



FACULTY OF
BUSINESS &
ECONOMICS

Melbourne Institute Working Paper Series

Working Paper No. 10/11

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Evidence from Australian Micro-Data 2001–2007

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Melbourne Institute Working Paper No. 10/11

ISSN 1328-4991 (Print)

ISSN 1447-5863 (Online)

ISBN 978-0-7340-4241-5

April 2011

* This paper is based on research commissioned by the Australian Government Department of Education, Employment and Workplace Relations (DEEWR) under the Social Policy Research Services Agreement (2005–09) with the Melbourne Institute of Applied Economic and Social Research. Additional research to complete this paper was funded by the Faculty of Business and Economics at the University of Melbourne. The research commissioned by DEEWR has benefited from comments by DEEWR staff, and we acknowledge the contributions of Kostas Mavromaras and Lucinda Platt to this earlier research. The paper uses the confidentialised unit record file from the Department of Families, Housing, Community Services and Indigenous Affairs' (FaHCSIA) Household, Income and Labour Dynamics in Australia Survey, which is managed by the Melbourne Institute of Applied Economic and Social Research. The views expressed in this paper are those of the authors alone and do not represent the views of the Minister for DEEWR, FaHCSIA, or the Commonwealth Government. We are grateful to Deborah Cobb-Clark for helpful comments.

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Abstract

This paper investigates the persistence over time of living in a jobless household, aiming to disentangle the roles of state dependence and unobserved heterogeneity. In addition, the potential heterogeneity of state dependence is examined through estimation of interaction terms with the lagged household joblessness variable. Finally, the robustness of results is explored through the use of alternative definitions of household joblessness each based on different variables available in our data. Using the two definitions that are most different, we find substantial state dependence which is larger for women than for men under both definitions. That is, being in a jobless household in the previous year increases the probability of currently living in a jobless household by 7.7 to 17.2 percentage points for men and 12.7 to 25.1 percentage points for women. Although state dependence clearly is an important factor, as are a number of observed characteristics, unobserved heterogeneity also plays an important role for men and women: 32 to 40 per cent of the unexplained variance can be attributed to unobserved heterogeneity for men, and for women this is 42 to 46 per cent. A few characteristics (age, disability, student status, living outside of major cities, having a university degree, presence of preschool children) seem to affect the level of state dependence to some extent. However, aside from the age effect, which can increase state dependence by up to 50 per cent for men aged 60 to 64, the level of state dependence seems fairly homogenous amongst men and amongst women.

JEL classification: D19, I32, J01, J64

Keywords: Household joblessness, state dependence, unobserved heterogeneity

1 Introduction

In the past decade, household joblessness has been raised as a concern in a number of countries due to its association with a wide range of negative outcomes. In particular, research shows strong links between household joblessness, on the one hand, and poverty and welfare dependence on the other hand (Organisation for Economic Co-operation and Development (OECD), 2001; Dickens and Ellwood, 2002; Nickell, 2004; Gregg *et al.*, 2010). Given the widespread evidence that parental income and background can have significant effects on the future welfare of children, Gregg *et al.* (2010) note that “household joblessness is also an important factor in the transmission of intergenerational effects of poverty”. Hence, there is concern about the long-term consequences for children growing up in jobless households. A few studies have recently examined the issue of household joblessness, its characteristics and its recent development.

For the UK, Gregg and Wadsworth (2004) point out the disconnection between broad economic trends and household joblessness rates. They find that the prevalence of individual joblessness has remained broadly in line with the economic cycle while the share of jobless households has tripled. The data show that “by 1996, nearly one in five of all (working-age) households were jobless and one in every seven individuals lived in a workless household, up from one in twenty in 1975.” Gregg *et al.* (2010) find similar patterns in household joblessness in a comparison of five OECD countries: United States, Britain, Germany, Spain and Australia. In all five countries, “individual workless rates have fallen over the past twenty years but household-based workless rates have not.” The study also reveals a few patterns specific to Britain and Australia. That is, “non-employment in Britain and Australia is more concentrated on single adults and families with children, than in other countries.” In addition, the high rates of employment polarisation in Britain and Australia “stem primarily from an “excess” of joblessness among single-adult households, that is absent in other countries.” This confirms results from an earlier study based on UK data by Nickell (2004) which emphasises the high correlation between household joblessness and poverty, especially child poverty. He notes that around 70 per cent of all individuals living in jobless households live in single-adult households.

The importance of household joblessness for other outcomes calls for further research. In particular, very little is known about the dynamics of household joblessness. This paper aims to fill this gap by applying an approach, recently applied by Cappellari and Jenkins (2011) to the issue of welfare dependence, to the issue of household joblessness in Australia. This approach allows us to gain additional insights regarding both the prevalence and persistence of household joblessness. Australia is of particular interest given the high degree of polarisation of employment across households and the similarity of the patterns observed in other OECD countries, the UK in particular. Recent studies by Scutella and Wooden (2004;

2008) and Headey and Verick (2006) have shown that household joblessness is associated with a broad range of negative outcomes in the Australian context as well. In particular, these three studies show a correlation between household joblessness and a range of indicators such as poverty, lower levels of financial wellbeing, subjective measures of financial stress, income support dependency, bad physical and mental health, and lower life satisfaction. Hence, gaining additional insights in the determinants of household joblessness seems as important in Australia as in other OECD countries, and is likely to have relevance beyond the Australian context.

We use the Household Income and Labour Dynamics in Australia (HILDA) Survey, Waves 1 to 7, covering the period from 2001 to 2007, to obtain comprehensive information on a set of nationally representative households. In particular, these data give us access to a range of variables measuring household members' employment status, allowing us to develop alternative measures of household joblessness. Drawing on Heckman (1981) to deal with initial conditions, we estimate a dynamic random effects probit model to explore the determinants of household joblessness. Following Cappellari and Jenkins (2011), we extend this modelling framework by interacting the state dependence variable of lagged household joblessness with all individual characteristics, thus allowing for different levels of state dependence for subgroups in the population. This approach allows us to shed light on the individual and household characteristics associated with household joblessness and its persistence. This is of particular interest given the questions surrounding the development of household joblessness rates in a number of countries, and in particular in Australia and the UK where the patterns of household joblessness seem to be similar. This approach distinguishes between state dependence and unobserved heterogeneity as potential causes for long-term household joblessness. The issue of household joblessness state dependence relates to the 'stickiness' of household joblessness as a state that may persist over time in a self-perpetuating manner. This distinction is important for policy development purposes since different strategies would be required to deal with household joblessness. If state dependence is important and previous household joblessness is the main determinant of current household joblessness, breaking the cycle of joblessness, preferably early in the cycle, is important. If unobserved characteristics are the main determinant, breaking the cycle will not help and households are likely to return to joblessness. The first action required is further investigation to discover what these unobserved characteristics might be. Once this is known, policy makers can determine what types of policies, if any, might be effective.

Despite the negative outcomes associated with household joblessness and the questions surrounding its development over time, few studies have examined the issue of household joblessness in Australia. In the late 1990s, a study by Miller (1997) revealed that "almost one-quarter of the total unemployment among couple families in 1994 was in families where both husband and wife were unemployed." Over time, similar levels of male unemployment were

shown to be associated with different levels of household joblessness. This illustrates the apparent disconnection between the rates of unemployment and the rates of household joblessness. It was also an indication of the increasing polarisation of employment across Australian households, later documented by Dawkins *et al.* (2002, 2005), which was only partly explained by the growing number of single adult households. A pattern shared with the UK is the large proportion of children living in jobless households in Australia (one in six in 1997-98).¹ Whiteford (2009) focuses on families with dependent children only, and concludes that “following nearly two decades of increasing joblessness, family joblessness has fallen since 1998 and is now nearly back to its level in 1980”. He implies that household joblessness has important consequences since in Australia a high proportion of poor children (70 per cent) live in jobless families, “making the joblessness of parents the main cause of relatively low income in childhood.” The question remains as to what caused this recent reduction in the proportion of jobless families.

The present study is different from Whiteford (2009) in that the focus is broader than families with children and the analysis is multivariate. We go beyond the study by Scutella and Wooden (2004) in that we examine the dynamics of household joblessness. In addition, the focus of this paper is on the individual and his or her probability of being a member of a jobless household, without the need to exclude households which experienced a change in their composition, as might occur through partnering or divorce. Finally, in contrast to other studies, we also explore the sensitivity to alternative definitions of joblessness and estimate our dynamic model for the two definitions that are most different.

Our results illustrate the importance of age, education, and other individual and household characteristics as determinants of household joblessness. We find that being in a jobless household in the previous year increases the probability of currently living in a jobless household by 7.7 to 17.2 percentage points for men and 12.7 to 25.1 percentage points for women. Although this shows that state dependence is substantial, unobserved heterogeneity also plays an important role for men and women: 32 to 40 per cent of the unexplained variance can be attributed to unobserved heterogeneity for men, and for women this is 42 to 46 per cent. The direction and relative size of the results for men and women are robust to the use of an alternative definition of joblessness. Although a few characteristics (disability, student status, living outside of major cities, having a university degree, presence of preschool children) have a small effect on the level of state dependence, only age seems to have a substantial effect..

¹ This point is also raised by McNamara *et al.* (2008) in a study on the social exclusion of Australian children based on data from the 2001 and 2006 Censuses of Population and Housing. They note “that, even by 2006, a relatively large proportion of children are living in jobless families, [which] is concerning, especially given Australia’s currently low unemployment rates.”

The structure of the paper is as follows. Section 2 discusses the sample selection and definitions of the key variables, as well as a range of summary statistics presenting the distribution of household joblessness persistence over time by household and individual characteristics. Section 3 sets out the modelling approach and the results are discussed in Section 4. Section 5 concludes.

2 Household Joblessness: Data and Descriptives

2.1 Sample Selection and Variable Definitions

The analysis is based on the first seven waves of the HILDA data set. HILDA is a longitudinal data set containing information on all individuals for a number of randomly selected households on a yearly basis. HILDA collects information on a large number of individual characteristics, such as education, health, labour force participation and income, and household characteristics, such as the number and age of children, and the number and a range of characteristics of other adults living in the household.²

The analysis is based on a number of variable definitions which are described below.

Jobless person: A person is defined as being in work in a particular time period if they reported having at least one job for that time period.. Any respondent of 18 years or over who worked less than 50 per cent of the time reported in the previous financial year (that is, time in unemployment together with time out of the labour force is more than 50 per cent of total time) is defined as being jobless.³ We use a number of derived variables, provided by HILDA, which state the percentage of reported time spent in employment, study, looking for a job, and other activities.⁴ To be defined as jobless, the percentage of time in employment needs to have a value under 50. This is called definition 1 hereafter.

In an alternative definition (to be called definition 1a), we use information based on the current labour force status (that is at the time of the interview). A person is defined as jobless if the recorded current situation is unemployed or out of the labour force.

In another alternative definition (to be called definition 2), we use information from the household questionnaire, in which one household member provides information about the employment status of all other household members. A person is defined as jobless if the status is neither working full time nor part time.⁵

² Detailed information on HILDA can be found on the website <http://melbourneinstitute.com/hilda/>

³ Tables 1 and 2 in Section 2.2 also show the proportions of jobless individuals using a 40 per cent and a 60 per cent cut-off point respectively in addition to a 50 per cent cut-off. The tables reveal limited sensitivity of the results to the alternative cut-off points.

⁴ The total reported time in the employment calendar may be less than a full year for some individuals. To the degree that non-reporting in the employment calendar is associated with the level of joblessness (a premise that we cannot test), this measure of joblessness will be biased.

⁵ For the year 2002, where this question is absent in the household questionnaire, we use imputed employment status instead.

Jobless household: This is a household in which all members over 18 are jobless in accordance with the definition of a jobless person. The joblessness of households that include working-age members for whom it is not possible to determine the personal joblessness or employment status, have been categorised as “household joblessness not determined”. These households are excluded from further analysis.

Given our interest in the degree of joblessness, we limit the sample of analysis to respondents who can be expected to work: that is only those of working age (between 18 and 64 years old) are selected. All respondents over 18 are included for each wave in which they are not of Age Pension age, and for as long as not all members of the household report being retired or full-time students. For individuals over 64, household joblessness is expected to depend mostly on retirement decisions, which are complex decisions related to health and wealth issues and are beyond the scope of this report. Only individuals for whom at least two consecutive waves are available are included in the multivariate analyses.

2.2 Persistence of Household Joblessness: Sensitivity to Alternative Definitions

We first carry out a sensitivity analysis regarding the cut-off point used for defining joblessness (with regard to deviations from 50 per cent). In addition, we use different variables from the HILDA survey to define joblessness in two alternative ways as described in Section 2.1. The prevalence and persistence of household joblessness based on these alternative definitions of joblessness are reported in Tables 1 and 2.

Table 1 Proportion of individuals in jobless households by household type and definition (in per cent)

	Calendar (Definition 1): worked less than			Current state (Definition 1a)	Household questionnaire (Definition 2)
	50%	40%	60%		
Couple	14.8	14.1	15.1	15.1	13.2
Lone parent	34.9	32.9	36.2	33.1	25.3
Related family	23.5	20.9	24.7	23.4	16.8
Lone person	48.1	46.9	49.0	48.3	46.5
Group	27.3	24.8	29.7	26.5	20.6
Multi-family	38.1	34.4	39.2	37.5	28.3
Total	22.0	21.0	22.6	22.1	18.8

Source: Authors' own calculations based on HILDA waves 2001-07 using population weights.

Table 1 shows that although the proportion of individuals in jobless households varies substantially by household type, the choice of the cut-off point in the calendar year to determine individual joblessness has no major effect. That is, the incidence of household joblessness does not vary much whether individuals are defined as jobless when they have worked for less than 40, 50 or 60 per cent of the year. In addition, Table 2 shows that the choice of the cut-off point has a negligible impact on persistence of household joblessness. This analysis suggests that the patterns in these tabulations remain unchanged and that the

actual percentages are not very sensitive to the precise cut-off point used for the definition of joblessness.

Instead of the calendar variables, the current labour force status at the time of the interview can be used to determine the joblessness status. Tables 1 and 2 show that the occurrence and persistence of household joblessness obtained with this alternative definition are again very similar to the results obtained with the calendar variables.

Table 2 Persistence of household joblessness by joblessness definition (in per cent)

	Calendar: worked less than			Current state	Household questionnaire
	50%	40%	60%		
Never	53.9	55.3	53.2	53.6	69.9
1 year	5.2	4.5	5.3	5.3	6.0
2 years	2.8	2.8	2.9	2.9	3.5
3 years	2.3	1.8	2.3	2.2	2.4
4 years	1.9	1.9	1.9	2.0	2.4
5 year	1.6	1.8	1.8	2.0	2.0
6 years	2.7	2.4	2.7	2.4	2.7
7 years	11.6	11.3	11.8	11.7	10.9
not determined	18.1	18.1	18.1	18.1	0.2
No of observations	12,205	12,205	12,205	12,205	12,205

Source: Authors' own calculations based on HILDA waves 2001-07 using population weights.

A problem with the current labour force status and the calendar variables, which are all recorded at the individual level, is that the number of missing values can be substantial due to non-responding household members. To circumvent this problem, it is possible to use information from the household questionnaire. In this questionnaire, one household member provides information about the employment status of all other household members. Tables 1 and 2 show that the use of this variable produces different results on the measures of both the occurrence and persistence of household joblessness. One possible explanation is that the household member filling out the household questionnaire is not always fully aware of the employment status of other household members. In addition, the data reveal that non-respondents to the HILDA survey are more likely to be working (according to the household questionnaire) than respondents. This explains why the incidence of household joblessness is lower when the definition is based on the household questionnaire. In the multivariate analysis, we present results based on two definitions: one based on the calendar and one on the household questionnaire.

2.3 Persistence of Household Joblessness by Individual and Household Characteristics

Table 3 reports the persistence of household joblessness by a range of household characteristics. Less than one fifth of all individuals experienced household joblessness over

the 7-year period covered by the HILDA and only about two per cent spent all seven years in a jobless household. Lone parents show the highest levels of persistence in household joblessness whereas the lowest levels are for couple households.

Table 3 Persistence of household joblessness by household characteristics (row percentages)

Characteristics measured in wave 1	Never	1 year	2-3 years	4-6 years	7 years	No of obs.
All	81.2	6.8	5.5	4.4	2.1	7,257
By household type						
Couple	87.3	5.7	3.8	2.2	1.0	5,731
Lone parent	49.9	10.4	14.6	17.2	7.9	825
Other related family	64.3	14.7	4.9	16.0	0.0	46
Lone person	78.2	7.8	7.2	4.1	2.7	541
Group	71.6	14.5	6.9	3.0	4.1	114
Size of the household						
1 person	76.4	9.5	7.1	3.8	3.1	655
2 persons	82.5	5.6	4.9	5.2	1.7	1,272
3 persons	74.8	8.7	5.9	7.9	2.8	1,239
4 persons	85.9	5.7	3.8	3.1	1.5	2,252
5 persons or more	81.3	6.2	7.6	2.8	2.2	1,839
Number of working-age members in household (15 - up to Age Pension age)						
1	59.3	10.7	10.5	12.5	6.9	1,210
2	85.8	5.9	4.7	2.4	1.3	4,741
3	86.5	6.4	3.3	3.6	0.2	849
4 or more	89.5	4.7	4.3	1.3	0.3	453
Number of resident children						
0	83.9	6.8	4.0	3.5	1.9	1,956
1	78.1	8.4	6.1	4.9	2.4	1,237
2	82.8	5.4	5.0	5.0	1.7	2,279
3	80.7	7.5	6.0	3.8	2.0	1,143
4 or more	70.7	6.1	12.9	5.9	4.4	642
Preschoolers present in household	77.8	7.2	6.0	5.7	3.3	2,760
Child(ren) present but no preschoolers	82.2	6.3	6.5	4.0	1.1	2,541
Remoteness						
Major City	83.7	6.1	4.5	3.9	1.7	4,433
Inner Regional	77.2	6.4	8.2	5.8	2.3	1,897
Outer Regional	74.1	12.0	6.4	3.9	3.6	829
Remote	78.5	3.9	4.9	7.0	5.7	98
SEIFA deciles						
1	63.8	8.7	10.5	9.2	7.8	521
2	75.8	8.0	5.7	7.3	3.2	810
3	73.3	7.9	9.6	6.2	2.9	866
4	73.4	6.3	10.2	8.3	1.7	791
5	83.7	8.9	3.4	1.4	2.7	743
6	82.6	7.0	5.5	2.4	2.5	600
7	86.9	5.6	2.0	3.4	2.1	731
8	86.0	7.5	3.2	3.4	0.0	667
9	88.3	4.5	3.9	2.8	0.4	807
10	91.0	4.2	3.4	1.5	0.0	721

Table 3 Continued

	Never	1 year	2-3 years	4-6 years	7 years	No of obs.
Reference person characteristics						
Male	85.4	6.2	4.2	2.7	1.4	12
Female	56.6	10.0	13.2	14.1	6.1	6
Education (reference person)						
Below year 10	61.3	8.0	5.6	13.8	11.3	473
Year 10-11 or certificate I-II	72.0	8.7	8.9	6.7	3.7	1,423
Secondary school	82.0	8.5	4.8	3.4	1.3	734
Certificate III/IV	85.5	6.3	4.8	2.6	0.8	2,112
Diploma	82.6	5.1	6.6	5.2	0.6	694
Degree and above	88.8	5.2	3.4	2.0	0.5	1,821

Note: All those who reached Age Pension age during the first seven waves of HILDA are excluded. In addition, those who lived in a multi-family household in the first wave, those who were full-time student in the first wave, as well as those who lived in a household in which all adult members were retired in the first wave are excluded.

Source: Authors' own calculations based on HILDA waves 2001-07 using population weights.

The persistence of household joblessness is more correlated with the number of working-age adults in the household than with the total size of the household. In addition, individuals in households with four or more children or in households with preschool-aged children exhibit higher levels of persistence.

The persistence of household joblessness is negatively correlated with the Socio-Economic Indexes for Areas (SEIFA)⁶ and it is lower in major cities than in other areas. The sample size for remote Australia is probably too small for the results to be significant, but it is clear that individuals living in regional and more remote areas are more likely to experience household joblessness. The persistence of household joblessness is also negatively correlated with the education level of the reference person in the household.⁷ In addition, the persistence is much lower if the reference person is a male rather than a female.

Table 4 reports the persistence of household joblessness by a range of individual characteristics. The persistence is lower for males than for females. It is also lower for those aged between 25 and 64 than for those under 25. Individual education levels are negatively correlated with the persistence of household joblessness, but not as strongly as the education level of the reference person.

Those with a low value on the mental health index or with long-term or work-limiting health conditions exhibit higher levels of persistence. The correlation with higher persistence levels

⁶ More specifically, we use the SEIFA index indicating relative socio-economic advantage and disadvantage.

⁷ A reference person is defined in the following way. If the household is a couple household, the male partner is chosen, while in the case of same-sex partners, the older partner is chosen. If it is a lone parent household, the parent is chosen, except in the case that the parent is over 64 years of age and lives with adult children, then the oldest child is chosen. If several generations are present in the household, the middle generation takes precedence: for example, in a household with a woman, her daughter and the daughter's child, the daughter is considered "the lone parent" and chosen as a reference person, even if the oldest woman in the household is 64 or younger. In a lone-person household – that person is the reference person. Unrelated persons, living in a group household, are considered separate lone-person households and, consequently, each of them is a reference person. In households of a number of other relatives living together, the oldest male person (if present) or just the oldest person below retirement age is chosen.

is also particularly strong for people from an indigenous background. However, this is only a small group in the HILDA sample.

Table 4 Persistence of household joblessness by individual characteristics in wave 1 (row percentages)

	Never	1 year	2-3 years	4-6 years	7 years	No of obs.
All	81.2	6.8	5.5	4.4	2.1	7,257
Male	82.7	6.2	5.3	4.0	1.8	3,617
Female	79.6	7.3	5.8	4.8	2.4	3,640
Age						
Less than 5	73.6	7.9	6.7	7.5	4.2	848
5-14	76.7	6.7	7.9	6.0	2.7	1,605
15-24	76.2	10.8	7.6	4.4	1.0	794
25-44	83.9	6.3	4.3	3.6	1.9	2,928
45-54	90.2	3.0	3.3	2.2	1.4	934
55-64	89.4	4.4	1.9	3.4	1.0	148
Education level						
Below Year 10	67.1	7.5	7.8	10.2	7.5	266
Year 10-11 or certificate I/II	76.3	8.3	7.1	5.7	2.7	1,254
Year 12	84.0	7.7	4.9	2.1	1.3	739
Certificate III/IV	87.9	4.5	4.3	2.3	1.0	920
Diploma	86.3	5.4	4.2	4.0	0.1	441
Degree and above	91.2	5.7	1.7	1.1	0.3	1,182
Mental health index						
80-100	88.5	5.6	3.2	1.7	1.1	2,276
60-79.9	84.0	6.5	4.9	3.4	1.2	1,595
<60	70.4	8.8	9.0	7.5	4.1	744
Long-term health condition	68.4	8.5	9.4	9.3	4.5	812
Work limiting health condition	60.5	10.0	9.4	12.1	8.0	429
Non-English background	80.8	8.2	5.0	4.4	1.6	388
Indigenous	54.5	9.1	14.9	11.5	10.0	67
No children	82.0	7.8	5.1	3.5	1.6	2,368
Has children	85.5	5.1	4.2	3.4	1.7	2,434
Work experience						
less than 1 year	53.4	13.1	13.7	7.4	12.4	130
1-5 years	74.2	10.6	6.6	5.5	3.1	415
5-10 years	80.1	8.1	4.7	4.8	2.2	636
10-30 years	88.2	5.0	3.4	2.6	0.8	2,733
more than 30 years	90.6	3.1	3.0	2.0	1.2	587
Unemployment history						
Never unemployed	88.7	5.2	2.9	2.1	1.1	3,196
Less than 1 year	86.0	6.8	4.3	2.1	0.7	464
1-2 years	77.5	9.7	6.2	5.0	1.6	546
more than 2 years	50.1	9.1	15.0	15.5	10.4	295
Participation in labour force since full-time education						
Always participated	90.2	5.1	3.2	1.5	0.1	1,805
More than half time	85.0	6.4	4.3	3.2	1.1	2,429
Half time and less	71.6	8.2	8.3	7.5	4.3	3,023

Note: All those who reached Age Pension age during the first seven waves of HILDA are excluded. In addition, those who lived in a multi-family household in the first wave, those who were full-time student in the first wave, as well as those who lived in a household in which all adult members were retired in the first wave are excluded.

Source: Authors' own calculations based on HILDA waves 2001-07 using population weights.

The differences in persistence between those who have child(ren) and those who do not are fairly small, where those with children appear to experience slightly less persistent household joblessness.

As expected, the persistence is higher for those who have experienced unemployment spells in the past and for those who have spent a large proportion of their time (since completing full-time education) out of the labour force. By contrast, the persistence in household joblessness is negatively correlated with work experience.

3 A Dynamic Model of Household Joblessness

State dependence describes the process whereby an individual is more likely to be in state X (in this case: to be living in a jobless household) in period $t+1$ if he/she was in state X in period t . This is independent of any observable characteristics they may have. However, being in state X for a number of subsequent periods could also be explained by unobserved characteristics (unobserved heterogeneity) which increase the probability of living in a jobless household. As mentioned in the introduction, this is an important distinction because the policy implications can be quite different depending on whether state dependence or unobserved heterogeneity is the main determinant of household joblessness.

To disentangle the effects of these two factors and to estimate the effect of observed characteristics on household joblessness, we estimate a dynamic random effects probit model. State dependence is defined as the extent to which household joblessness in one year increases the probability of household joblessness in the following year. The model accounts for the endogeneity of the initial conditions, while controlling for differences in observed and unobserved characteristics between individuals (observed and unobserved heterogeneity). The approach suggested by Heckman (1981) is implemented to deal with the initial conditions problem in the dynamic random effects probit model. Following Cappellari and Jenkins (2011), we allow all variables to affect both prevalence and state dependence in household joblessness by interacting the state dependence parameter with all explanatory variables.

The probability of individual i being in a jobless household at time t (Y_{it}), for $t > 0$, is a function of household joblessness at time $t-1$ ($Y_{i,t-1}$) and a number of observable characteristics

(X_{it}):

$$Y_{it}^* = \gamma Y_{i,t-1} X_{it} + \beta' X_{it} + v_{it}, t > 0 \quad (1)$$

$$Y_{it} = \begin{cases} 1 & \text{if } Y_{it}^* \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

where Y_{it}^* is the underlying latent variable for observed household joblessness (Y_{it}). X_{it} is a vector of observed variables (containing for example: age categories, education level, SEIFA index, living in a city, disability, mental health, household type, presence of children, having a partner, being retired, being a full-time student and the state-level unemployment rate) which may affect joblessness (Y_{it}) but which are uncorrelated with the error term v_{it} . In a dynamic model, γ (representing state dependence) is a parameter to be estimated, while static models restrict γ to be equal to 0. Repeated observations for a given group of individuals over time allow us to construct a model in which individuals may differ in their propensity to being a member of a jobless household. Such individual (unobserved) heterogeneity is specified in estimation by decomposing the error term v_{it} into two separate terms: a constant component for each individual and a time-varying component. This is written as:

$$v_{it} = \alpha_i + u_{it} \quad (2)$$

where α_i is an individual-specific and time-invariant random component, assumed to be normally distributed, with zero mean and variance σ_α^2 , and u_{it} is a time- and individual-specific disturbance, assumed to be a serially independently distributed standard normal and uncorrelated with X_{it} and α_i . Thus, we estimate a random effects dynamic probit model of being a member of a jobless household (Y_{it}), which is specified as:

$$Y_{it}^* = \gamma Y_{i,t-1} X_{it} + \beta' X_{it} + \alpha_i + u_{it} \quad (3)$$

$$Y_{it} = \begin{cases} 1 & \text{if } Y_{it}^* \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

Since the total error term ($v_{it} = \alpha_i + u_{it}$) of the model is correlated over time due to the individual-specific time-invariant α_i component, we have:

$$\rho = \text{Corr}(v_{it}, v_{is}) = \frac{\sigma_\alpha^2}{\sigma_\alpha^2 + \sigma_u^2} \quad t, s = 1, \dots, T \text{ and } t \neq s \quad (4)$$

where ρ measures the proportion of the total variance contributed by the individual-level (or panel-level) variance component. Based on this statistic, a likelihood ratio test can be constructed to test the null hypothesis that $\rho = 0$, which tests for the presence of unobserved heterogeneity. If ρ is zero, the panel-level variance component is not important. That is, the panel estimator would not be different from a pooled estimator, in which no account is taken of individual-specific unobserved differences. In addition, although the random effects model assumes α_i to be uncorrelated with X_{it} , we also add \bar{x}_i , which is the average of the observations on some of the exogenous variables over the sample period, as regressors to the

model in the actual estimation (Mundlak, 1978). This is aimed at controlling for the potential correlation between α_i and X_{it} .

We now turn to a potential source of bias arising from the initial conditions problem. The presence of state dependence in the form of a lagged dependent variable $Y_{i,t-1}$ introduces what is called an initial conditions problem. This is caused by our lack of knowledge of the data-generating process governing the initial household joblessness outcome. If the individual initial conditions are correlated with the α_i , the estimator will be inconsistent and tend to overestimate γ (that is, overstate the extent of state dependence). Heckman (1981) therefore proposed to approximate the initial household joblessness states by a reduced-form equation:

$$Y_{i0}^* = \beta_0' Z_{i0} + \mu_{i0} \quad (5)$$

$$Y_{i0} = \begin{cases} 1 & \text{if } Y_{i0}^* \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

That is, to account for the endogeneity of the initial conditions, household joblessness in the first time period $t=0$ (Y_{i0}) depends on a set of individual characteristics as measured in the first wave, Z_{i0} , which includes the variables in X_{it} as measured in the first period, work experience in years and squared work experience, the proportion of time spent in unemployment since completing full-time education, the proportion of time not in work since completing full-time education and whether or not individual i is from a non-English speaking background. μ_{i0} is the standard normal distribution and correlated with α_i , but uncorrelated with u_{it} for $t \geq 1$. Using an orthogonal projection, the latter can be written as $\mu_{i0} = \theta \alpha_i + u_{i1}$, ($\theta > 0$) with α_i and u_{i1} independent of one another.

Consistent estimates can then be obtained by jointly estimating the approximate reduced form probability of household joblessness for the initial state of the sample (5) and the latent dynamic household joblessness (3), using maximum likelihood. In the next section, only the results for (3) are presented since (5) is just an auxiliary equation.⁸ The only parameter of interest arising from (5) is θ , since its significance indicates whether there is endogeneity of the initial conditions.

4 Results on the Dynamics of Household Joblessness

The estimated coefficients and marginal effects are reported in Tables 5 and 6 using the definition of household joblessness based on calendar questions (definition 1, described in Section 2.2, using the 50 per cent cut-off point), for females and males respectively. To check the robustness of the results, the same estimates using the definition of household joblessness

⁸ Full results are available from the authors upon request.

based on household questionnaires (definition 2) are reported in Appendix Tables A.1 and A.2. Presentation of marginal effects allows easy comparison across models.

Allowing for the endogeneity of the initial conditions is shown to be important, since the estimator of θ is significant in all specifications. These results thus validate the chosen specification of a dynamic random effects model which allows for the endogeneity of the initial conditions. The importance of allowing for the individual random effects is shown by a clear rejection of the null hypothesis that $\rho = 0$ (the absence of individual heterogeneity) in all specifications. This indicates that panel-level variance is an important determinant of household joblessness. That is, beyond the observed characteristics controlled for in the model, there are other unobserved variables playing an important role in explaining the prevalence and persistence of household joblessness (32 to 46 per cent of unexplained variance is due to panel-level variance).

Columns 3 and 4 in tables 5 and 6 show that state dependence is highly relevant for males and females as indicated by the significant coefficient on the intercept of the lagged household joblessness variable.⁹ That is, even after controlling for a range of individual and household characteristics and unobserved heterogeneity, being in a jobless household in one year significantly increases the probability of being in a jobless household the following year. Using an alternative household joblessness definition does not change this result, although lagged household joblessness is only significant at the ten per cent level for males and at the five per cent level for females under the alternative joblessness definition (Appendix Tables A.1 and A.2). The marginal effects show that the effects are larger under the first definition than under the second, for both males and females. For the reference person—who is 18 to 29 years of age, has an education level of less than Year 10 and lives in a couple household—being in a jobless household in the previous year increases the probability of household joblessness in the current year by 17.2 percentage points for males under the first definition, but only by 7.7 percentage points under the second definition. State dependence is somewhat stronger for females than for males as shown by the marginal effects for females of 25.1 and 12.7 percentage points under the first and second definition, respectively. Larger measurement errors of household joblessness under the second definition may lead to more variability in joblessness from year to year, and thus a weaker relationship of household joblessness status between periods of time. These are large effects, compared to an overall average probability of just over 20 per cent to live in a jobless household.

⁹ Note that the lagged joblessness variable does not need to relate to the same household as in the current period. It is the joblessness of the household of which the individual was a member at that time.

Table 5 Dynamic model of household joblessness (definition 1, females)

	Direct effects		Interactions with lagged household joblessness		
	Coefficient	Marg. Eff.	Coefficient	Marg. Eff.	
Intercept	-1.265 ***		1.712 ***		0.251
<i>Age (reference is 18-29)</i>					
30-39	-0.102	-0.009	0.303 *		0.029
40-49	-0.133	-0.012	0.109		0.010
50-59	-0.036	-0.003	-0.033		-0.003
60-64	0.167	0.016	0.127		0.012
<i>Education level (reference is <Year 10)</i>					
Year 10, 11 or Cert. I/II	-0.184 *	-0.019	0.129		0.012
Year 12	-0.276 **	-0.027	-0.076		-0.007
Cert. III/IV	-0.358 ***	-0.035	-0.118		-0.010
Diploma	-0.295 **	-0.029	-0.166		-0.014
University	-0.611 ***	-0.055	-0.166		-0.014
SEIFA index	-0.065 ***	-0.006	0.002		0.000
Not in major city	0.168 **	0.015	-0.083		-0.007
Disability	0.298 ***	0.028	-0.206 *		-0.017
Mental health index	-0.008 ***	-0.0002	0.003		0.000
Missing mental health index	-0.710 ***	-0.054	0.346		0.034
<i>Household type (reference is couple)</i>					
Lone parent	1.001 ***	0.101	-0.467		-0.036
Related family and group households	0.542 **	0.047	-0.516		-0.039
Lone person	0.670 ***	0.061	-0.224		-0.018
Multi-family household	0.765 ***	0.072	-0.143		-0.012
No. of all resident children	-0.317 ***	-0.026	-0.038		-0.003
No. of resident children under 4	0.337 ***	0.033	-0.080		-0.007
Partnered	-0.510 **	-0.046	-0.186		-0.015
Retired	0.519 ***	0.053	0.053		0.005
Full-time student	1.056 ***	0.119	-0.667 ***		-0.049
State-level unemployment rate	0.067 *	0.002	-0.010		-0.001
<i>Survey year (ref. is 2002)</i>					
2003	-0.205 **	-0.018	0.128		0.012
2004	-0.110	-0.010	0.237		0.022
2005	-0.051	-0.005	-0.038		-0.003
2006	-0.225 *	-0.019	-0.166		-0.014
2007	0.066	0.006	-0.201		-0.017
Individual averages across the waves for					
Disability	0.523 ***	0.014			
No. of all resident children	0.318 ***	0.006			
No. of resident children under 4	0.228 ***	0.008			
Partnered	0.105	0.003			
Retired	1.919 ***	0.050			
Full-time student	0.163	0.004			
State-level unemployment rate	-0.090 *	-0.002			
Rho (ρ)	0.418 ***				
Theta (θ)	1.086 ***				
Number of observations	30,048				

Note: The initial conditions equation includes all variables in the main equation except the lagged joblessness indicator. In addition, work experience in years, squared work experience, the proportion of time spent in unemployment since completing full-time education, the proportion of time not in work since completing full-time education and whether or not individual i is from a non-English speaking background are included.

Table 6 Dynamic model of household joblessness (definition 1, males)

	Direct effect		Interaction with lagged household joblessness		
	Coefficient	Marg. Eff.	Coefficient		Marg. Eff.
Intercept	-1.243	***	1.424	***	0.172
<i>Age (reference is 18-29)</i>					
30-39	0.173		0.380	*	0.031
40-49	0.136		0.704	***	0.065
50-59	0.241	**	0.559	***	0.049
60-64	0.592	***	0.911	***	0.091
<i>Education level (reference is <Year 10)</i>					
Year 10, 11 or Cert. I/II	-0.386	***	0.296		0.022
Year 12	-0.419	***	0.113		0.008
Cert. III/IV	-0.460	***	0.207		0.015
Diploma	-0.354	**	-0.125		-0.008
University	-0.484	***	-0.148		-0.010
SEIFA index	-0.046	***	-0.035		-0.002
Not in major city	0.213	***	-0.338	***	-0.020
Disability	0.400	***	-0.169		-0.011
Mental health index	-0.007	***	0.002		0.000
Missing mental health index	-0.427	***	0.050		0.003
<i>Household type (reference is couple)</i>					
Lone parent	0.250		0.002		0.000
Related family and group households	0.524	**	-0.392		-0.023
Lone person	0.412	**	0.024		0.002
Multi-family household	0.594	**	-0.158		-0.010
No. of all resident children	-0.176	**	-0.074		-0.005
No. of resident children under 4	0.192	*	0.208		0.015
Partnered	-0.202		-0.026		-0.002
Retired	0.746	***	-0.093		-0.006
Full-time student	0.711	***	-0.362		-0.022
State-level unemployment rate	0.055		-0.032		-0.002
<i>Survey year (ref. is 2002)</i>					
2003	-0.171	*	0.047		0.003
2004	-0.141		0.154		0.011
2005	-0.128		-0.196		-0.012
2006	-0.287	**	-0.161		-0.010
2007	-0.115		-0.062		-0.004
Individual averages across the waves for					
Disability	0.688	***	0.059		
No. of all resident children	0.014		0.001		
No. of resident children under 4	0.253	*	0.022		
Partnered	-0.249	*	-0.021		
Retired	1.501	***	0.129		
Full-time student	1.214	***	0.105		
State-level unemployment rate	-0.099	*	-0.009		
Rho (ρ)	0.318	***			
Theta (θ)	1.145	***			
Number of observations	28,188				

Note: The initial conditions equation includes all variables in the main equation except the lagged joblessness indicator. In addition, work experience in years, squared work experience, the proportion of time spent in unemployment since completing full-time education, the proportion of time not in work since completing full-time education and whether or not individual i is from a non-English speaking background are included.

The use of the alternative joblessness definition only affects the level of significance and size of a few coefficients and the sign of a few insignificant coefficients are reversed, but the direction and relative size of significant coefficients remains similar. Hence, the conclusions arising from the results are robust to the use of the alternative joblessness definition. The results also show that, all coefficients which are at least significant at the ten per cent level have the same sign for males and females, even though the size of the marginal effects varies considerably by gender.

Interestingly, the direct effect of the state-level unemployment rate for each of the observed years on the probability of household joblessness is positive but not significant for males and significant only at the ten per cent level for females.¹⁰ Appendix Tables A.1 and A.2 show that using the alternative definition of household joblessness, the direct effect is positive but insignificant for females while it is positive and significant at the five per cent level for males. The effect of the unemployment rate on the state dependence of household joblessness is insignificant in all models. Hence, there is only limited evidence of a significant relationship between the unemployment rate and the incidence of household joblessness. This weak effect is in line with earlier findings where high joblessness rates were found to exist both in low and high unemployment environments (Miller, 1997; Gregg *et al.*, 2010).

In addition to the state-level unemployment rate, which is a proxy for the state of the local labour market, all models include a year-dummy to capture other variations in circumstances over time. Compared to 2002 (the reference year), in nearly all years are individuals less likely to be part of a jobless household, although in most cases the difference with 2002 is not significant (particularly when using the alternative joblessness definition). For women, using the alternative definition, 2004 appears to be a year of slightly higher joblessness rates (1.4 percentage points higher than in 2002). Overall, the fluctuations appear fairly small. None of the years show higher or lower state dependence than another year. This indicates that the decreasing trend in the rates of household joblessness observed over the 2001-2007 period (see Whiteford, 2009; and Héroult *et al.*, 2010) does not seem to be explained by factors external to this study but, instead, by changes in the composition of the population with respect to the factors explicitly controlled for in the model.

Turning to the household and individual characteristics, the results show the expected effects on the probability of joblessness and that only a few of the variables interacted with lagged household joblessness are statistically significant. This indicates that once someone is part of a jobless household there are few differences in the state dependence of this joblessness between individuals with different characteristics. That is, the ‘stickiness’ of household joblessness is of similar magnitude for almost all individuals, irrespective of their characteristics. There are, however, a few exceptions although differences in state dependence

¹⁰ Since we have included average values of unemployment rates for the individual as well, this variable picks up the effect of year-to-year changes in unemployment.

are mostly fairly small. For males and/or females: age, living outside a city, having a university degree, having a disability and being a full-time student are all factors affecting the persistence of household joblessness to some extent. Older men (compared to 18-29 year old men) are more likely to remain in a jobless household. For women, only the effect for 30-39 year old women is significant, increasing the state dependence compared to the youngest group. Under definition 1, men who live outside a city experience less state dependence compared to men living in cities, and to a lesser extent the same is true for women (when using definition 2). Under definition 2, men and women with a university degree experience less state dependence than men with less than Year 10 of high school. Under both definitions are women with a disability less likely to experience state dependence than women without a disability. Finally, under definition 1, female full-time students are less likely to experience state dependence than other women.

The above indicates that state dependence is fairly homogenous across subgroups but it does not imply that the probability of being in a jobless household is the same for different subgroups. On the contrary, people with different characteristics have different probabilities of becoming part of a jobless household, as well as remaining in a jobless household. The latter is, however, not due to differences in state dependence for these subgroups, but is directly attributable to their characteristics. The results show that a wide range of characteristics affect the probability of being part of a jobless household. We discuss the effects briefly here.

Men over 30 years of age face a higher risk of household joblessness than males between 18 and 29 years old. This effect is strongest for men over 50 years of age and largest for males aged between 60 and 64 years; the increase in household joblessness probability is 4.6 percentage points under the first definition and 8.0 percentage points under the second definition. The effect is also positive for women in this age group (1.6 and 3.5 percentage points respectively), but only significant under the second definition.

Education significantly reduces the probability of household joblessness. Compared to Year 9 or less, higher education levels significantly reduce the probability of household joblessness. However, the largest effects are associated with a university degree (-3.7 and -2.6 percentage points under the first and second definitions for men and -5.5 and -5.8 percentage points for women). A potential explanation for the larger effect for women is that men are likely to participate in the labour market independent of whether they have finished a higher education or not whereas female participation depends more on their investment in human capital.

The SEIFA index decile has a negative effect on the probability of household joblessness, indicating that those living in more advantaged areas are less likely to live in a jobless household. Living outside of the major cities is a factor associated with a slightly higher

incidence of household joblessness but the effect is insignificant under the second definition for males.

The presence of a disability or poor mental health increases the probability of household joblessness.¹¹ The marginal effects associated with mental health are modest but very significant (for women, 0.02 and 0.03 percentage point reduction in the probability of household joblessness per additional unit of mental health on a scale between 0 and 100, and for men in between 0.06 and 0.09 percentage point decrease). An increase in the mental health index by one standard deviation (19 points for females and 17 points for males) would therefore lead to a reduction in the probability of household joblessness by 0.4 to 0.6 and 1 to 1.7 percentage points for females and males respectively. Disability increases an individual's probability of household joblessness by in between 2.8 and 3.1 percentage points.¹²

Household composition is important for both men and women. Compared to living in a couple household (the reference group), living in any other household type increases the probability of household joblessness. For females, being a lone parent has the strongest effect, increasing household joblessness by 10.1 and 9.8 percentage points under the first and second definition respectively, whereas for men this is the smallest effect which is insignificant as well. For men, the largest effect is for multi-family households under both definitions (4.5 to 5.4 percentage points). It is clear that the effects of household type are smaller for males than for females and the same is true for the effects of the presence of children. The number of children has a negative effect on the probability of joblessness, while the effect of the presence of children under five years old in the household is positive and larger than the negative effect of children. For women, an additional child under five years old increases the probability of household joblessness by 0.7 and 2.1 percentage points under the first and second definition respectively.¹³ By comparison, the corresponding effects for males are 0.3 and 1.3 percentage points. Obtaining a partner is associated with lower probabilities of household joblessness for females, by over 4 percentage points. For males, the effect of gaining or losing a partner is small and insignificant although partnered men are significantly less likely to live in a jobless household (as can be seen from the individual's value of being partnered averaged over the waves).

As expected, being a full-time student increases the probability of household joblessness significantly for both males and females. Under the first definition, being a full-time student

¹¹ The mental health index is missing for all who did not complete the Self Completion Questionnaire (SCQ) from HILDA. To avoid reducing the sample of analysis substantially, a dummy to indicate a missing health index is included in the models. This dummy affects the probability of household joblessness negatively. This suggests that non-completion of the SCQ is correlated with employment, possibly because less time is (made) available for filling out surveys by those who are working.

¹² This is measuring the effect of changes at the individual level since we control for the average value of disability across all observed waves.

¹³ To obtain these marginal effects, the marginal effects associated with an additional child have to be combined with those associated with an additional child under five years old.

increases the probability of household joblessness by 11.9 and 6.1 percentage points for females and males respectively. It is, however, difficult to explain why these effects jump to 22.1 and 18.2 percentage points under the second definition. One possible explanation is the different definition of the student variable in the two specifications. The definition of 'student' differs in these two cases to maintain consistency with the definition of joblessness being used. Under the first definition, students are those who have been a full-time student for more than 50 per cent of the time in the last twelve months. The second definition makes use of household-level information, which is less detailed in this regard. Under this definition, only non-working students at the time of the interview can be recorded as student. Finally, being retired increases the probability of household joblessness by 5.3 and 6.9 percentage points under the first definition for females and males respectively, and 8.4 and 9.3 percentage points under the second definition.

5 Conclusion

Household joblessness has recently raised concerns in a number of developed countries, in particular due to its association with a wide range of negative outcomes. International comparisons, such as Gregg *et al.* (2010), have noted similarities in the high levels of and the composition of household joblessness in Australia, the UK and a number of other OECD countries. In view of the limited amount of research on this topic, this paper aims to shed light on the determinants of household joblessness and its persistence from an individual's perspective, using Australian data. Importantly, we distinguish between state dependence and unobserved heterogeneity as potential determinants of long-term household joblessness.

We use the Household Income and Labour Dynamics in Australia (HILDA) Survey, Waves 1 to 7 to obtain comprehensive information on a set of nationally representative households. We apply the recent approach of Cappellari and Jenkins (2011) in the context of welfare dependence to the issue of household joblessness. This approach, based on a dynamic random effects probit model, allows us to shed light on the factors associated with household joblessness, whilst controlling for observed and unobserved heterogeneity and allowing for heterogeneous state dependence. All analyses are done at the individual level using as the dependent variable whether the individual lives in a jobless household so we can investigate the dynamics of living in a jobless household over time without the need to exclude households which change in composition (and where the relevant household may change over time), as might occur through partnering or divorce.

As a robustness check, all results are reported for two alternative joblessness definitions, one based on calendar questions regarding the previous year and one based on current information provided by the reference household member for all members in the household. This sensitivity analysis shows that, although the two alternative definitions of household joblessness lead to fairly different numbers of households allocated to the jobless households'

group, the estimated effects of individual and household characteristics on household joblessness are consistent between the two definitions.

The results reveal that state dependence is important for men and women under both definitions of joblessness and that the effects of state dependence are larger for females than for males. *Ceteris paribus*, being in a jobless household in the previous year increases the probability of living in a jobless household in the current year by an additional 12.7 to 25.1 percentage points (depending on the definition used) for women and an additional 7.7 to 17.2 percentage point increase for men. Only a limited number of characteristics (age, living outside a city, having a university degree, having a disability and being a full-time student) affect the state dependence of an individual's membership of a jobless household. Moreover, with the exception of age in the male models, the effects of these characteristics are small compared to the average size of state dependence indicating that state dependence is fairly homogenous across all subgroups. For example, with the exception of those with a university degree, education offers little protection against state dependence of household joblessness, which contrasts with expectations. The most substantial effects are observed for 60-64 year old men who have state dependence levels which are more than 50 per cent higher than those of the reference group of 18 to 29 year old men, and to a lesser extent (around 30 per cent higher) for 40-59 year old men. For the groups of individuals experiencing the most substantial state dependence, policies aimed at breaking the cycle of household joblessness, preferably early in the cycle could be particularly useful. For example, under the first definition, the probability of living in a jobless household in the next period is estimated to be around 25 percentage points (around 10-12 percentage points under the second definition) higher for women of any age and for men over 40 years of age who are currently living in jobless households compared to similar women and men *not* currently living in jobless households..

The results also show that a wide range of observed individual, household and environmental factors affect the probability of household joblessness directly. Important individual factors are education, health, age, own retirement status and student status. Education, health and own retirement status are clearly factors that can potentially be targeted by government policies to reduce the household joblessness due to these factors. Household and partner's characteristics are more important for women than for men in determining whether they are living in a jobless household. For example living in a lone parent household increases the probability of living in a jobless household to a large extent for women. This result is according to expectation given the generally poor labour market outcomes for lone mothers in Australia. The group of single mothers is particularly affected by household joblessness. They require specific attention, especially since a substantial number of children are growing up in these households, experiencing lengthy periods of household joblessness (and related poverty).

The lack of a clear link between local unemployment rates and household joblessness rates reported by Miller (1997), Gregg and Wadsworth (2004) and Gregg *et al.* (2010) is confirmed by the results in this paper. We find limited evidence of the effect of the unemployment rate (measured yearly at the State level) on the prevalence or persistence of household joblessness. The fact that the year dummies included in the model are not statistically significant indicates that the decreasing trend in the rates of household joblessness observed over the 2001-2007 period (see Whiteford, 2009; and Héroult *et al.*, 2010) is explained by factors included in this study. That is, it is explained by changes in the composition of the population with respect to the factors explicitly controlled for in the model.

Finally, another result of interest is that unobserved differences between individuals affect persistence in household joblessness. This means that beyond the (fairly comprehensive set of) observed characteristics controlled for in the model, there are unobserved variables playing an important role in explaining the prevalence and persistence of household joblessness. That is, 32 to 40 per cent of the unexplained variance can be attributed to unobserved heterogeneity for men, and for women this is 42 to 46 per cent. Further research into these unobserved determinants of household joblessness could be useful.

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Appendix

Appendix Table A.1 Dynamic model of household joblessness (definition 2, females)

	Direct effect		Interaction with lagged household joblessness	
	Coefficient	Marg. Eff.	Coefficient	Marg. Eff.
Intercept	-1.555	***	1.075	**
<i>Age (reference is 18-29)</i>				
30-39	-0.030		0.180	
40-49	-0.090		0.032	
50-59	0.077		-0.075	
60-64	0.366	***	0.128	
<i>Education level (reference is <Year 10)</i>				
Year 10, 11 or Cert. I/II	-0.204	**	0.160	
Year 12	-0.249	**	-0.171	
Cert. III/IV	-0.317	***	-0.079	
Diploma	-0.380	***	-0.018	
University	-0.660	***	-0.396	**
SEIFA index	-0.067	***	0.003	
Not in major city	0.217	***	-0.176	*
Disability	0.308	***	-0.242	**
Mental health index	-0.007	***	0.002	
Missing mental health index	-0.512	***	0.012	
<i>Household type (reference is couple)</i>				
Lone parent	1.001	***	-0.289	
Related family and group households	0.474	*	0.341	
Lone person	0.703	***	-0.051	
Multi-family household	0.944	***	0.023	
No. of all resident children	-0.322	***	0.006	
No. of resident children under 4	0.471	***	-0.255	***
Partnered	-0.479	**	0.113	
Retired	0.777	***	-0.050	
Full-time student	1.677	***	-0.127	
State-level unemployment rate	0.011		0.032	
<i>Survey year (ref. is 2002)</i>				
2003	-0.048		-0.018	
2004	0.156	**	0.083	
2005	-0.044		0.060	
2006	-0.094		-0.210	
2007	-0.044		0.036	
<i>Individual averages across the waves for</i>				
Disability	0.534	***	0.021	
No. of all resident children	0.206	***	0.008	
No. of resident children under 4	0.286	***	0.011	
Partnered	0.008		0.000	
Retired	1.831	***	0.072	
Full-time student	0.499		0.020	
State-level unemployment rate	-0.024		-0.001	
Rho (ρ)	0.464	***		
Theta (θ)	1.171	***		
Number of observations	32,784			

Note: The initial conditions equation includes all variables in the main equation except the lagged joblessness indicator. In addition, work experience in years, squared work experience, the proportion of time spent in unemployment since completing full-time education, the proportion of time not in work since completing full-time education and whether or not individual i is from a non-English speaking background are included.

Appendix Table A.2 Dynamic model of household joblessness (definition 2, males)

	Direct effect		Interaction with lagged household joblessness	
	Coefficient	Marg. Eff.	Coefficient	Marg. Eff.
Intercept	-1.431	***	0.853	* 0.077
<i>Age (reference is 18-29)</i>				
30-39	0.359	***	0.022	0.307 0.022
40-49	0.292	**	0.017	0.579 *** 0.047
50-59	0.507	***	0.033	0.299 0.022
60-64	1.025	***	0.080	0.292 0.021
<i>Education level (reference is <Year 10)</i>				
Year 10, 11 or Cert. I/II	-0.333	***	-0.025	0.084 0.006
Year 12	-0.430	***	-0.031	-0.067 -0.004
Cert. III/IV	-0.409	***	-0.030	0.070 0.005
Diploma	-0.371	**	-0.027	-0.123 -0.008
University	-0.360	***	-0.026	-0.451 ** -0.025
SEIFA index	-0.078	***	-0.005	-0.004 0.000
Not in major city	0.028		0.002	-0.015 -0.001
Disability	0.416	***	0.030	-0.078 -0.005
Mental health index	-0.008	***	-0.0009	0.001 0.000
Missing mental health index	-0.484	***	-0.028	-0.112 -0.007
<i>Household type (reference is couple)</i>				
Lone parent	0.196		0.012	0.420 0.032
Related family and group households	0.592	***	0.042	-0.374 -0.021
Lone person	0.609	***	0.043	0.090 0.006
Multi-family household	0.728	***	0.054	0.372 0.027
No. of all resident children	-0.265	***	-0.016	0.003 0.000
No. of resident children under 4	0.396	***	0.029	0.009 0.001
Partnered	0.060		0.004	0.045 0.003
Retired	0.971	***	0.093	0.027 0.002
Full-time student	1.574	***	0.182	-0.260 -0.015
State-level unemployment rate	0.094	**	0.010	-0.006 0.000
<i>Survey year (ref. is 2002)</i>				
2003	-0.124		-0.008	-0.045 -0.003
2004	-0.045		-0.003	0.066 0.004
2005	-0.104		-0.007	-0.115 -0.007
2006	-0.433	***	-0.026	-0.086 -0.005
2007	-0.037		-0.003	0.030 0.002
<i>Individual averages across the waves for</i>				
Disability	0.491	***	0.051	
No. of all resident children	0.051		0.005	
No. of resident children under 4	0.087		0.009	
Partnered	-0.448	***	-0.046	
Retired	1.610	***	0.167	
Full-time student	1.983	***	0.205	
State-level unemployment rate	-0.101	**	-0.010	
Rho (ρ)	0.400	***		
Theta (θ)	1.096	***		
Number of observations	29,637			

Note: The initial conditions equation includes all variables in the main equation except the lagged joblessness indicator. In addition, work experience in years, squared work experience, the proportion of time spent in unemployment since completing full-time education, the proportion of time not in work since completing full-time education and whether or not individual i is from a non-English speaking background are included.