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## B Changes to part time employment

### Model specification

The econometric model used to examine the roles played by the year, age and cohort effects on part time employment is based on an approach developed by Beaudry and Lemieux (1999) in their work using Canadian labour market data. The decision to work part time is binary in nature (that is, an individual decides whether to work part time or not). For persons as a group, the proportion who work part time will lie between 0 and 1. This is equivalent to modelling the odds of a person working part time. Accordingly, the values of the dependent variable, the part time employment rate (PTE), as measured by the part time employment to population ratio, can be similarly constrained by the following logistic transformation:

$$\text{LnPTE} = \text{Ln}\left(\frac{\text{PTE}}{(1 - \text{PTE})}\right)$$

The dependent variable, the part time employment to population ratio, is for cohort  $j$  at time  $t$  expressed in the form:

$$\text{Ln}\left(\frac{\text{PTE}_{jt}}{(1 - \text{PTE}_{jt})}\right)$$

As noted in chapter 3, the year effect captures the effects of events that happen contemporaneously with participation in part time employment. In this study, in common with other approaches, only one macroeconomic variable is used, the unemployment rate among men 25-44 years. As the labour force participation rate for male prime age groups has remained largely stable in the longer run, this variable captures, as far as possible, the short term fluctuations in the labour market as reflected by changes in the macroeconomy.<sup>1</sup>

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<sup>1</sup> A common problem with cohort analysis surrounds the problem of collinearity between the year, age and cohort effects, *the identification problem*. The age of the cohort  $j$  in time  $t$ ,  $A_{jt} = t-j$ . That is, the age is a simple combination of the year and birth year. This introduces the problem of perfect collinearity among the explanatory variables. This study assumes that the year effect is represented by the macroeconomic variable,  $UR_t$ , which varies over time according to economic conditions. It is therefore not a simple combination of age and cohort, and overcomes the collinearity problem.

A simple model would treat the cohort and age variables independently. That is, the cohort effect would have the same effect on every age group. This would be represented by a simple displacement of the intercept term for each of the part time employment lifecycle curves. However, researchers such as Beaudry and Lemieux (1999) have found both changes in the shape of the lifecycle curves as well as an upward displacement in those curves. This implies that the cohort effects operate differently on different age groups. Accordingly, it is appropriate that age-cohort interaction terms be introduced to allow the age effect to vary from one cohort to another.

The following specification of the model incorporates this interaction:

$$\text{Ln}\left(\frac{\text{PTE}_{jt}}{(1 - \text{PTE}_{jt})}\right) = \alpha + \lambda \text{UR}_t + \beta_1 A_{jt} + \gamma_1 C_j + \sigma_1 A_{jt} C_j$$

Where  $\text{PTE}_{jt}$  is the part time employment rate for cohort  $j$  in time  $t$ ,  $\text{UR}_t$  is the unemployment rate for men 25–44 years at time  $t$ ,  $A_{jt}$  is the set of age variables at time  $t$ , which captures the lifecycle changes in part time employment.  $C_j$  is the set of cohort variables which captures the social phenomenon that different groups share which sets them apart from other groups.  $A_{jt}C_j$  represents the age and cohort interaction allowing for the possibility of different cohort effects across the age groups.

The data for this analysis are derived from the ABS Labour force survey which provides information on the age and employment status of the population over the period 1966 to 2006. The data are collected for twelve 5 year age groups, namely 15–19 years, 20–24 years, ....., 65–70 years and 70+ years. Men and women are modelled separately given the marked differences in their part time employment rates.

The oldest cohort members were born in the first decade of the 20<sup>th</sup> century, with the youngest cohort's members born in the last decade of the 20<sup>th</sup> century. There are eighteen 5 year cohorts born 1901–1906, 1907–1911, ....., 1987–1991. The older and younger cohorts have fewer observations than other cohorts but no cohort can be tracked throughout its working life — the length of a 40 year data base is clearly too short to capture any cohort's entire working life.

Tables B.1 and B.2 provide the results of various specifications for men's and women's part time employment respectively. The individual parameter values are stable for different model specifications. Model 1M for men and W1 for women have been selected as the preferred models. Figure B.1 presents the estimated and actual aggregate part time employment populations ratios based on models 1M and 1W. Both models describe a close fit between actual and estimated part time

employment to population shares for selected years that conform to the movements of cohorts through successive age groupings. The average absolute difference between aggregate actual and estimated shares is 0.6 percentage points for women and 0.4 percentage points for men.

**Table B.1 Models of year, age and cohort effects on male part time work**  
Estimated models of  $\ln(\text{PTE}/(1-\text{PTE}))^{\text{a}}$

	<i>Model 1M</i>	<i>Model 2M</i>	<i>Model 3M</i>	<i>Model 4M</i>
<i>Variables<sup>b</sup></i>				
CONSTANT	–	–	-3.17 (-17.83)	–
UNEMPLOYMENT	0.02 (1.84)	–	0.06 (1.82)	0.02 (1.74)
AGE	-4.34 (-43.67)	-4.32 (-43.09)	–	-4.34 (-42.47)
AGE <sup>2</sup>	1.14 (34.16)	1.14 (33.64)	–	1.14 (31.18)
AGE <sup>3</sup>	-0.09 (-29.04)	-0.09 (-28.62)	–	-0.09 (-25.78)
COHORT <sup>2</sup>	0.04 (23.46)	0.04 (25.24)	–	0.04 (19.52)
AGE*COHORT	–	–	–	0.0003 (0.06)
<i>Diagnostic statistics</i>				
Adjusted R <sup>2</sup>	0.92	0.92	0.03	0.92
SE Regression	0.18	0.19	0.65	0.19
N	84	84	84	84

<sup>a</sup> The data used was yearly averages of monthly labour force data 1981, 1986, 1991, 1996, 2001 and 2006 and August labour force data for 1966, 1971, 1976. A dummy variable was used to account for any changes arising from the different basis of the earlier data. The coefficient on the variable was found not to be statistically significant. <sup>b</sup> UNEMPLOYMENT is the unemployment rate for men aged 25–44 years. AGE is calculated as the lower age of age group divided by 10. COHORT refers to the [(birth year-1900)/10].

Source: ABS (*Labour Force Historical Timeseries Australia*, Cat. no. 6291.0.55.001 LM8 Data Cubes and 6204055001ITS0002 Table 4).

**Table B.2 Models of year, age and cohort effects on female part time work**  
 Estimated models of  $\ln(\text{PTE}/(1-\text{PTE}))^{\text{a}}$

	<i>Model 1W</i>	<i>Model 2W</i>	<i>Model 3W</i>	<i>Model 4W</i>
<i>Variables<sup>b</sup></i>				
CONSTANT	–	–	–	-1.82 (-4.23)
UNEMPLOYMENT	–	0.002 (0.11)	–	0.02 (0.23)
AGE	-6.02 (-11.38)	-6.03 (-11.22)	-4.82 (-12.13)	–
AGE <sup>2</sup>	2.67 (9.50)	2.67 (9.41)	2.02 (9.80)	–
AGE <sup>3</sup>	-0.40 (-7.79)	-0.40 (-7.72)	-0.29 (-7.24)	–
Age <sup>4</sup>	0.02 (5.76)	0.02 (5.72)	0.01 (4.55)	–
COHORT	0.46 (7.59)	0.46 (7.51)	0.29 (8.59)	–
AGE*COHORT	(-0.04) (-3.22)	-0.04 (-3.20)	–	–
DATA(1)	-0.29 (-2.55)	-0.28 (-2.15)	-0.30 (-2.53)	-0.79 (-1.75)
<i>Diagnostic statistics</i>				
Adjusted R <sup>2</sup>	0.95	0.95	0.94	0.05
SE Regression	0.25	0.25	0.27	1.08
N	84	84	84	84

<sup>a</sup> The data used was yearly averages of monthly labour force data 1981, 1986, 1991, 1996, 2001 and 2006 and August labour force data for 1966, 1971, 1976. A dummy variable, called DATA, was used to account for any changes arising from the different basis of the earlier data. <sup>b</sup> UNEMPLOYMENT is the unemployment rate for men aged 25–44 years. AGE is calculated as the lower age of age group divided by 10. COHORT refers to the [(birth year-1900)/10].

Source: ABS (*Labour Force Historical Timeseries, Australia*. Cat. no. 6291.0.55.001 LM8 Data Cubes and 6204055001ITS0002 Table 4).

Figure B.1 **Estimated and actual aggregate part time employment share of population, selected years — men and women**

Based on estimates derived from models 1M and 1W



