# Parenthood and Employment Outcomes: The Effect of a Birth Transition on Men's and Women's Employment Hours.

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**Abstract**

In this paper we focus on the effect of a birth transition on men's and women's paid employment hours in Australia. Previous research has shown that childbirth is typically associated with women's withdrawal from the paid workforce, while for men, there is either little observed change or a slight increase in work hours. Various demographic and institutional factors have been shown to affect these patterns. Australia is a particularly interesting case as it combines both a very high rate of part time employment, especially for women, with some of the longest working weeks in the OECD. Recent research has used longitudinal data to examine employment hours of mothers and fathers, but this research is often limited in both the number of waves of data and analytical design. We extend this work by using eleven waves of data from the Household, Income and Labour Dynamics in Australia (HILDA) panel survey and take a life course approach to analysing the change in employment hours immediately following a first birth, the trend in hours of employment over waves following the birth, and the change and subsequent trend in hours of employment following a second birth. Our results show that a first birth does affect the likelihood of leaving employment for women but not for men. For women who are in employment, time spent in paid work is reduced by almost half following a first birth and is reduced by a further six hours per week following a second birth, but slowly increases with time following a birth. For men, time spent in paid work is not reduced after the first birth but work hours are significantly lower by two hours following a second birth.

## 1. Introduction

The transition to parenthood is an important stage in the life course. There is a vast array of evidence suggesting that the processes leading to social and economic inequalities between men and women intensify around the time of the birth of children resulting in ongoing and long-term gender stratification over the life course (Moen 2003; Harkness and Waldfogel 2003;Connolly and Gregory 2009). Many of these inequalities stem from changes in the division of labour between men and women, and in particular, women's propensity to withdraw or reduce their paid work hours following parenthood (Jacobs and Gerson 2004) and to increase their time spent on unpaid work (Baxter, Hewitt and Haynes 2008). Recent research also reports a decline in women's levels of commitment to employment following a first birth (Evertsson 2013) and changes in women's attitudes to mothering and gender roles (Baxter, Buchler, Western and Perales 2012). Overall the research clearly indicates that parenthood is an important life course transition for women with both short and long-term consequences for women's time use, earnings and employment trajectories (Budig and England, 2001; Kaufman and Uhlenberg 2000; Singley and Hynes 2005).

Much less research has focused on the effect of parenthood on men's employment. The assumption tends to be that men remain in employment throughout the life course and that parenthood is either associated with no change in employment hours, or an increase in employment hours to compensate for the reduced earnings of their partner. But changes in expectations about fathering toward more hands-on involvement (Lamb 2004), evidence of intensification and increased hours of parenting for both men and women (Gauthier, Smeeding, & Furstenberg, 2004), and the greater role of women as financial providers for the household, suggests the need for a closer look at the association between employment and parenthood for both men and women.

In this paper we use longitudinal survey data to investigate how women's and men's time in paid work changes with the birth of a first and second child and whether this continues to change with time after a birth. The majority of previous work on the issue uses cross sectional data (Hynes & Clarkberg, 2005) or uses panel data with one or two waves of data (Baxter, Hewitt and Haynes 2008; Gray 2012), but the interplay between work hours and birth is likely to be complex, to change over time and change with the birth of more children. Women's work hours vary before they have children and mothers work hours also vary considerably, with many women not returning to work for many years after birth and others returning full time soon after birth. Much of this variation is attributed to the selection of women with certain characteristics back into the work force and the number of hours they work after birth. None of this previous research has appropriately captured these complexities.

Our analyses simultaneously consider the effects of a birth on both the probability of an individual entering the workforce and on a change in the number of hours worked if they are employed. We use a two part mixed regression model with correlated random effects across the three birth transition phases (before first birth, following first birth, following second birth), to estimate the immediate and longer term effects of a birth transition on the two components of the employment process. These models enable us to better model and account for selection processes in changes in women's and men's work hours around the birth of their children.

## 2. Background

One of the main changes traditionally associated with parenthood is women's withdrawal from paid work to take on additional care and unpaid labour with associated consequences for women's access to resources and earnings outside the home (Budig and

Hodges 2010). But women's labour force participation rates have risen markedly over the last 30 years in all western countries and there is additional evidence that some groups of women, particularly those with higher levels of education and higher earnings, remain in employment for longer periods of time leading up to a birth, return to work more quickly, or take no employment breaks around childbirth (Baxter, 2005; Gregg, Gutiérrèz-Domenech and Waldfogel, 2007). Women's employment participation also varies cross-nationally, with differing institutional, policy and normative contexts differentially supporting or discouraging women's attempts to combine parenting and paid employment (Hofferth 1996; Gornick and Meyers 2003; Craig, Mullan and Blaxland 2010; Cooke and Baxter 2010). In Australia, one of the main ways in which women have negotiated paid and unpaid work is through entering part-time employment after child birth, with Australia second only to the Netherlands in the percentage of employees in part time employment (OECD 2009). Like other countries, there are marked gender disparities in the gender distribution of part time employment with the rate for women at 38.5%, compared to 12.4% for men (OECD 2009).

There is less attention paid to men's employment patterns in relation to parenting (Kaufman and Uhlenberg 2000; Gray 2013). Although very few men move to part time employment to accommodate parenting demands, there is emerging evidence of an intensification of parenthood leading to increased time on parenting tasks for both men and women (Bianchi, 2000; Craig, Mullan, & Blaxland, 2010; Gauthier, Smeeding, and Furstenberg, 2004; Sayer, Bianchi, & Robinson, 2004; Sullivan, 2006). At the same time, new fatherhood models, particularly amongst more educated groups, encourage a more hands-on approach to fathering and greater involvement by fathers in the day-to-day care of children. Previous research suggests that men's hours of paid and unpaid work remain remarkably stable after childbirth and that it is mainly women who alter their paid and unpaid work hours to accommodate childcare needs (Baxter, Hewitt and Haynes 2008). But there

may be some groups of men who have both the resources, flexibility and desire to vary their paid work hours after childbirth.

This paper addresses these issues using eleven waves of the Household, Income and Labour Dynamics in Australia (HILDA) panel survey. Most previous studies, particularly in Australia, have examined variations in working hours for parents and non-parents using cross-sectional data (Craig and Mullan 2010). Baxter (2005; Baxter,2013) and Gray (2013) have used longitudinal data to examine mothers and fathers employment hours, but their research is limited in both number of waves of data and analytical design. We extend this work by using eleven waves of data from a national household panel study and sophisticated statistical panel data techniques that enable us to simultaneously model the likelihood of being in paid employment and the number of hours worked, prior to a first birth, immediately following a first and second birth and with time leading up to and following a birth.

We examine four main research questions: First, does a first birth affect the likelihood of being in employment for men and women? Second, of those who are in employment, does a first birth affect men's and women's hours of employment? Third, is a first birth associated with a greater likelihood of transitioning out of employment, or into part time employment for women, and a greater likelihood of transitioning into full time employment for men? Fourth, is there a difference in men's and women's work hours and changes in work hours with the birth of a second child compared to the birth of a first child?

In the following section we describe the methods used for our analyses including the composition of the analytic sample, and the variables used in the analyses. In Section 4 we describe the two-part statistical regression model with random effects and present the results in Section 5. Our conclusions are discussed in Section 6.

## 3. Methods

### 3.1 Data and Analytic Sample

The data for our analyses were extracted from the first eleven waves of the Household, Income and Labour Dynamics in Australia (HILDA) panel survey collected between 2001 and 2011. Wave one of HILDA comprised 7,682 households and 13,969 individuals (Watson and Wooden 2002a, b) with households selected using a multi-stage sampling approach across regions of Australia. The household response rate at wave one was 66% (Watson and Wooden 2002a, b). Within households, data were collected from each person aged over 15 years (where available) using face-to-face interviews and self-completed questionnaires and at wave one a response rate of 92% was achieved. Following an individual response rate of 86% for wave 2, response rates of between 90-95% have been maintained between waves (Watson, 2013).

The research questions in our study are concerned with the associations between the likelihood of employment, paid work hours and birth transitions. Therefore the analytical sample includes men and women who experience the birth of their first child (and possibly a second child) during the first eleven waves of the HILDA survey (2001-2011). This sample of men and women experiencing entry to parenthood was chosen because it allows consistency in examining work hours before and after the experience of a first birth across all respondents in the sample.

The final analytical sample includes 710 women and 669 men (n=1379) for whom 1379 first births were observed and 751 second births. The majority of these births will not be unique to men and women but will be shared among couples, however, we consider analyses for men and women separately because of the traditionally different employment patterns around birth transitions for men and women.

### 3.2 Measures

*Dependent variable*

The main outcome measure in this study is hours spent in paid employment. At each wave, HILDA respondents were asked '...how many hours per week do you usually work in all jobs?' If a respondent was not employed or not in the labour force then the number of hours worked in paid employment was recorded as zero. The distribution of hours worked per week for individuals typically has a spike at zero representing people who do not work in paid employment and a range of positive hours for people who are employed either part-time, full-time or under a casual arrangement.

*Birth transitions*

To identify birth transitions we use a variable that contains information on the 'total number of children ever had'. We also used a measure for the number of dependent children (defined as 18 and under) to determine whether the birth corresponded to a first birth, a second birth or a higher order birth. Based on these measures, the analytic sample was restricted to those respondents who experienced a first birth between 2001-2011 and no more than two births in this time period.

To capture the change in work hours associated with each birth transition we created three variables to identify the periods before first birth (*pre_birth*=1 in this period, 0 otherwise), after the first birth but before the second birth (*post_birth1*=1 in this period, 0 otherwise) and after the second birth (*post_birth2*=1 in this period, 0 otherwise). A variable, *time*, was also created to measure the number of waves prior to or following a birth. This is an integer variable with values ranging from -10 (when a first birth occurs between waves 10 and 11) to 9. The value of *time* is zero at the first wave immediately following a birth. The *time* variable was interacted with each of the three indicator variables to enable an

examination of change in work hours over time, leading up to and following a birth transition.

*Control variables*

We also included a range of controls that have been found to be associated with the likelihood of employment and the number of paid work hours following a birth transition. These were age of respondent in years, household income in the previous wave, education (1= attained bachelor degree or higher, 0=other) and relationship status (1=partnered, 0=single). We include a measure for gender role attitude in response to the statement: 'It is much better for everyone involved if the man earns the money and the woman takes care of the home and children'. Responses ranged from 1 = Strongly Disagree to 7 = Strongly Agree. This question was asked in waves 1, 5, 8 and 11. In our models, we carried wave 1 values on this variable forward for waves 2 to 4, we carried wave 5 values forward for waves 6 and 7, and carried wave 8 values forward for waves 9 and 10. All measures are time varying with descriptive statistics for each variable approximately one-two years prior to birth, immediately following birth and one-two years following birth, shown in Table 1, separately for women and men.

In our analytic sample, women worked an average of 30 hours per week prior to a first birth and this decreased to 12 hours per week the year following birth, while the average hours worked by men remained at 40 hours per week before and following the first birth. Women were approximately 29 years old and two years younger than men at the time of first birth. Household income is highest prior to first birth and is reduced on average by $11,000 for responding women and $7,000 for responding men. Gender attitudes reported by women are more liberal (2.78) than those reported by men (3.29) in the year following birth. The

proportion of responding women who are partnered following a first birth is 91% while 38% of women and 28% of men have a bachelor's degree or higher.

**Table 1: Descriptive statistics (mean, standard deviation (SD) and count of non-missing values) for control variables, one-two years prior to birth, in wave immediately following birth and one-two years later.**

| | | Years prior to and following a first birth | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1-2 years prior | | Immediately after | | 1-2 years after | |
| | | Women | Men | Women | Men | Women | Men |
| Average hours worked per week | Mean | 30.11 | 39.96 | 12.03 | 40.29 | 15.23 | 40.59 |
| | SD | 17.56 | 17.30 | 16.59 | 16.12 | 15.45 | 16.76 |
| | Count | 709 | 669 | 710 | 669 | 578 | 540 |
| Age (years) | Mean | 28.24 | 30.15 | 29.24 | 31.15 | 30.29 | 32.11 |
| | SD | *6.67* | *7.30* | *6.67* | *7.30* | *6.38* | *6.96* |
| | Count | 710 | 669 | 710 | 669 | 582 | 546 |
| Household income ($10,000's) | Mean | 99.56 | 95.01 | 96.05 | 92.63 | 87.91 | 87.64 |
| | SD | *69.21* | *68.38* | *74.45* | *68.98* | *90.16* | *85.64* |
| | Count | 710 | 669 | 710 | 669 | 582 | 546 |
| Gender attitude(high value more traditional) | Mean | 2.74 | 3.25 | 2.78 | 3.29 | 2.74 | 3.25 |
| | SD | *1.78* | *1.73* | *1.77* | *1.77* | *1.68* | *1.79* |
| | Count | 561 | 529 | 597 | 560 | 511 | 474 |
| Education (Bachelor degree or >) | Mean | 0.37 | 0.28 | 0.38 | 0.28 | 0.38 | 0.29 |
| | SD | *0.48* | *0.45* | *0.48* | *0.45* | *0.49* | *0.45* |
| | Count | 710 | 669 | 710 | 669 | 579 | 540 |
| Relationship status (partnered) | Mean | 0.89 | 0.88 | 0.91 | 0.93 | 0.89 | 0.92 |
| | SD | *0.31* | *0.33* | *0.29* | *0.25* | *0.32* | *0.28* |
| | Count | 710 | 668 | 710 | 667 | 579 | 539 |

## 4. Analytical Approach

### 4.1 Choice of Model

Typically, and particularly for women, the distribution of hours worked is characterised by a large, or inflated, number of zero observations that arise for people who are not employed, and a continuous distribution of positive work hours for those who are employed. The choice of model selection and estimation procedure for these types of data

consisting of two parts will largely depend on the interpretation of the process generating the zero observations (Madden, 2008). For our application we chose the two-part regression model with random effects and discontinuities at the time of birth for the purpose of analysing actual hours worked before and after a birth.

Two possible approaches to analysing a zero-inflated positive continuous outcome are the Heckman sample selection model (Heckman, 1979; Puhani, 2000) and the two-part regression model (Olsen and Schafer, 2001; Tooze, 2002). The Heckman selection model assumes that there is an underlying continuous latent variable on which an individual makes a decision to enter into paid work when the latent variable achieves a value that maximises the utility of the decision. Although the hours worked are not observed for individuals who are not in paid employment, it is possible to model the potential hours worked assuming that these individuals were in paid employment. The selection model also assumes that the error associated with the decision-making latent variable is correlated with the error associated with the number of hours worked, such that if a person was less likely to be in paid work, they would also tend to work less than the average hours per week if they were employed. In our study, the primary focus is on the change in paid work hours following the birth of a child and we argue that the decision not to participate in paid work after birth, perhaps on a temporary basis, dominates any decisions around potential hours worked (Madden, 2008). In other words there is unlikely to be a latent positive expected number of hours worked which might have been realised under certain circumstances. It is more likely that a mother, or father, has previously made a firm decision to stay at home to care for their child immediately following a birth transition. In this case, we are more interested in modelling actual hours worked rather than potential hours worked and hence use the two-part model for analysis. However, we acknowledge that the factors that influence the decision to work may be

correlated with the factors that influence the number of hours worked per week and we allow the unobserved heterogeneity in both parts of the model to be correlated.

For each individual in the sample data, we observe the hours worked and number of children on up to eleven occasions and we also observe when a birth transition representing a first or second birth occurs. For the 1,379 women and men in the sample, 6.5% of first births occurred in wave 2 and this annual percentage of first births steadily increased to 15% in wave 11. For the first part we model the probability of being in paid employment (or occurrence) using a logistic regression model with a random intercept. For individuals who are employed, we model the positive number of hours worked using a linear regression model also with a random intercept. The inclusion of random intercepts in both parts of the model is one way to account for unobserved heterogeneity among individuals. A random intercept in the occurrence part of the model allows some individuals to have a consistently high or low propensity to work over all waves of the survey, while a random intercept in the intensity part allows individuals to have a tendency to high or low mean hours worked. Specification of the correlation among these two random effects will capture the tendency of individuals with a high (low) propensity for employment to also work for longer (shorter) hours. Because individuals may increase their work hours at different rates over time following the birth of a child, we also allow the regression coefficient for *time* since birth to vary randomly in some of our models.

### 4.1 The Two-Part Regression Model with Correlated Random Effects

The two-part regression model simultaneously models the probability that an individual works or not (occurrence) and the number of hours worked (intensity). Each part of the model is regressed on a set of specified explanatory variables. For individuals who have zero work hours recorded, it is assumed that they are not in paid employment and for the

intensity part of the model, their hours worked is assumed to be missing. See Haynes and Gibbings (2006) for an application using four waves of HILDA data.

Let the random variable $Y_{ij}$ denote the number of hours worked in a week and take the observed value $y_{ij}$ for individual *i* at time *j* (*j = 1,2,...,11*). For women *i*=1,...,710 and for men *i*=1,...669. For the first part of the model, let $R_{ij}$ be a random variable denoting the occurrence of being employed where

$$R_{ij} = \begin{cases} 0, & \text{if } \mathrm{Y_{ij}} = 0 \\ 1, & \text{if } \mathrm{Y_{ij}} > 0 \end{cases} \tag{1}$$

with conditional probabilities

$$\Pr(R_{ij} = r_{ij} \mid \boldsymbol{\theta_1}) = \begin{cases} 1 - p_{ij}(\boldsymbol{\theta_1}), & \text{if } \mathrm{r_{ij}} = 0 \\ p_{ij}(\boldsymbol{\theta_1}), & \text{if } \mathrm{r_{ij}} = 1 \end{cases} \tag{2}$$

and $\boldsymbol{\theta_1} = [\boldsymbol{\beta}_1^{'}, \mu_{1ki}]$ is a vector of fixed-effects $\boldsymbol{\beta_1}$, and random intercepts $\mu_{1ki}$. The random intercepts are estimated for each individual *i* and birth transition phase *k*, where *k* =1,2,3 denotes the time period before and following a first and second birth: *k*=1 represents the period before first birth, *k*=2 represents the period following first birth & before second birth and *k*=3 represents the period following second birth. To model the probability of employment we assume a logistic regression model such that

$$\text{logit}\,(p_{ij}) = \log\left(\frac{p_{ij}}{1 - p_{ij}}\right) = \mathbf{X}_{\mathbf{1ij}}^{'}\boldsymbol{\beta}_1 + I_{ik}u_{1ki} \tag{3}$$

where $\mathbf{X}_{\mathbf{1ij}}^{'}$ is a vector of covariates and $\mathbf{I_{ik}}$ is a vector of indicator variables that take the value one when an individual *i* is in the phase *k*, and zero otherwise.

For the intensity part of the model we assume that the number of hours worked is missing if it is recorded as a zero.

$$Y_{ij} = \begin{cases} S_{ij} & \text{if } \mathrm{Y_{ij}} > 0 \\ . & \text{if } \mathrm{Y_{ij}} = 0 \end{cases} \tag{4}$$

Let $S_{ij}$ denote the number of hours worked for those who are employed and who work a positive number of hours (intensity of work). The mean hours worked for people who are employed is $E(S_{ij} \mid \boldsymbol{\theta}_2)$ where $\boldsymbol{\theta}_2 = [\boldsymbol{\beta}_2^{'}, \mu_{2i}]^{'}$ is a vector of fixed-effects $\boldsymbol{\beta}_2$ and random intercepts $\mu_{2ki}$ in the intensity part of the model. For the positive number of hours worked we assume a normal continuous model:

$$S_{ij} = \mathbf{X}_{\mathbf{2ij}}^{'}\boldsymbol{\beta}_{\mathbf{2}} + I_{ik}\mu_{2ki} \tag{5}$$

In these models we have included terms to capture: a discontinuity in hours worked immediately following first and second birth; any change in hours worked with time before and post birth; correlations in unobserved heterogeneity between the occurrence and intensity parts of the model, and correlations in unobserved effects of recurrent episodes of birth by allowing random effects for time prior to birth and following first and second births. This is the correlated logistic-normal regression model and in this study we estimate the model using the *twopart* command in MPLUS Version 7, statistical software. The *twopart* command estimates the parameters for the two parts of the model (equations 4 and 5) jointly using the EM algorithm.

## 5. Results

### 5.1 Preliminary Analysis

Figures 1 and 2 show histograms for hours worked per week at six different time points relative to the first birth year: approximately two years before a first birth, up to three

years following a birth, for women and men separately. The percentage of women who are not in paid employment increased from about 12% two years prior to a first birth, to about 22% one year prior to birth and this increased further to 58% in the wave immediately following birth.

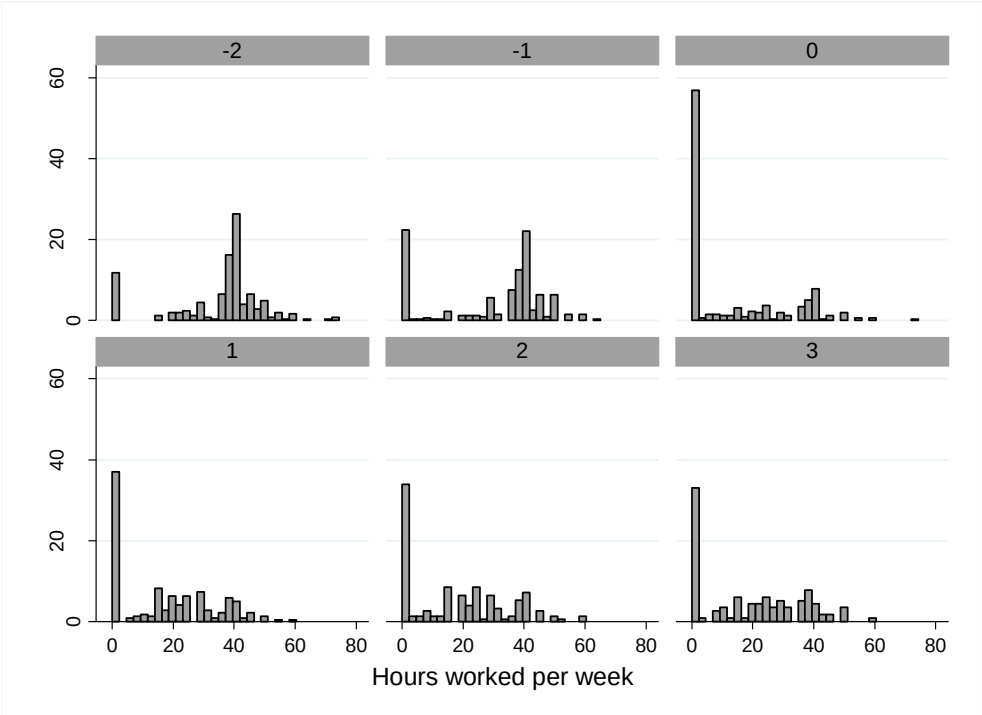



**Figure 1: Histograms showing women's hours worked before birth (2 and 1 waves prior) and following birth (immediately, 1, 2 and 3 waves following)**

Between one and two years following birth about 38% of women are still not in paid employment and this falls slightly to about 34% two years later. For men, the patterning of work hours around a birth transition is very different (Figure 2). The percentage of men not in paid employment varies only from 8% to 12% for the six waves around the first birth transition.

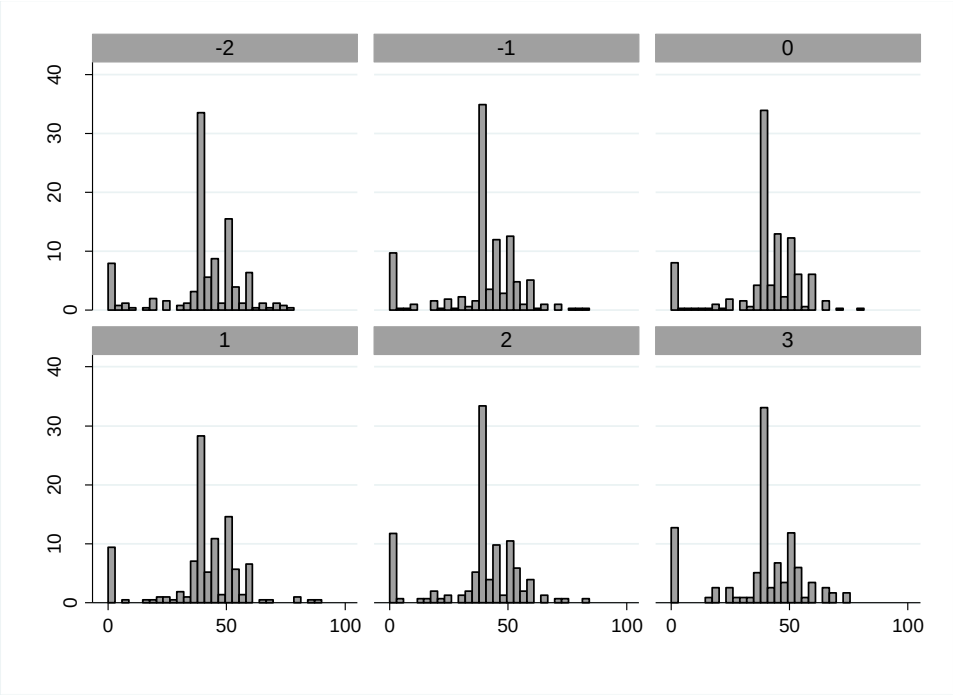



**Figure 2: Histograms showing men's hours worked before birth (2 and 1 waves prior) and following birth (immediately, 1, 2 and 3 waves following)**

Table 2 shows the percentages of women and men in each employment status transition for all waves combined prior to and immediately following a birth. The results differentiate a first and second birth. For a first birth, only 17% of women remained in full-time employment following first-birth compared to 77% of men. Following the second birth, the number of women remaining in full-time employment decreased to 7% but increased for men (82%). It is interesting that in the first year following the birth of a first child 44% of women remain in paid work in either a full-time (19%) or part-time (25%) capacity, while 90% of men remain in paid work. Table 3 shows the corresponding average hours worked per week by employment status transition, separately for men and women. Women who work full-time before and after the birth transition spend about 41 hours per week in employment while men are employed 46 hours per week on average with no change before and after a birth. Women who changed their employment from full-time to part-time, worked about 18

hours per week in the wave following birth, while the few men who changed to part-time worked about 24 hours per week.

**Table 2: Employment status transitions before and after birth by women and men.**

| **Employment status** | **First Birth (%)** | | **Second Birth (%)** | |
|---|---|---|---|---|
| Before – Following Birth | Women<br>n=710 | Men<br>n=669 | Women<br>n=314 | Men<br>n=283 |
| Full time – Full time | 17.6 | 77.0 | 7.0 | 81.6 |
| Full time – Part time | 15.8 | 1.8 | 6.7 | 4.6 |
| Full time – Not emp | 29.0 | 3.1 | 5.7 | 1.4 |
| Part time – Full time | 1.0 | 4.5 | 2.9 | 2.5 |
| Part time – Part time | 4.9 | 3.1 | 23.6 | 3.2 |
| Part-time – Not emp | 11.1 | 0.6 | 20.7 | 1.8 |
| Not emp – Full time | 0.1 | 2.7 | 0.0 | 1.1 |
| Not emp – Part time | 4.4 | 1.9 | 2.9 | 1.1 |
| Not emp – Not emp | 16.1 | 5.2 | 30.6 | 2.8 |

**Table 3: Average hours worked prior to and immediately following first birth by employment transition, separately for women and men.**

| **Employment status** | **Women's hours worked (average, n=710)** | | | **Men's hours worked (average, n=669)** | | |
|---|---|---|---|---|---|---|
| Before – Following First Birth | *n* | Before | After | *n* | Before | After |
| Full time – Full time | *125* | 42.29 | 41.43 | *515* | 46.67 | 46.07 |
| Full time – Part time | *112* | 41.78 | 18.46 | *12* | 42.00 | 24.42 |
| Full time – Not emp | *206* | 41.40 | 0.00 | *21* | 46.29 | 0.00 |
| Part time – Full time | *7* | 24.43 | 37.71 | *30* | 21.93 | 43.50 |
| Part time – Part time | *35* | 24.74 | 16.20 | *21* | 23.86 | 25.67 |
| Part-time – Not emp | *79* | 23.01 | 0.00 | *4* | 17.00 | 0.00 |
| Not emp – Full time | *1* | 0.00 | 35.00 | *18* | 0.00 | 45.33 |
| Not emp – Part time | *30* | 0.00 | 13.74 | *13* | 0.00 | 20.92 |
| Not emp – Not emp | *114* | 0.00 | 0.00 | *35* | 0.00 | 0.00 |

### 5.2 Model Results

Table 4 shows estimated parameters from the two-part regression model analysing paid work hours for women before and after the first and second birth of a child. Table 5 shows estimated parameters from similar models for men. Both tables report results for three different models. Model 1 is the two-part regression model including indicator variables for the three birth transition phases and a time variable interacted with the indicator variables that measure number of waves (or approximate years) before and after a birth. Model 1 also contains a random intercept on the pre-birth phase for an individual in both parts of the model to measure unobserved heterogeneity in an individual's propensity to work and also their intensity in paid work (hours of employment) before a first birth.

Model 2 is an extension of Model 1 which additionally includes random effects on all three indicator variables to capture unobserved heterogeneity in the propensity to work and the number of hours worked immediately following episodes of a first and second birth. Model 3 extends Model 2 further by allowing all random effects to covary within each part of the model and also by allowing the random effects for the pre-birth phase and the post-birth1 phase to co-vary across both parts of the model. Allowing the random effects to covary across the two parts of the model accounts for the likely correlation in the propensity of an individual to be employed and the number of hours they are employed per week.

The model comparison statistics AIC and BIC are used to assess relative improvements in the model fits as the models become progressively more complex. For both women and men, the AIC and BIC statistics are lowest for Model 3, although the biggest reduction occurs from Model 1 and 2. The improvement from Model 1 to 2 indicates that there is significant unobserved variation in the likelihood to work and the intensity of work following both a first birth and a second birth that is not captured by the random effect for the pre-birth phase. The improvement from Model 2 to 3 indicates that there are significant

correlations among the unobserved factors associated with hours worked by an individual in each birth transition phase and between the likelihood of working and the hours of paid work. Allowing random effects to covary in the model is a way of controlling for selection effects. Throughout the remainder of this section we interpret results for the full Model 3. We interpret the fixed effects from the occurrence (likelihood of employment) part of the model first, followed by the intensity (hours of employment) part of the model. Finally, we discuss the variance and covariance of the random effects.

For women, Model 3 results show that the likelihood of being employed was significantly lower following a first birth and lower still following a second birth. Also, the likelihood of employment declined as a first birth approached. Following both a first and second birth however, the likelihood of employment increased with time. Furthermore, the likelihood of women's employment increased with age in our sample of women who are of child-bearing age and was greater for women with a bachelor's degree or higher. Women who were partnered and had more liberal gender attitudes were also more likely to be employed. The second part of the model for women shows that the number of paid hours worked decreased significantly by approximately half (17 hours) following a first birth and by a further six hours following a second birth. Following both a first and second birth the number of paid work hours increased with time by about one hour per year. The number of paid hours worked was significantly higher for older women, women who were partnered and women with a bachelor degree or higher.

For both parts of the model there was significant unobserved heterogeneity in all three birth transition phases, however, not all random effects were correlated. In the occurrence part of the model there was a significant correlation between the unobserved factors associated with the likelihood of employment following first and second births, however the unobserved heterogeneity for the post birth transition phases were not correlated with that for

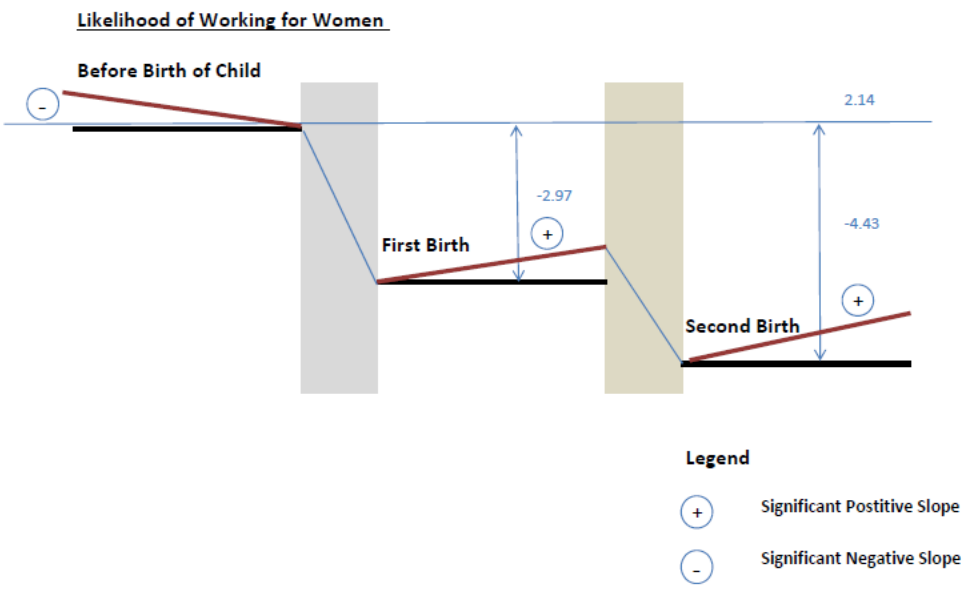
the pre-birth phase indicating that the unexplained propensity to work before a first birth is not related to the unexplained propensity to work after a birth. In the intensity part of the model there was a significant negative correlation between the unobserved factors associated with the number of hours in paid work prior to first birth and following a first birth. That is, women who tended to work more hours before a first birth experience a greater reduction in hours worked after birth, or in other words, women were more likely to work part-time or not at all after a first birth regardless of whether they are working full-time or part-time before a birth. There is a significant positive correlation in unobserved heterogeneity following the first and second births, indicating that women who work fewer hours after the first birth are also likely to work fewer hours after the second birth. There is a positive correlation between pre-birth unobserved heterogeneity, and post-birth unobserved heterogeneity, for both the occurrence and intensity parts of the model suggesting that there is a selection effect such that women with a higher propensity to work in paid employment tend to work more hours than the average.

For men, Model 3 results (Table 5) show that the likelihood of employment was not reduced following either a first or second birth. However, the likelihood of employment increased as a first birth approached and again following a second birth. Further, the likelihood of employment did not change with age but was greater for men with a bachelor's degree or higher. Men who were partnered and had more liberal gender attitudes were more likely to work.

The second part of the model for men shows that the number of paid hours increased with time leading up to a birth, did not change after a first birth, but decreased by about two hours immediately following the second birth. The number of paid hours worked did not change with men's age, but was higher for partnered men and men with a bachelor degree or higher.

For both parts of the model there was significant unobserved heterogeneity in most of the three birth transition phases, with the exception of the likelihood of employment following the second birth. In the occurrence part of the model there was a significant correlation between the unobserved factors associated with the likelihood of employment following first and second births, however, similar to the results for women, the unobserved heterogeneity for the post birth transition phases were not correlated with that for the pre-birth phase. In the intensity part of the model there was a significant negative correlation between the unobserved factors associated with the number of hours in paid work prior to first birth and following both a first and second birth. Similar to women, men who tend to work more hours before a first birth experience a higher reduction in hours worked after birth, however, the reduction in hours worked is much lower for men than women. There is a positive correlation between pre-birth unobserved heterogeneity for both the occurrence and intensity parts of the model suggesting that there is a selection effect for those who are more likely to be employed to also be more likely to spend longer hours in paid employment.

Figures 3 and 4 show the results of the Model 3 analyses described above graphically for women and men, respectively.



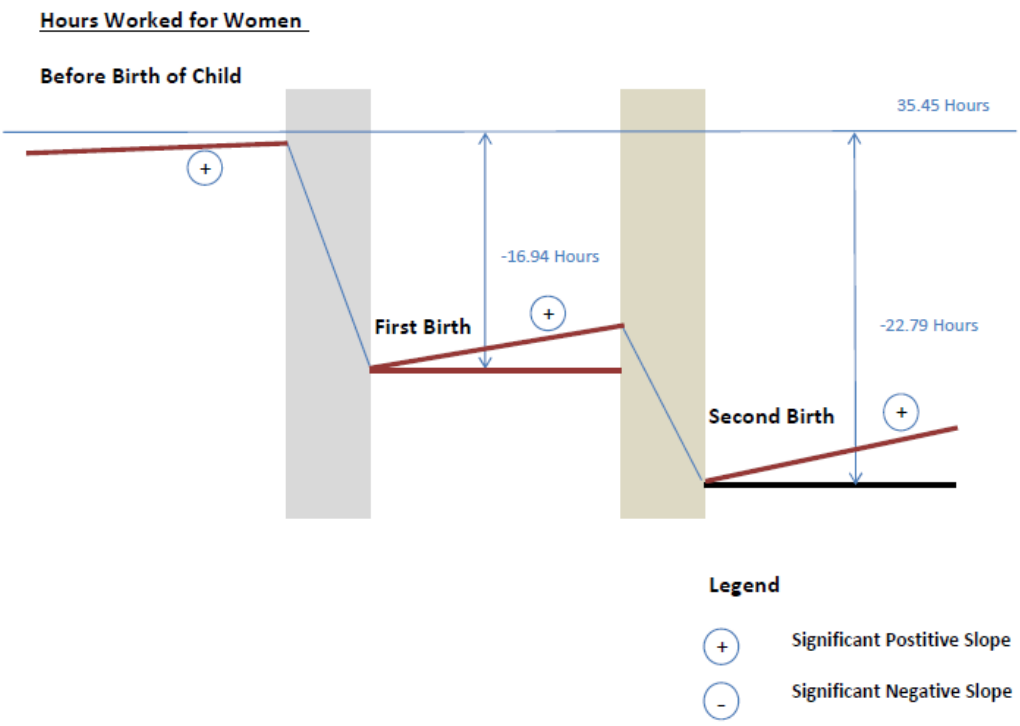




**Figure 3: Graphical representation of results for Model 3 for women separately for the occurrence and intensity parts of the model**


**Figure 4: Graphical representation of results for Model 3 for men separately for the occurrence and intensity parts of the model**

## 6. Conclusions

Our paper examines changes in the likelihood of employment and hours of employment for men and women at the time of the birth of a first or second child. Although we know broadly that women tend to withdraw from employment or to spend fewer hours in employment following parenthood while men tend to remain in employment, previous studies have not examined how the

likelihood of employment is related to hours of employment, patterns before and after first and second births, and variations in these patterns across gender. In this paper we examine these issues using advanced statistical models for longitudinal data. By analysing 11 waves of HILDA we are able to take account of both pre- and post-birth years, control for important covariates and control for unmeasured heterogeneity.

First, we investigated whether a first birth affects the likelihood of being in employment for men and women. Our results suggest that the likelihood of women working declines significantly after a first birth, while in contrast the likelihood of men being employed increases slightly leading up the first birth. Interestingly, for women, the likelihood of employment increased significantly over time after a first birth. The results were more mixed for our second question examining whether a first birth affects men's and women's hours of employment if they are in employment. For women there is a large decline (17 hours) in working hours after the birth of a first child, although the number of work hours increases over time. For men, even though there is a significant increase in the likelihood of employment, for those who are employed hours of work do not change.

Our third research question asked whether a first birth was associated with a greater likelihood of transitioning out of employment, or into part time employment for women, and a greater likelihood of transitioning into full time employment for men. This question was addressed by examining correlations between the unobserved heterogeneity in hours of employment before the first birth and in the transition phase following the first birth. For women, a negative correlation shows that women who worked more than average hours before a first birth experience a greater reduction in hours of employment following a first birth than women who work fewer hours before the birth. This result combined with the coefficient showing an average reduction in paid employment of 17 hours following a first birth indicates that women in full-time employment either transition into part-time employment or out of employment altogether for some time, while those in part-time

employment before a first birth may reduce their hours in part-time employment or leave employment. For men, the corresponding correlation is also negative but there is no significant reduction in hours worked following a first birth. Instead there is a significant increase in hours worked leading up to a first birth. This means that the 82% of men in our sample who are in full-time employment before a first birth are likely to remain in full-time employment. The negative correlation in unobserved heterogeneity could indicate that men who work less than average before a first birth are likely to work more hours following a birth. However, it is not clear whether the 18% of men who are not employed or who work part-time before a first birth, transition into full-time employment.

Our results showed differences for first and second births. For women the likelihood of working further declines after a second birth and the hours worked (for women who are working) declines a further 6 hours. Women who worked fewer hours after a first birth are significantly more likely to work fewer hours after their second birth. For men, work hours after a first birth do not change, but after a second birth there is a decline in work hours.

These results provide important insights into the ways in which men and women accommodate paid work and parenting demands. In particular they highlight the importance of examining both the likelihood of employment and hours of employment, as well as differentiating first and second births. Further they show differences in employment participation prior to a birth as well as in the period following a birth. And finally they help to understand whether women with certain characteristics, such as a propensity to be in employment, are likely to work varying numbers of hours.

Becoming a parent is a critical life course stage with evidence of important long and short-term consequences for the allocation of time by men and women to paid and unpaid work, and consequent changes in the gender division of labour. At the same time, studies have provided evidence of an intensification of parenting for both men and women suggesting that patterns of parenting increasingly demand more time spent with children. These trends suggest that women may

increasingly seek to spend more time in paid employment to alleviate gender inequality, while men may seek to spend more time with children to fulfill fatherhood ideals. It is thus timely to investigate gender variations in employment at the time of childbirth.

More broadly, decisions at the household level about the allocation of men's and women's time to employment at the time of a birth have important implications not only for men and women individually, but also for the wellbeing and health of children, for the economy and for the welfare state. In Australia these issues have recently come to the fore with legislation passed in 2011 introducing government-funded Paid Parental Leave for 18 weeks following the birth of a child at the national minimum wage and Dad and Partner Pay in 2012 for 2 weeks, also at the national minimum wage. Both pieces of legislation reflect current concerns to both support women to remain in employment following childbirth and men to participate in parenting children. Engaging mothers in the workforce is essential to both national prosperity and to individual and family well-being. The labour force participation rates of Australian mothers are low by international standards, particularly amongst those with pre-school children (OECD 2012), and the majority are employed part time(ABS 2008). One implication from our research is that the legislation may have varying effects for men and women depending on whether the birth is a first or second birth. Future studies will be needed to address this question and to further understand the changing relationship between parenthood and employment hours for men and women.

Table 4: Estimated parameters for two-part regression models for women

| | Women | | Women | | Women | |
|---|---|---|---|---|---|---|
| | Model 1 | SE | Model 2 | SE | Model 3 | SE |
| Part 1: Binary Model | | | | | | |
| *Fixed Effects* | | | | | | |
| Pre-birth level | 2.18*** | 0.26 | 2.22*** | 0.29 | 2.14*** | 0.33 |
| Time pre-birth | -0.16*** | 0.05 | -0.17*** | 0.05 | -0.18*** | 0.05 |
| Post-birth 1 level | -2.94*** | 0.18 | -2.97*** | 0.21 | -2.97*** | 0.26 |
| Time post birth 1 | 0.48*** | 0.04 | 0.52*** | 0.05 | 0.51*** | 0.05 |
| Post-birth 2 level | -4.02*** | 0.27 | -4.33*** | 0.33 | -4.43*** | 0.38 |
| Time post birth 2 | 0.32*** | 0.04 | 0.40*** | 0.05 | 0.42*** | 0.05 |
| Age (Grand Mean) | 0.06*** | 0.01 | 0.07*** | 0.01 | 0.07*** | 0.01 |
| Lag HH Income (Grand Mean) | 0.00** | 0.00 | 0.00** | 0.00 | 0.00 | 0.00 |
| Education (1 = Bach or higher) | 0.92*** | 0.20 | 0.94*** | 0.22 | 1.23*** | 0.22 |
| Relationship (1=Partnered) | 0.44** | 0.17 | 0.41* | 0.19 | 0.40* | 0.19 |
| Gender Attitudes | -0.19*** | 0.04 | -0.23*** | 0.04 | -0.24*** | 0.04 |
| *Random Effects* | | | | | | |
| Variance Pre-birth level | 4.01*** | 0.44 | 3.77*** | 0.49 | 3.78*** | 0.76 |
| Variance Post-birth 1 level | | | 2.31*** | 0.69 | 3.81*** | 1.00 |
| Variance Post-birth 2 level | | | 2.81* | 1.13 | 5.22** | 1.97 |
| Covariance (Pre, Post1) | | | | | -0.78 | 0.69 |
| Covariance (Pre, Post2) | | | | | -0.36 | 0.88 |
| Covariance (Post1, Post2) | | | | | 2.99** | 1.03 |
| | | | | | | |
| Part 2: Continuous Model | | | | | | |
| *Fixed Effects* | | | | | | |
| Pre-birth level | 36.78*** | 0.85 | 36.26*** | 0.77 | 35.45*** | 0.78 |
| Time pre-birth | 0.41*** | 0.13 | 0.32** | 0.11 | 0.31** | 0.11 |
| Post-birth 1 level | -15.61*** | 0.49 | -15.59*** | 0.65 | -16.94*** | 0.76 |
| Time post birth 1 | 0.98*** | 0.15 | 0.84*** | 0.14 | 0.97*** | 0.14 |
| Post-birth 2 level | -22.60*** | 0.95 | -23.31*** | 1.24 | -22.79*** | 1.30 |
| Time post birth 2 | 1.20*** | 0.19 | 1.19*** | 0.20 | 1.13*** | 0.20 |
| Age (Grand Mean) | 0.16* | 0.07 | 0.25*** | 0.06 | 0.26*** | 0.07 |
| Lag HH Income (Grand Mean) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Education (1 = Bach or higher) | 3.86*** | 0.64 | 3.95*** | 0.60 | 4.61*** | 0.60 |
| Relationship (1=Partnered) | 1.79*** | 0.49 | 2.16*** | 0.50 | 1.94*** | 0.50 |
| Gender Attitudes | -0.46*** | 0.11 | -0.49*** | 0.11 | -0.50*** | 0.11 |
| *Random Effects* | | | | | | |
| Variance Pre-birth level | 61.47** | 5.0 | 45.11*** | 3.93 | 54.08*** | 5.17 |
| Variance Post-birth 1 level | | | 66.08*** | 10.50 | 87.57*** | 13.87 |
| Variance Post-birth 2 level | | | 68.08*** | 13.47 | 94.67*** | 20.09 |
| Covariance (Pre, Post1) | | | | | -14.97* | 5.81 |
| Covariance (Pre, Post2) | | | | | -17.22 | 9.92 |
| Covariance (Post1, Post2) | | | | | 60.75*** | 13.76 |
| | | | | | | |
| Residual Variance | 80.78*** | 1.61 | 64.79*** | 1.27 | 63.55*** | 1.24 |
| Covariance (Binary pre-birth, Continuous pre-birth) | | | | | 7.78*** | 1.21 |
| Covariance (Binary post1, Continuous post1) | | | | | 5.90** | 2.03 |
| | | | | | | |
| Log likelihood | -15049.86 | | -14900.11 | | -14834.92 | |
| AIC | 30149.72 | | 29858.23 | | 29743.85 | |
| BIC | 30311.61 | | 30046.02 | | 29983.44 | |
| Number Individuals | 692 | | 692 | | 692 | |
| Number Observations | 4796 | | 4796 | | 4796 | |

Table 5: Estimated parameters for two-part regression models for men

| | Men | | Men | | Men | |
|---|---|---|---|---|---|---|
| | Model 1 | SE | Model 2 | SE | Model 3 | SE |
| Part 1: Binary Model | | | | | | |
| *Fixed Effects* | | | | | | |
| Pre-birth level | 4.28*** | 0.38 | 4.43*** | 0.42 | 4.21*** | 0.45 |
| Time pre-birth | 0.16** | 0.06 | 0.18** | 0.06 | 0.17** | 0.06 |
| Post-birth 1 level | -0.59* | 0.27 | 0.06 | 0.44 | 0.50 | 0.69 |
| Time post birth 1 | -0.08 | 0.09 | -0.12 | 0.10 | -0.12 | 0.10 |
| Post-birth 2 level | -1.33** | 0.49 | -1.15 | 0.61 | -1.41 | 0.76 |
| Time post birth 2 | 0.23* | 0.11 | 0.25* | 0.12 | 0.27* | 0.12 |
| Age (Grand Mean) | 0.02 | 0.01 | 0.03 | 0.01 | 0.02 | 0.01 |
| Lag HH Income (Grand Mean) | 0.00*** | 0.00 | 0.00*** | 0.00 | 0.00*** | 0.00 |
| Education (1 = Bach or higher) | 0.87* | 0.35 | 0.93* | 0.40 | 1.18** | 0.41 |
| Relationship (1=Partnered) | 0.80*** | 0.23 | 0.83*** | 0.25 | 0.80** | 0.26 |
| Gender Attitudes | -0.11* | 0.05 | -0.13 | 0.07 | -0.14* | 0.07 |
| *Random Effects* | | | | | | |
| Variance Pre-birth level | 6.23*** | 1.05 | 6.77*** | 1.26 | 6.32*** | 1.44 |
| Variance Post-birth 1 level | | | 3.35* | 1.52 | 4.32* | 1.90 |
| Variance Post-birth 2 level | | | 1.09 | 1.58 | 2.28 | 1.84 |
| Covariance (Pre, Post1) | | | | | 0.53 | 1.18 |
| Covariance (Pre, Post2) | | | | | -0.82 | 1.18 |
| Covariance (Post1, Post2) | | | | | 2.88* | 1.39 |
| | | | | | | |
| Part 2: Continuous Model | | | | | | |
| *Fixed Effects* | | | | | | |
| Pre-birth level | 42.10*** | 0.60 | 42.09*** | 0.59 | 41.94*** | 0.67 |
| Time pre-birth | 0.22* | 0.09 | 0.20* | 0.09 | 0.31*** | 0.09 |
| Post-birth 1 level | -1.01* | 0.42 | -0.99* | 0.48 | -0.98 | 0.56 |
| Time post birth 1 | 0.01 | 0.14 | -0.03 | 0.15 | 0.03 | 0.15 |
| Post-birth 2 level | -2.34** | 0.79 | -2.45** | 0.85 | -1.97* | 0.95 |
| Time post birth 2 | 0.09 | 0.17 | 0.09 | 0.18 | 0.11 | 0.18 |
| Age (Grand Mean) | 0.07 | 0.06 | 0.10 | 0.06 | 0.03 | 0.06 |
| Lag HH Income (Grand Mean) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Education (1 = Bach or higher) | 3.06*** | 0.53 | 3.09*** | 0.54 | 3.28*** | 0.55 |
| Relationship (1=Partnered) | 2.21*** | 0.42 | 2.23*** | 0.43 | 1.99*** | 0.45 |
| Gender Attitudes | 0.10 | 0.10 | 0.09 | 0.10 | 0.06 | 0.10 |
| *Random Effects* | | | | | | |
| Variance Pre-birth level | 70.87*** | 3.83 | 68.84*** | 3.97 | 88.54*** | 5.59 |
| Variance Post-birth 1 level | | | 14.80*** | 2.55 | 31.00*** | 3.71 |
| Variance Post-birth 2 level | | | 13.95*** | 4.25 | 53.77*** | 11.28 |
| Covariance (Pre, Post1) | | | | | -23.83*** | 3.32 |
| Covariance (Pre, Post2) | | | | | -34.53*** | 6.24 |
| Covariance (Post1, Post2) | | | | | 38.48*** | 6.18 |
| | | | | | | |
| Residual Variance | 64.40 | 0.69 | 59.87*** | 0.76 | 57.43*** | 0.72 |
| Covariance (Binary pre-birth, Continuous pre-birth) | | | | | 9.64*** | 1.66 |
| Covariance (Binary post1, Continuous post1) | | | | | 0.67 | 1.51 |
| | | | | | | |
| Log likelihood | -15950.40 | | -15926.22 | | -15868.63 | |
| AIC | 31950.80 | | 31910.44 | | 31811.26 | |
| BIC | 32111.00 | | 32096.28 | | 32048.36 | |
| Number Individuals | 646 | | 646 | | 646 | |
| Number Obs. | 4483 | | 4483 | | 4483 | |

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