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## 4 Data source, model specification and descriptive analysis

### 4.1 The HILDA survey data

The focus of this study is on labour supply, as measured by working hours. Working hours refer to total hours per week usually worked in all paid employment. This is a more appropriate measure of labour supplied than hours worked per week in an individual's main job, particularly for married women who may be more likely to have several part-time jobs than single women or men (although this may also be the case for younger workers).

The data used in this study are drawn from the first six waves of the Household, Income and Labour Dynamics in Australia (HILDA) Survey. The HILDA survey collects information about family composition and dynamics, individual and family incomes, demographic characteristics and labour market activity and history of the respondents. It also collects information on family childcare usage and individual health (for further details of this survey see Watson and Wooden (2004)).

As married women are the focus of the study, the sample included only women aged 18 to 64 years (inclusive) who were either married or in a de facto relationship at the time of the survey. Full-time students were excluded from the analysis.

Respondents could get married or divorced during the six-year data period, or leave the survey over the period examined (known as panel attrition). Accounting for all these factors in the model would substantially complicate the estimation procedure, and therefore, to make the estimation manageable, a balanced panel sample was used. The balanced sample consisted of women who were either married or in a de facto relationship in *all* six years of the survey. It should be noted that the consistency of the model estimation results rely on the assumption that staying married and/or in the sample is independent to labour market activity of the women. To the extent that such an assumption might be violated, caution should be exercised when generalizing the results to the general population of married Australian women.

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## 4.2 Two types of model specifications

For each of the four models described in chapter 3, two model specifications have been used. The models differ in terms of the inclusion of wages and the treatment of total family income, and have different advantages and disadvantages.

In the first specification, a woman's own wage is excluded from the model. A woman's non-labour income which is used as an explanatory variable in this specification, includes her individual non-earning income, such as investment income, private transfer and windfall income, and her partner's total income, all measured for the previous financial year. Welfare payments are excluded from non-labour income to avoid endogeneity issues, as the payments are means tested and thus affected by labour supply. This specification is often referred to as a reduced form labour supply model (Killingsworth 1983).

In the second specification, a woman's own wage, along with her partner's wage and working hours are included. Wages are defined as earnings per hour and are obtained by dividing weekly earnings by weekly hours worked. In this specification non-labour income also measured for the previous financial year is also included but consequently represents total family income net of earnings of both partners. This specification is often referred to as a structural labour supply model.

The reduced form specification is estimated for two reasons:

- wages are not available for those who are not employed
- even if wages were all observable, they might be endogenous to labour supply in the sense that individual wages might be affected by working hours and/or both working hours and wages could be determined by some correlated or common unobserved factors.

As a result, it seems common in the literature on dynamic labour supply to estimate the reduced form labour supply model, where wages do not enter the model as an explanatory variable (see, for example, Hyslop 1999; Knight, Harris and Loundes 2002; Lee and Tae 2005; Tatsiramos 2008).

Nevertheless, the effect of wages on individual labour supply remains a fundamental question in labour economics. The second specification therefore attempts to shed some light on this question. However, the approach has limitations since wages, particularly own wages, are treated as exogenous. Accounting for endogeneity of a woman's own wages would require instrumental variables which would be selected such that they only affect their wages but not their labour supply. Such instrument variables are not available in the survey. Despite the likelihood of bias if the exogeneity of wages assumption is violated, it is difficult to predict the direction the bias it would take since wages might also be measured with error.

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Several other assumptions implicit in these models are worth highlighting. In the reduced form specification, a partner's earnings form part of the woman's non-labour income and are assumed to have only an income effect on the woman's labour supply decision. The partner's labour supply itself is assumed to have no independent effects on the woman's labour supply. The validity of this assumption is questionable as there are studies showing that leisure time of a couple may be complementary (Blau and Riphahn 1999). This implies that a couple's labour supply could also be complementary. To test this hypothesis, the partner's working hours are included in the structural specification of the models. Further the wage of a woman's partner is also included to estimate how her labour supply responds to her partner's wage.

### **Other model specification issues**

In both specifications non-labour income enters the model as two variables: the mean (over the six years) of non-labour income and the deviation from the mean. The mean variable is used to estimate the effect of permanent non-labour income, while the deviation is used to estimate the effect of transitory non-labour income. In the literature, it is often hypothesised that permanent non-labour income should have a larger effect on labour supply than transitory non-labour income.

Following the same logic, a distinction is also made between permanent and transitory wages (both a woman's own wages and her partner's) in the structural specification. Mean wages are used to represent permanent earnings capacity, and the deviation from mean wages is used to measure transitory earnings. All financial variables are deflated to 2001 dollar values using the national consumer price index (CPI).

As mentioned, wages are not available for those who are not employed. To include wages in the model for these individuals, wages need to be predicted. The common approach to predicting wages is the three-step Heckman procedure. In the first step a selection equation (on whether an individual is employed or not) is estimated to calculate the inverse Mills' ratio. In the second step the wage equation is estimated for those with positive wages with the inverse Mills' ratio included as one of the explanatory variables. The wages of those who are not employed are then predicted in the third step, using the parameters obtained from the wage equation estimation in the second step. For a detailed description of the procedure and the estimation results of the selection and wage equations, see appendix A.

Other variables included in both specifications of the models are: age (five age group dummies); education (five dummies indicating the highest qualification obtained); health status (indicating whether an individual has a long-term health

condition); the numbers of children aged 0 to 2, aged 3 to 5 and aged 6 to 17; whether they live in a capital city; immigration status (three dummies); and the unemployment rate at the major statistical region level. These are standard variables for modelling labour supply (Birch 2005). In addition, five year (or wave) dummies are included to account for the year effects on the labour supply of married women. The definitions of the variables used in the model are shown in table [Error! Not a valid link.](#)

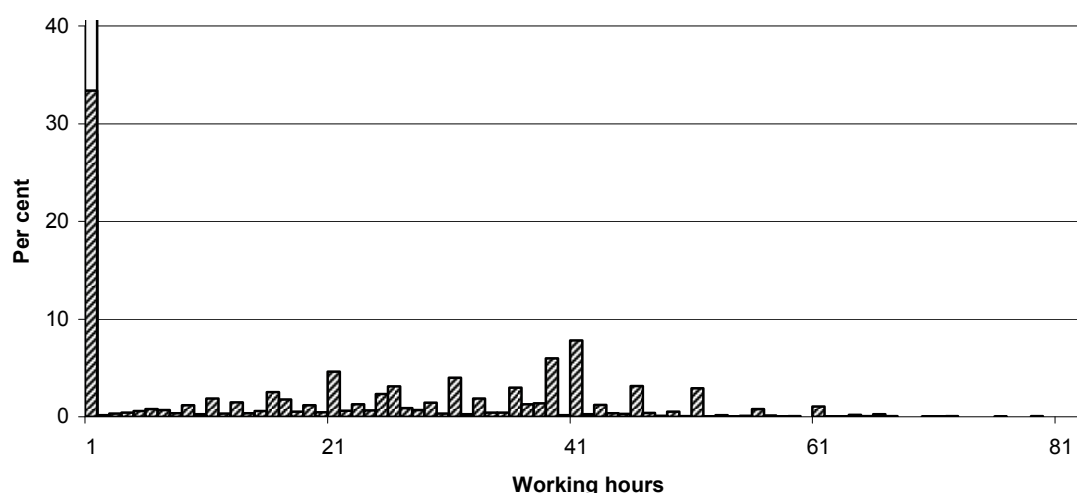
### 4.3 Descriptive analysis

The summary statistics of the sample are reported in table 4.1, along with the additional variables used in the initial condition equation.

The average working hours of the women in the sample (including those with zero hours) is just under 22 hours per week. About 29 per cent of women did not work at the time of survey (figure 4.1). The next largest group consists of women who worked 40 hours a week, accounting for about 8 per cent. About 5 per cent of the women worked 20 hours a week. Using the Australian Bureau of Statistics (ABS) definition of part-time employment (those working less than 35 hours a week), around 39 per cent of the women in the sample worked part-time, and 32 per cent worked full-time hours.

As most variables appear to fit with prior expectations, the summary statistic are not discussed here in detail.

Figure 4.1 Distribution of working hours of married women



Data source: Author's calculation based on the HILDA survey, waves 1–6.

Table 4.1 **Summary statistics and variable definitions**

<i>Variables</i>	<i>Definition of variable</i>	<i>Mean</i>
<b>A. Variables used in reduced form specification (9,132 observations)</b>		
Hours	Weekly working hours in all jobs	21.6058
st.d.		18.1971
Aged 18-25	Dummy, =1 if aged 18-25	0.0231
Aged 26-35	Dummy, =1 if aged 26-35	0.2340
Aged 36-45	Dummy, =1 if aged 36-45	0.3717
Aged 46-55	Dummy, =1 if aged 46-55	0.2717
Aged 56 plus	Dummy, =1 if aged 56 and over	0.0995
Degree	Dummy, =1 if have a degree or higher qualification	0.2560
Diploma	Dummy, =1 if have a post-school diploma	0.1090
Certificate	Dummy, =1 if have a post-school certificate	0.1375
Year 12	Dummy, =1 if completed year 12	0.1493
Year 11 or lower	Dummy, =1 if did not completed year 12	0.3482
Health	Dummy, =1 if have a long-term health condition	0.1782
Child 0-2	Number of resident children aged 0 to 2	0.1855
st.d.		0.4501
Child 3-5	Number of resident children aged 3 to 5	0.1708
st.d.		0.4261
Child 6-17	Number of resident children aged 6 to 17	0.8513
st.d.		1.0868
Capital city	Dummy, =1 if live in a capital city	0.5768
OZ born	Dummy, =1 if born in Australia	0.7727
NESC	Dummy, =1 if immigrants from an Eng-speaking country	0.1038
ESC	Dummy, =1 if immigrants from a non-Eng-speaking country	0.1235
Unem rate (%)	Local unemployment rate at the ABS Major Statistical Region level	5.8423
st.d.		1.2569
A woman's non-labour income (\$10 000)	Family non-earnings income (including investment income, private transfers and windfall income, but excluding welfare payments), plus partner's earnings	5.7910
st.d.		5.9680
<b>B. Additional variables used in structural specification (9,132 observations)</b>		
A woman's own wage	Hourly wages of women	16.5394
st.d.		14.5375
Partner's wage	Hourly wages of partners	22.1900
st.d.		20.0768
Partner's hours	Weekly working hours of partners	41.3137
st.d.		18.0836
Family non-labour income (\$10 000)	Total non-earnings income of the family, including investment income, private transfers and windfall income, but excluding welfare payments	1.6865
st.d.		5.9933

(continued next page)

Table 4.1 (continued)

<i>Variables</i>	<i>Definition of variable</i>	<i>Mean</i>
<b>C. Additional variables used in the initial condition equation (1,522 observations)</b>		
Mother white collar	Dummy, =1 if mother worked as a manager, administrator or professional	0.1531
Mother other white collar	Dummy, =1 if mother worked as a clerical, sales or service worker	0.3830
Mother blue collar	Dummy, =1 if mother worked as a tradesperson, labourer, production or transport worker or related worker	0.2313
Mother occupation unknown	dummy, =1 if mother's occupation unknown	0.2326
Proportion of life employed	The proportion of time employed since first leaving full-time education	0.7217
st.d.		0.2581
Proportion of life unemployed	The proportion of time unemployed since first leaving full-time education	0.0201
st.d.		0.0742
Number of individuals <sup>a</sup>		1 522

<sup>a</sup> There are 1 522 women in the sample, making to 9 132 (1 522x6) observations. The summary statistics in panels A and C are based on the 9 132 observations of the pooled six waves data, but those in panel C are based on the 1 522 women in the first wave.

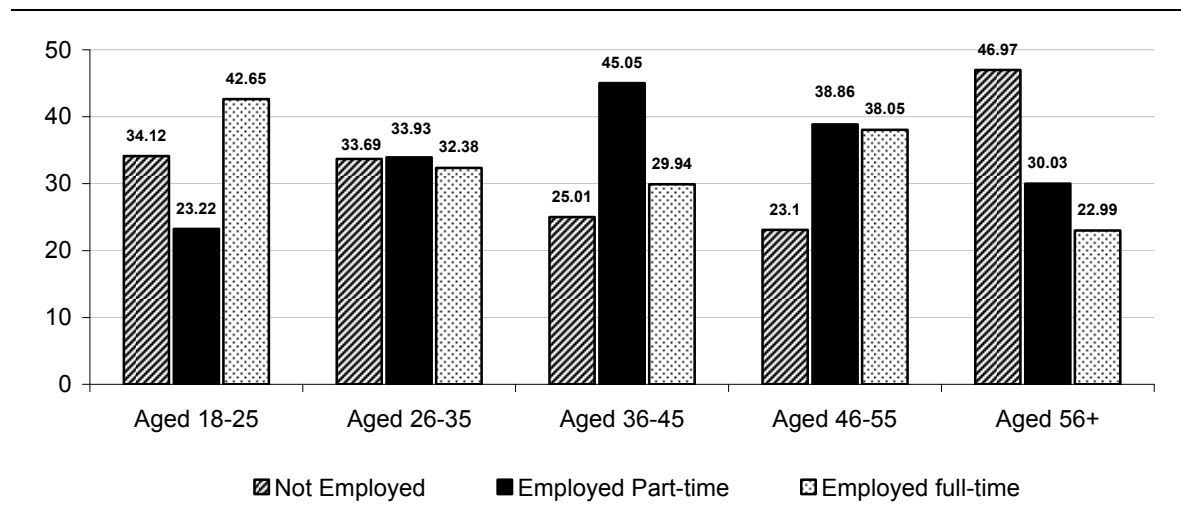
## Drivers of labour supply

The following figures depict the relationship between labour supply and selected independent variables used in the models. For ease of description labour supply is classified into three categories: not employed, part-time employed and full-time employed (ABS definition). The sample used for the descriptive analysis is the same as in table 4.1.

This descriptive analysis should, however, be read with caution since the apparent relationships may be confounded by other observed and unobserved factors that have not been controlled for in the descriptive analysis. For example, a woman's labour supply may be positively related with her partner's labour supply (figure 4.10). However, the positive association may be due to similar levels of education of partners and wives or similar preferences between work and leisure. To isolate the 'true' relationship from all influencing factors, econometric models, as described in chapter 3 are required. The model estimation results are presented in chapter 5.

Figure 4.2 depicts how labour supply and a woman's age are related. The relationship is not linear, with labour force participation following the 'm-shaped' pattern observed in broader labour force surveys. The proportion of women not employed falls from 34 per cent for those aged 18-25 years to 23 per cent for women aged 46-55 years, but then increases sharply to 47 per cent for women aged over 56 years, reflecting early retirement.

**Figure 4.2 Labour force status of married women by age**  
Per cent

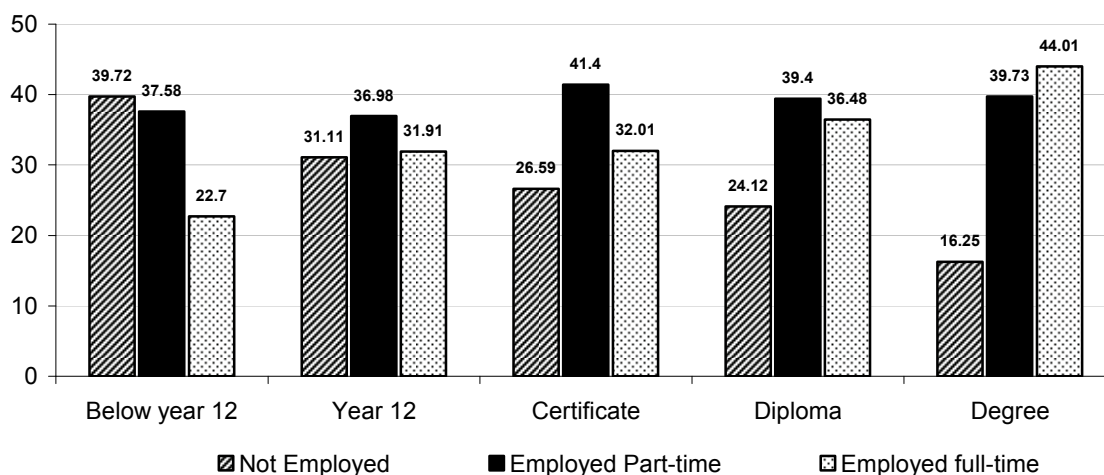


*Data source:* Author's calculation based on the HILDA survey, waves 1–6.

Of those involved in paid work, the proportion working full-time is highest for women aged 18-25 years (43 per cent). It decreases to 30 per cent for women aged 36-45 years, perhaps reflecting child-bearing and child-caring activity of the women in this age group. The proportion in full-time employment increases again for those aged 46-55, but mainly at the expense of part-time employment. This increase is likely driven by a reduction in child-caring activity as their children grow up, allowing more time for paid work.

The positive effect of education on labour supply is well documented in the literature, and is reflected in this sample (figure 4.3). The proportion of women that are not employed decreases with increasing levels of education, while the proportion working full-time increases. For example, while 40 per cent of those women who did not complete year 12 are not employed, only 16 per cent of those with a degree are not employed. Also, the proportion working full-time among degree holders is 44 per cent, almost double those who did not complete year 12. Interestingly, the proportion working part-time is similar across women with different levels of education.

**Figure 4.3 Labour force status of married women by education**  
Per cent

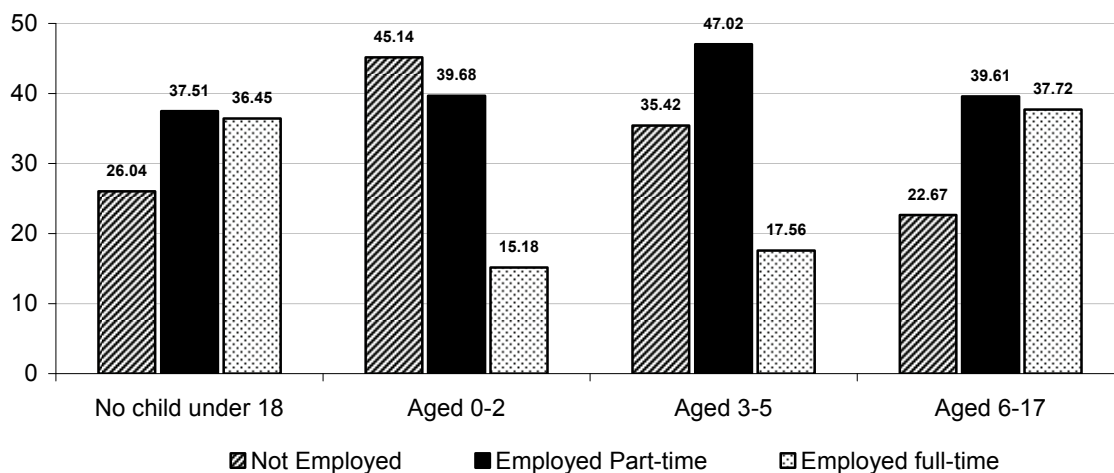


Data source: Author's calculation based on the HILDA survey, waves 1–6.

To examine the effects of young children on the labour supply of married women, the number of children by age of children is included in the model. For ease of presentation, figure 4.4 only shows the labour force status of women by age of the youngest child in the family. The age of the youngest child appears to be an important influence on their mother's labour supply. Among those mothers whose youngest child is under 18 years, the lower the child's age, the more likely it is that they will not be employed and the less likely it is that they will work full-time. For example, 45 per cent of women in the sample with a youngest child under three years are not employed. In contrast, 23 per cent of those with a youngest child aged 6-17 are not employed. In terms of full-time work, 38 per cent of those with a youngest child aged 6-17 work full-time, compared with only 15 per cent of those with a youngest child aged under three.

Women with a youngest child aged 3-5 years supply more labour than those with a youngest child under three, particularly through working part-time. Labour supply of women who have no children under 18 years appears to be similar to those whose youngest child is between 6 and 17 years.

**Figure 4.4 Labour force status of married women by age of the youngest child**  
Per cent



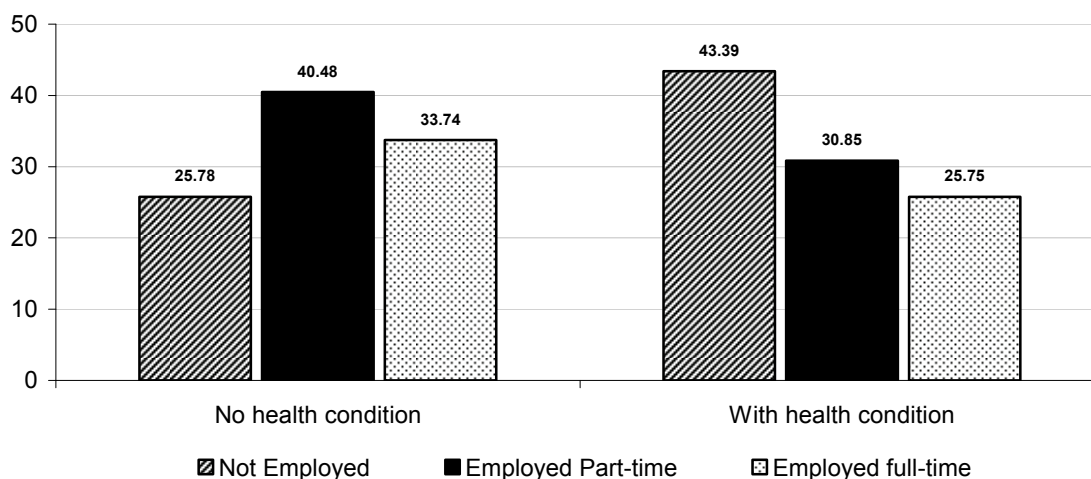
Data source: Author's calculation based on the HILDA survey, waves 1–6.

Health appears to be an important factor affecting a woman's labour supply (figure 4.5).<sup>1</sup> In the sample, women who have a health condition are much more likely not to be employed than those without a health condition (43 versus 26 per cent). The proportion working full-time and part-time is respectively 8 and 9 percentage points higher among those without a health condition than among those with a health condition. Health may directly affect labour supply since disutility of working may be higher when health problems are present. Health may also affect labour supply indirectly through its effects on productivity and wages (Cai 2009).

The importance of country of birth to a woman's labour supply is shown in figure 4.6. The greatest difference appears to be between women who immigrated from a non-English speaking country and women who were either born in Australia or had migrated from an English speaking country. The proportion not employed is higher among immigrants from non-English speaking countries than for the other two groups, with the difference largely driven by a lower proportion of non-English speaking origin immigrants working part-time. The proportion not employed is slightly lower and the proportion of working full-time is slightly higher among woman who migrated from English speaking countries than among those born in Australia.

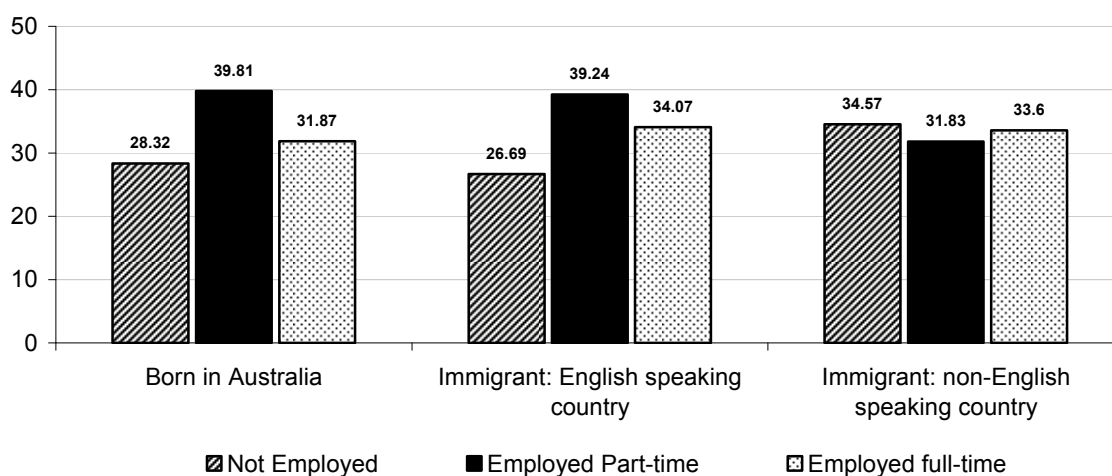
<sup>1</sup> Health is measured by whether an individual has a health condition that has lasted or is expected to last for six months or more.

**Figure 4.5 Labour force status of married women by health condition**  
Per cent



Data source: Author's calculation based on the HILDA survey, waves 1–6.

**Figure 4.6 Labour force status of married women by country of birth**  
Per cent

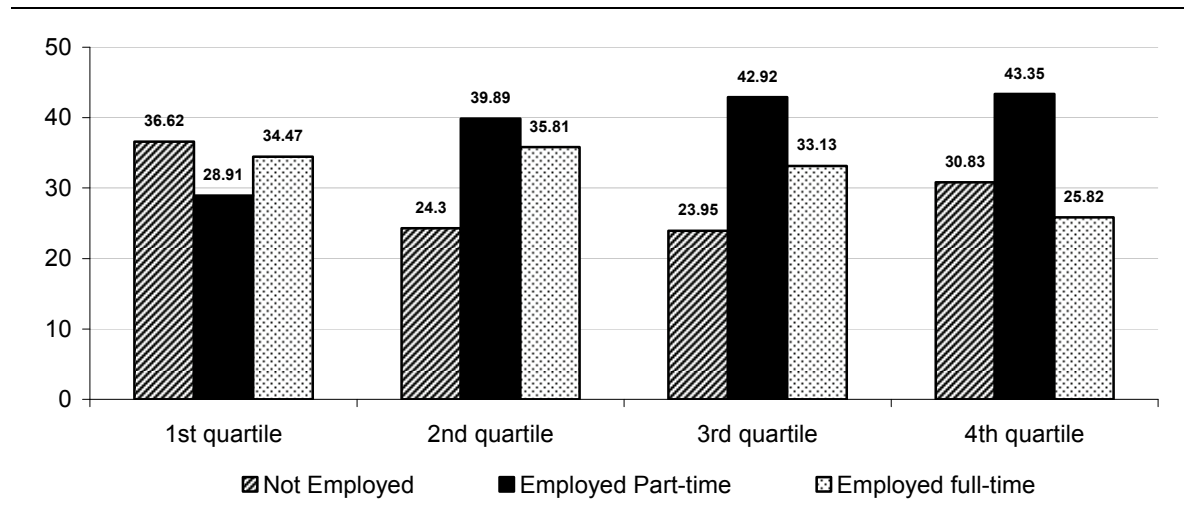


Data source: Author's calculation based on the HILDA survey, waves 1–6.

To examine the relationship between a woman's non-labour income and her labour supply, the sample was divided into four equal-size groups based on the quartiles of non-labour income, where those in the fourth quartile have the highest non-labour income group (figure 4.7). There appears to be a negative relationship between a woman's non-labour income and full-time employment for the top three quartiles (quartiles 4, 3 and 2), with the proportion of women working full-time rising from 26 per cent to 36 per cent from the fourth to second quartile. The proportion of women in the top non-labour income quartile not employed (30 per cent) is also

higher than for those in the next two non-labour income quartiles (both around 24 per cent). However, this relationship does not hold for women whose non-labour income is in the bottom quartile, where a higher proportion (37 per cent) are not employed.

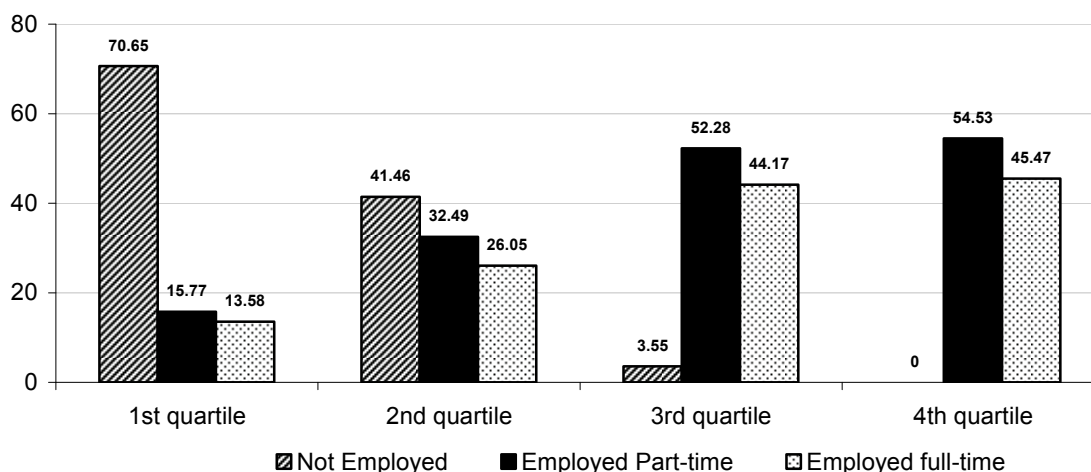
**Figure 4.7 Labour force status of married women by quartile of non-labour income**  
Per cent



*Data source:* Author's calculation based on the HILDA survey, waves 1–6.

Figure 4.8 shows the relationship between labour supply and a woman's own wage, including predicted wages for women who are not employed. As for the non-labour income variable, women here are divided into four equal-size groups based on the wage quartiles (the fourth quartile represents the highest wage group). The figure shows a positive relationship between labour supply and wages of women. The proportion of women who are not employed decreases with wages, while the proportion working either part-time or full-time increases with wages. For example, 71 per cent of the women in the first wage quartile are not employed, but women in the top wage quartile are all employed. On the other hand, only 14 per cent of women in the first wage quartile work full-time, compared with 45 per cent of women in the top wage quartile.

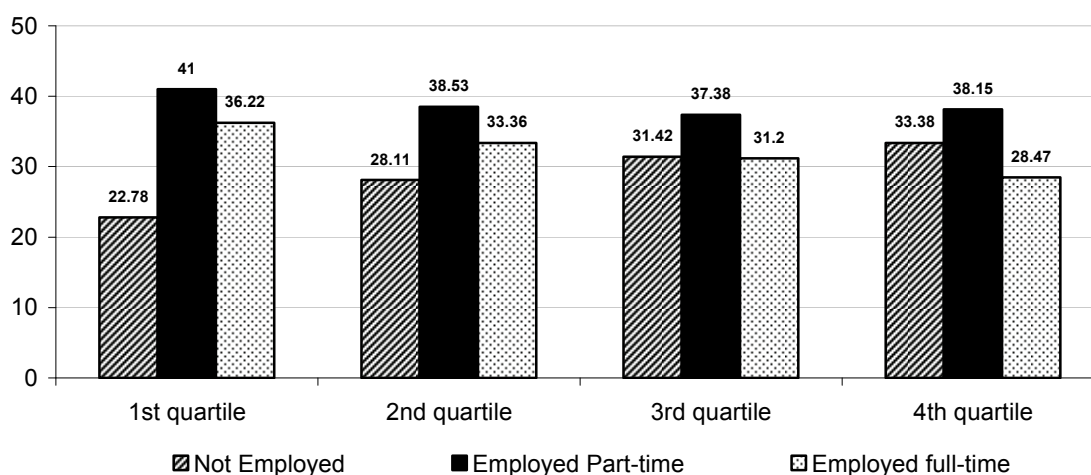
**Figure 4.8 Labour force status of married women by quartile of own wages**  
Per cent



Data source: Author's calculation based on the HILDA survey, waves 1–6.

A married woman's labour supply appears to be negatively related to her partner's wage (figure 4.9). The proportion of women who are not employed increases with their partner's wage, while the proportion working full-time decreases.

**Figure 4.9 Labour force status of married women by quartile of their partner's wage**  
Per cent



Data source: Author's calculation based on the HILDA survey, waves 1–6.

Figure 4.10 suggests a complementary relationship between the labour supply of a married woman and that of her partner. The proportion of women who are not employed decreases as their partner supplies more labour to the workforce (moving from not-employed to working full-time).

**Figure 4.10 Labour force status of married women by partner's labour force status**  
Per cent



Data source: Author's calculation based on the HILDA survey, waves 1–6.

### *Observed inter-temporal persistence*

Examining observed transitions in labour force status provides one indicator of inter-temporal persistence of labour supply. For women in the sample, transitions in labour force status are shown in table 4.2. Panel (a) in the table shows the transition on a year-on-year basis, while panel (b) presents the transition between wave 1 (2001) and wave 6 (2006).<sup>2</sup>

The numbers along the diagonal (highlighted in bold) are the proportion of women who do not change labour force status over time, that is, those that show persistence in labour supply. Irrespective of the time window examined, labour force status of the women in the sample exhibits substantial persistence. As expected, short-term persistence (panel (a)) is higher than long-term persistence (panel (b)). On a year-on-year basis, about 80 per cent of the women stay in the same labour force state

<sup>2</sup> Changes in labour force status across years within 2001 and 2006 are not taken into account in panel (b) of table 2.

from one year to the next. Over the six years examined, the proportion of married women staying in the same labour force state is still above 60 per cent.

**Table 4.2 Labour force status transition**  
Per cent

<i>Initial LFS</i>	<i>LFS transiting to</i>			<i>Number of observations</i>
	<i>Not-employed</i>	<i>Part-time</i>	<i>Full-time</i>	
<b>(a). Year-on-year transition</b>				
Not-employed	<b>79.1</b>	17.03	3.87	2 225
Part-time	9.93	<b>78.26</b>	11.81	2 930
Full-time	5.99	12.83	<b>81.18</b>	2 455
All	28.88	39.25	31.87	7 610
<b>(b). Transition from 2001 to 2006</b>				
Not-employed	<b>62.3</b>	28.22	9.48	443
Part-time	13.2	<b>63.65</b>	23.15	553
Full-time	12.74	25.29	<b>61.98</b>	526
All	27.33	40.08	32.59	1 522

*Data source:* Author's calculation based on the HILDA survey, waves 1–6.

In both the short and long-term, the probability of transitioning to part-time employment from non-employment is much higher than the probability of transitioning to full-time employment from non-employment. Other relationships are also evident with the probability of transitioning to full-time employment from part-time employment being greater than that of transitioning to non-employment from part-time employment. Also the probability of transitioning to part-time employment from full-time employment is higher than that of transitioning to non-employment from full-time employment.