do, nonetheless, suggest that part-time employment does to some extent serve as a stepping stone to full-time employment, at least for those with the youngest child aged under 12 years or over 16 years of age. Specifically, having been working part-time in the previous wave significantly increases the probability of full-time employment in the current wave for single mothers with youngest children in these age categories. Aggregating across the 'employed PT previous wave' and its relevant interaction term[15], the point estimates in the uncorrelated random effects model imply part-time employment in the previous wave increases the probability of full-time employment in the current wave by 4.4 percentage points if the youngest is under 6 years of age, by 3.8 percentage points if the youngest is aged 6-11 years, and by 8.5 percentage points if the youngest child is aged 16 years or over. For the correlated random effects model, the corresponding figures are 3.1, 2 and 7 percentage points, respectively.

For single mothers with the youngest child in the 12-15 years age range, which approximately corresponds to the first four years of high school, point estimates imply that part-time employment in the previous wave decreases the probability of full-time employment in the current wave. However, these estimates are not statistically significant, so the data do not support the inference, with any real confidence, that part-time employment is actually hindering the transition to full-time employment for women in this situation.

[15] The non-linearity of the logit model means that these estimates of aggregate effects are approximate only. Note that the two lowest age-of-youngest-child categories are combined in interactions with previous-wave labour force status. This is because the model with random effects correlated across choices would not estimate when separate interaction terms were included. We suspect this is connected to very low rates of full-time employment for those who have given birth within the last year.

More generally, it should be noted that none of the interaction terms between 'employed part-time in previous wave' and the dependent children dummies is statistically significant, and therefore caution is warranted in inferring differences in the stepping stone role of part-time employment across sole parents by age of youngest child. In fact, it must be acknowledged that the sample size for sole parents in the HILDA Survey does not support statistically robust identification of how the stepping stone function of part-time employment changes as dependent children age. Differences by age group of youngest child appear likely given the large variation in point estimates, but statistical tests cannot rule out the absence of differences. This notwithstanding, we note that Tables 15b and 16b show an aggregate positive effect of previous-wave part-time employment on the probability of current-wave full-time employment in both specifications. In the model with uncorrelated random effects, the mean marginal effect is 3.7 percentage points; in the model with correlated random effects, the mean marginal effect is 2.3 percentage points.

6 Determinants of time spent in employment over the course of the year

6.1 Random effects Tobit model

The econometric analysis undertaken to date considers only labour force status in the survey reference week of each wave. While continuity of employment is considered in the dynamic panel models by including lags of labour force status, they do not consider the amount of time spent in employment in each year, information available from the work calendar. We therefore estimate random effects panel models of the determinants of the proportion of time spent in employment. These models do not, however, allow investigation of the role of part-time work in facilitating transitions to full-time employment. As noted earlier, the work calendar does not distinguish part-time employment from full-time employment.

In the current context, the panel Tobit model takes the form:

$$
\begin{aligned}
y_{it}^{*} &= \beta' \mathbf{X}_{it} + \alpha_i + \varepsilon_{it} \\
y_{it} &= \begin{cases} 1 \text{ if } y_{it}^{*} \geq 1 \\ y_{it}^{*} \text{ if } 0 < y_{it}^{*} < 1 \\ 0 \text{ if } y_{it}^{*} \leq 0 \end{cases}
\end{aligned}
\tag{10}
$$

where y_{it}^{*} is the latent dependent variable, censored from above at 1 and below at 0, and y_{it} is the observed dependent variable – the proportion of the year employed. As before, α_i is an

unobserved individual effect correlated across time for each individual and uncorrelated across individuals, and ε_{it} is a random disturbance term.

6.2 Results

Table 17 presents the coefficient estimates from the panel Tobit model. In general, results are as might be expected, and in fact the estimates suggest many parallels between the determinants of point-in-time employment and the determinants of the length of employment over the year – our measure of 'continuity' or 'amount' of employment. Time in employment is significantly lower for NESB immigrants and indigenous Australians, is increasing in educational attainment, is lower for persons with a disability, in poor health or living with a disabled person, is decreasing in the number of dependent children, increasing in the age of the youngest child and higher for those paying off a mortgage. Duration as a sole parent, child care difficulties, non-labour, non-welfare income and partner status do not appear to affect the proportion of the year employed. To the extent that they are comparable, these effects are broadly similar to those obtained in the static panel logit. The main differences are that in the Tobit model there are significant negative effects on length of employment of being ESB immigrant and stronger effects of having another household member with a disability and of being in poor health. A further difference from the static panel logit model findings is that no significant year effects are evident in the Tobit model.

Table 17: Tobit model of the proportion of time employed in the preceding 12 months

	Coefficient estimate	Standard error
Age- 25-29	0.012	0.118
Age- 30-34	0.271**	0.126
Age- 35-39	0.347***	0.134
Age- 40-44	0.438***	0.141
Age- 45 and above	0.440***	0.149
ESB immigrant	-0.183*	0.104
NESB immigrant or indigenous	-0.586***	0.082
Education - Year 11-12	0.288***	0.082
Education - Certificate or diploma	0.458***	0.072
Education - Degree and above	0.769***	0.091
Long term health condition	-0.269***	0.085
Disability in household	-0.194**	0.075
Poor health	-0.313*	0.173
Health missing	0.155*	0.081
No of dependent children - 2	-0.266***	0.067
No of dependent children - 3+	-0.519***	0.091
Age of youngest < 1	-0.460***	0.170
Age of youngest 6-11	0.312***	0.071
Age of youngest 12-15	0.317***	0.098
Age of youngest 16+	0.443***	0.125
Living in Major City	0.026	0.058
Duration of being sole parent	-0.001	0.007
Sole parent duration missing	-0.134*	0.077
Degree of child care difficulties	0.002	0.002
Degree of child care difficulties missing	-0.288***	0.069
Income	0.003	0.005
Still paying off mortgage	0.197***	0.060
Partnered	0.146	0.114
Partnered & no of dependent children - 2	0.014	0.123
Partnered & no of dependent children - 3+	0.030	0.145
Partnered & age of youngest < 1	0.227	0.229
Partnered & age of youngest 6-11	-0.040	0.115
Partnered & age of youngest 12-15	0.102	0.166
Partnered & age of youngest 16+	-0.367*	0.211
Wave 2	-0.056	0.064
Wave 3	-0.028	0.064
Wave 4	-0.011	0.065
Wave 5	0.043	0.066
Constant	0.443***	0.166

Note: ***, ** and * denote significance of the coefficient estimate at the 1%, 5% and 10% levels, respectively. Sample size: 2275; Log-likelihood: -1660.895; χ^2 : 389.40.

7 Conclusion

This study has taken a dynamic perspective on the examination of the labour market behaviour of single mothers, considering the extent, nature and determinants of transitions between labour force states using household panel data. Descriptive analysis shows that transitions between non-employment and employment are not frequent, with sole parent females averaging 1.3 transitions over the full five years of the first five waves of the HILDA Survey, and just over half making no transitions over the period. There is, however, clear evidence that moves from non-employment to part-time employment, and from part-time employment to full-time employment, are the most frequent of the transition paths of single mothers. This is true whether the time-frame over which transitions are examined is one year (as in Table 8), three years (Table 9) or four years (Tables 9 and 10). This suggests part-time work is something of a stepping stone from non-employment to full-time employment. However, we note that Table 11 shows that, of those not in the labour force in Wave 1, only 10 per cent were in full-time employment in Wave 5, compared with 36 per cent in part-time employment. It is not known from the descriptive analysis what proportion of those in part-time employment in Wave 5 will ultimately make the transition to full-time employment. The descriptive analysis is therefore somewhat inconclusive as to the magnitude of the stepping-stone phenomenon, which in part motivates the econometric analysis.

Relatively small sample sizes for the target population group constrain the inferences that can be drawn from the econometric analysis. Nonetheless, there are clear indications, consistent with the descriptive analysis, that part-time work is more help than hindrance to transitions to full-time employment. This is true for a sole parent whose youngest child is below high school age or over 16 years of age: for such a person, all else equal, part-time employment in the previous wave increases the probability of full-time employment in the current wave by between 2 and 8.6 percentage points. It is, however, difficult to interpret the magnitude of these effects. For example, if current part-time employment is thought to be at least partially at the expense of current full-time employment, it is a matter of subjective assessment whether the ‘benefits’ of the boost to future full-time employment prospects generated by current part-time employment outweigh the ‘costs’ of the reduction in current full-time employment.

8 Appendix

Table A1: Sample sizes

Descriptive analysis		
Cross-sectional analysis		
Wave 1	523	
Wave 3	492	
Wave 5	491	
Longitudinal analysis	355	
Econometric analysis	Observations	Persons
Pooled (cross-sectional) logit	2280	456
Random effects logit	2280	456
Dynamic logit	1824	456
Tobit	2280	456

Table A2: Sample means

	Labour force status			
	Employed full-time	Employed part-time	Not employed	All persons
Age- 25-29	0.07	0.09	0.15	0.11
Age- 30-34	0.09	0.15	0.17	0.14
Age- 35-39	0.17	0.17	0.15	0.16
Age- 40-44	0.21	0.25	0.15	0.20
Age- 45 and above	0.42	0.27	0.24	0.31
ESB immigrant	0.12	0.10	0.08	0.09
NESB immigrant or indigenous	0.18	0.10	0.25	0.19
Education - Year 11-12	0.17	0.27	0.25	0.23
Education - Certificate or diploma	0.32	0.30	0.28	0.29
Education - Degree and above	0.35	0.19	0.07	0.18
Long term health condition	0.07	0.11	0.26	0.16
Disability in household	0.13	0.13	0.29	0.20
Health missing	0.10	0.06	0.08	0.09
Poor health	0.01	0.01	0.05	0.02
No of dependent children - 2	0.28	0.34	0.34	0.33
No of dependent children - 3+	0.07	0.16	0.24	0.17
Age of youngest < 1	0.01	0.02	0.08	0.04
Age of youngest 6-11	0.26	0.36	0.26	0.29
Age of youngest 12-15	0.23	0.18	0.11	0.16
Age of youngest 16+	0.26	0.12	0.10	0.14
Living in Major City	0.66	0.56	0.60	0.60
Duration of being sole parent	7.36	7.16	7.41	7.32
Sole parent duration missing	0.40	0.47	0.58	0.51
Proportion of life employed	0.80	0.70	0.44	0.60
Degree of child care difficulties	28.19	28.11	28.09	28.12
Degree of child care difficulties missing	0.91	0.88	0.93	0.91
Income	$1156.46	$717.01	$820.10	$869.39
Still paying off mortgage	0.37	0.28	0.16	0.25
Partnered	0.20	0.23	0.24	0.23
Employed FT in wave 1	0.66	0.08	0.04	0.21
Employed PT in wave 1	0.23	0.70	0.11	0.32
Employed FT in previous wave	0.76	0.08	0.05	0.25
Employed PT in previous wave	0.16	0.72	0.11	0.32

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