

The Effects of Parenthood on Workforce Participation and Income for Men and Women

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Abstract This paper examined the effects of parenthood on workforce participation for men and women in the Christchurch Health and Development Study, a 30-year longitudinal study of a birth cohort of 1,265 individuals born in New Zealand in 1977. The findings suggested that the effects of parenthood on workforce participation were different for men and women. For women, parenthood was associated with decreasing participation in paid employment and fewer hours worked. For men, however, parenthood was not associated with decreased workforce participation and in some cases was associated with increased working hours. These findings had consequences for personal income, with 83–90 % of the total gender income gap in this cohort being attributed to gender differences in the effects of parenthood. These findings suggest that parenthood has markedly different effects on workforce participation and income for men and women.

Keywords Parenthood · Gender differences · Workforce participation · Income · Longitudinal study

Introduction

It has been well-documented across many societies that there are consistent and ongoing gender gaps in workforce

participation and earnings, with women being less likely to be engaged in paid employment than men, and receiving lower levels of remuneration for the same work than men (Blau and Kahn 1996, 2000; Jaumotte 2003; The World Bank 2012; Van der Lippe and Van Dijk 2002). Given the historical movement toward rectifying gender discrimination in the workplace and elsewhere (Inglehart and Norris 2003; The World Bank 2012), these observations have led to debates about the origins of these gaps.

In general, explanations of the gender gaps in workforce participation and earnings have been polarized. One explanation has been that the lower levels of workforce participation and earnings for women reflect various structural barriers that inhibit women from full engagement with the workforce and remuneration commensurate to their level of employment (Inglehart and Norris 2003; Macpherson and Hirsch 1995). These barriers include such factors as sex role stereotypes, the perception of barriers that may cause young women to reduce their level of aspiration, and gender discrimination in employment.

A second explanation is that gender differences in female and male life courses have implications for workforce participation and income. In particular, a major life course event is parenthood. It may be proposed that gender differences in the way in which this event is managed lead females and males to make very different decisions regarding workforce participation, with these decisions contributing to the gender gap in income (Anderson et al. 2002; Budig and England 2001; Ciscel et al. 2000; O'Dorchai 2008).

The purpose of the present study was to examine the effects of parenthood on workforce participation and earnings for men and women, in a longitudinal birth cohort studied to age 30. In particular, the study sought to estimate the effects of parenthood on the gender gap after accounting

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for a range of possible confounding and covariate factors, in order to examine the extent to which the gender gap in workforce participation and earnings could be accounted for by differential reactions to parenthood.

The Gender Gap in Workforce Participation and Earnings

There is extensive evidence to suggest that there has been a consistent gender gap in both workforce participation and earnings, with men being more likely than women to be engaged in the workforce, and earn substantially higher salaries for doing the same work (Blau and Kahn 1996, 2000; Jaumotte 2003; Molina and Montuenga 2009; The World Bank 2012; Van der Lippe and Van Dijk 2002). For example, a recent report by The World Bank (2012) shows that there remains persistent inequalities between female and male income and workforce participation across a number of developed nations. Furthermore, despite widespread recognition of these gaps, evidence suggests that relatively little progress has been made in recent years in terms of redressing the imbalances between female and male workforce participation and earnings. A report by the International Labor Organization using data from over 200 countries suggests that between 1980 and 2008, the gender gap in workforce participation narrowed only slightly, from 32 to 26 % points (Elder 2010).

Barriers for Women

As noted above, one explanation for the gender imbalance in workforce participation and earnings is that there are systematic barriers in place that work to assign females and males to differing career pathways, and to unfairly reduce women's remuneration in comparison to men performing the similar roles. It has been argued, for example, that sex role stereotypes result in females being prepared for work roles that carry lower status and lower levels of pay (Evans and Diekman 2009; Konrad et al. 2000; Miller and Budd 1999; Tinklin et al. 2005). Also, Tinklin et al. (2005) showed that, in a sample of young British respondents, females and males indicated that they intended to pursue more gender stereotyped occupations (such as teaching and nursing for females), despite acknowledging the equal importance of education and work for both genders. Furthermore, research has suggested that these barriers extend to the perception of one's available opportunities for educational and career achievement (Luzzo and McWhirter 2001; McWhirter 1997; McWhirter et al. 1998). For example, McWhirter (1997) found that, in a sample of high school students, females perceived a significantly greater number of barriers against post-secondary and career achievement than males.

A related but perhaps more direct barrier to female equality in pay and workforce participation may be gender discrimination in the workplace (Booth et al. 2003; Duncan 1996; Fretz and Leong 1982; McKenna and Johnson 1981; Nsiah et al. 2012; Wright and Ermisch 1991). In an analysis of British Household Panel Survey data, Booth et al. (2003) showed that while women were as likely as men to receive promotion, they received significantly smaller wage increases following promotion. Also, Duncan (1996), using data from the US National Longitudinal Study of Youth, showed that longitudinal changes in work skills and effort among females could not fully account for a persistent gender gap in earnings, indicating that the most likely explanation for the gap was gender discrimination in pay. The cumulative effect of these barriers is to discourage women from becoming equally engaged in the workforce, to limit their opportunities for advancement in their careers, and to lower their level of remuneration in relation to men.

Life Course Explanations: The Impact of Parenthood

As noted above, a further explanation advanced for the gender gap in workforce participation is the differential life course experienced by women and men, particularly with respect to parenthood. Evidence suggests, for example, that becoming a parent is associated with a change to more traditional gender roles, with men increasing their involvement in the workforce and women decreasing their workforce participation (Abroms and Goldscheider 2002; Baxter et al. 2008; Christie-Mizell 2006; Gjerdingen and Center 2005; Sanchez and Thomson 1997). For example, Gjerdingen and Center (2005) examined the impact of parenthood on workforce participation in United States couples, and reported that the birth of a first child resulted in a decrease in women's paid employment of around 11 h per week, but had no effect on men's paid employment hours.

Further evidence suggests that, relative to childless women, mothers work fewer hours and earn lower wages (Anderson et al. 2003; Gangl and Ziefle 2009; Joshi and Paci 1998; Joshi et al. 1999; Waldfogel 1998). For example, Gangl and Ziefle (2009), using data from birth cohorts in Germany, Britain and the United States, reported that mothers in all three countries were significantly more likely to be working part-time, were employed in jobs with lower socioeconomic prestige, and earned a significantly lower hourly wage than women without children. While most previous literature in this area has focussed on women, a small number of studies have examined the wage effects of fatherhood and have reported that fatherhood is not associated with a drop in wages, and may in some circumstances be associated with an increase in wages (Astone

et al. 2010; Dommermuth and Kitterød 2009; Petersen et al. 2007). For example, Petersen et al. (2007) reported that men who were fathers experienced a small wage premium of 1–3 % compared to men who were not fathers. In general, the literature suggests that parenthood places a differential burden on women and men, with women's participation in the workforce and earnings being decreased as a result of becoming a parent.

Although much of the previous literature suggests that parenthood may have a differential effect on workforce participation for males and females, some recent Scandinavian studies suggest that the effects of parenthood on workforce participation may have become more similar for men and women in recent years (Dribe and Stanfors 2009; Petersen et al. 2007; Young and Wallace 2009). For example, Dribe and Stanfors (2009), using Swedish data from the Multinational Time Use Survey, found that while parenthood in 1990–1991 had led to a more traditional gender role division of labor in Swedish households, in 2000–2001 parenthood was not associated with significant differences in work associated with traditional gender roles.

The Present Study

Although it is difficult to examine the impacts of macro-social forces such as discrimination at the level of the individual, survey data do allow for in-depth examination of the linkages between parenthood and workforce participation, and the extent to which there are gender differences in these linkages. In particular, prospective longitudinal studies that have extensive information concerning possible background or covariate factors associated with becoming a parent allow for more accurate estimates of the strength of associations between parenthood and workforce participation for both women and men. These factors may include such things as family socioeconomic and demographic background, educational achievement, exposure to adversity in childhood, and related factors. It is possible that these covariate factors may in part explain the differences in workforce participation and income between parents and non-parents. Accounting for the influence of such factors provides less biased estimates of the effect of parenthood on workforce participation and income.

An important feature of longitudinal studies is that, subject to the availability of repeated measures data, it proves possible to take into account non-observed genetic and environmental factors that have a fixed effect on the associations between parenthood and workforce participation (Cameron and Trivedi 1998; Greene 1990). In the context of research into parenthood and workforce participation, factors that may potentially be subsumed by the fixed effects term are all individual, family, social, and

related factors that are fixed at the point of adolescence and which have a fixed effect on both parenthood and workforce participation outcomes. In this way the use of fixed effects models complements and extends analyses employing observed covariate factors.

A further issue is that much of the previous literature in this area uses cohorts of individuals who were born in the 1950 and 1960s. Recent decades have seen changes in the participation of women in the labour market (Blau 1998; Cohen and Bianchi 1999). It is therefore possible that the results of previous studies may not apply to more modern cohorts of individuals who were raised during a period of high female workforce participation and less traditional gender role attitudes. As noted above, data from Scandinavian studies suggest that the gender gap in terms of the effects of parenthood on workforce participation may have narrowed in recent years (Dribe and Stanfors 2009; Petersen et al. 2007).

Against this background, this paper reports a longitudinal analysis of the effects of parenthood on male and female workforce participation and earnings in a New Zealand birth cohort studied to the age of 30. The specific aims of this study were to estimate:

1. The associations between parenthood and measures of workforce participation for males and females;
2. The strength of association between parenthood and workforce participation for females and males, net of both observed confounding factors and non-observed sources of confounding that may increase the likelihood of parenthood by age 30;
3. The effects of parenthood on the gender gap in earnings by males and females.

Method

Data and Participants

Data were drawn from the Christchurch Health and Development Study, a longitudinal study of a birth cohort of 1,265 individuals born in Christchurch, New Zealand in mid-1977 and followed to age 30. Ninety-eight percent of the pregnant mothers in Christchurch who were due to give birth in mid-1977 agreed to participate in the research. Participants were followed up at birth, 4 months, 1 year, yearly until age 16, then at ages 18, 21, 25 and 30. Data were collected using a combination of semi-structured interviews with parents and children, standardised tests, and teacher reports. The methodology and major findings of the study have been described previously (Fergusson and Horwood 2001; Fergusson et al. 1989). At age 25 the remaining sample consisted of 1,003 individuals, and at

age 30 it consisted of 987 individuals (see “[Sample Size and Sample Bias](#)” section below for more information on sample loss).

Dependent Measures

Employment

At age 25 and 30, participants were asked if they were currently in paid employment. Participants who reported working in paid employment for any number of hours per week were classified as being employed. Overall, 82.5 % of participants were employed at age 25 and 83.2 % at age 30.

Hours Worked

At ages 25 and 30, participants were asked to report the number of hours worked weekly in each of their current paid jobs. The hours were summed to provide a total for all hours worked weekly in paid employment. Participants who were not employed were classified as having working hours of zero. At age 25, weekly working hours had a mean of 32.6 and a standard deviation of 18.9, and at age 30 they had a mean of 34.0 and a standard deviation of 19.1.

Income

At ages 25 and 30, participants were asked to report their personal gross income (in New Zealand dollars) from all sources over the previous 12 months as one of the following income bands: zero income or loss; NZ \$1–5,000; NZ \$5,001–10,000; NZ \$10,001–15,000; NZ \$15,001–20,000; NZ \$20,001–25,000; NZ \$25,001–30,000; NZ \$30,001–40,000; NZ \$40,001–50,000; NZ \$50,001–70,000; NZ \$70,001–100,000; NZ \$100,001 or more. These responses were converted to single point estimates by taking the mid-point of the relevant income band. Incomes in the top band were set to \$120,000. Incomes reported in currencies other than New Zealand dollars were converted to New Zealand dollars using purchasing power parities (OECD 2007). After currency conversion, incomes above NZ \$120,000 were truncated to NZ \$120,000. At age 25, annual incomes had a mean of \$30,007 and a standard deviation of \$19,077, and at age 30 they had a mean of \$48,283 and a standard deviation of \$29,766.

Predictors

Parenthood

At age 25 and 30, participants were asked whether they currently had any dependent children (biological or step-children)

who lived with them full-time. Overall 19.0 % of participants had dependent children living with them at age 25 and 35.7 % at age 30 (3.5 % of participants were step-parents with no biological children at age 25, and 5.6 % of participants were step-parents with no biological children at age 30).

Gender

Gender was the participant’s sex reported at the birth interview. At age 25, 48.7 % of the sample was male, and at age 30, 48.4 % was male.

Covariate Factors

To control for confounding, associations between parenthood and workforce participation were adjusted for covariate factors spanning a wide range of measures taken from the study database, and found in a range of previous studies to be associated with parenthood amongst the cohort (Boden et al. 2008; Woodward et al. 2006). A selection of potentially confounding factors measured during childhood or adolescence were chosen. These factors were related to: childhood family socioeconomic background and demographic factors (family socioeconomic status, family living standards, family income, parental age, parental education level); exposure to physical abuse, sexual abuse, and interparental violence in childhood; family functioning (parental alcohol problems, parental illicit drug use, parental criminal offending, exposure to family adversity, family instability); childhood behaviour problems (conduct problems, attention problems); personality and individual factors (neuroticism, parental attachment); cognitive and academic ability.

Also, a series of possible covariate factors relating to the parenthood and workforce participation measures at ages 25 and 30 were also examined in the analyses, including measures of: life stress; substance use; presence of a cohabiting partner; and educational achievement. Those potential confounding and covariate factors that were found to be a significant ($p < .05$) predictor in at least one model are described below.

Family Living Standards (0–10 Years)

At each year a global assessment of the material living standards of the family was obtained via interviewer rating. Ratings were made on a five point scale that ranged from “very good” to “very poor”. These ratings were averaged over the 10 year period to give a measure of typical family living standards during this period.

Family Socioeconomic Status (at Birth)

This was assessed at the time of the participant's birth using the Elley–Irving (Elley and Irving 1976) scale of socioeconomic status for New Zealand. This scale classifies SES into levels on the basis of paternal occupation ranging from 1 = “professional occupations” to 6 = “unskilled occupations”.

IQ

At ages eight and nine participants were assessed with the revised Wechsler Intelligence Scale for Children (Wechsler 1974). The measure used in the present analysis was the average of the total IQ scores at ages 8 and 9 and had a split-half reliability of .95.

Academic Progress Age 11–13

At ages 11–13, participants' school teachers were asked to rate the participant's performance in reading, handwriting, written expression, spelling and mathematics using a five point scale ranging from very good to very poor. Ratings were averaged across years and curriculum areas to provide a global measure of academic performance. This measure had a reliability of $\alpha = .96$.

Childhood Sexual Abuse

At ages 18 and 21 participants were questioned about their exposure to sexual abuse during childhood (before age 16). This information was used to construct a four-level scale representing the most extreme form of childhood sexual abuse reported by the participant at either age 18 or 21: no abuse (85.9 % of sample); non-contact abuse only (2.7 %); contact abuse not involving attempted or completed intercourse (5.1 %); attempted/completed oral, anal or vaginal intercourse (6.3 %) (Fergusson et al. 1996).

Childhood Adversity

This variable was a count measure of 39 measures of family disadvantage from age 0–15, including measures of disadvantaged parental background, poor prenatal health practices and perinatal outcomes, and disadvantageous child-rearing practices (Fergusson et al. 1994).

Cohabiting Partner

At age 25 and 30, participants were asked if they were currently involved in a cohabiting partner relationship. Overall 47.6 % of participants were in a cohabiting relationship at age 25 and 66.0 % at age 30.

Highest Level of Educational Achievement

At ages 25 and 30, participants were questioned about the educational qualifications that they had attained. The highest reported educational qualification was classified on a seven point scale where: “1” was no qualifications, “2” was one or more school certificate passes, “3” was passing sixth form certificate, “4” was passing higher school certificate, “5” was passing university bursary examination, “6” was attending university, and “7” was attaining a university degree [for a detailed description of this scale, see: Fergusson et al. (2006)]. At age 25, this measure had a mean of 4.2 and a standard deviation of 2.2, and at age 30 it had a mean of 4.0 and a standard deviation of 2.3.

Statistical Analysis

Association Between Parenthood and Workforce Outcomes

The associations between the repeated measures of parenthood and workforce participation were tested for statistical significance by fitting regression models to the data for each workforce participation outcome using a generalised estimating equation (GEE) approach (Liang and Zeger 1986; Zeger and Liang 1986). The GEE approach pooled the repeated measures on the parenthood measure and on each workforce participation measure at ages 25 and 30 years to produce an estimate of the population-averaged association between parenthood and the workforce participation measure, using an unstructured correlation matrix. For the continuous measures (hours worked and income) a linear regression model was fitted of the form:

$$Y_{it}^G = B_0^G + B_1^G X_{it} + U_{it}^G \quad (1)$$

where Y_{it}^G was the score on outcome Y for the i th participant in time period t ($t = 25, 30$) for gender G , and X_{it} was parenthood status for the i th individual in time period t .

For the dichotomous measure (employment) a logistic regression model was fitted of the form:

$$\text{logit}(Y_{it}^G) = B_0^G + B_1^G X_{it} \quad (2)$$

where $\text{logit}(Y_{it}^G)$ was the log odds of employment for the i th participant in time period t ($t = 25, 30$) for gender G . In all cases the fitted model permitted the repeated measures of the outcomes to be correlated. In these models the coefficient B_1^G represents the effect of parenthood on the workforce participation measure pooled over the two observation periods. In each case a test of significance of the association was given by a Wald Chi-squared test of the hypothesis that $B_1 = 0$.

In order to adjust the population-averaged associations between parenthood and workforce participation for confounding, the GEE models described above were extended to include a series of covariate factors (see covariates, above, for details). Covariate factors were nested within gender to allow the effects of the covariates on the outcome measure to vary for males and females. All covariates were initially included, and then the model was gradually refined to include only those covariates that were significant ($p < .05$) predictors of the outcome. For the continuous measures the extended model was of the form:

$$Y_{it}^G = B_0^G + B_1^G X_{it} + \sum B_j^G Z_{ij} + \sum B_k^G Z_{ikt} + U_{it}^G \tag{3}$$

and for the employment status outcome it was of the form:

$$\text{logit}(Y_{it}^G) = B_0^G + B_1^G X_{it} + \sum B_j^G Z_{ij} + \sum B_k^G Z_{ikt} + U_{it}^G \tag{4}$$

where Z_{ij} were a set of fixed covariates and Z_{ikt} a set of time dynamic covariate factors for individual i , and the interpretations of all other variables are similar to those in the original models. In these extended models the coefficient B_1^G represents the effect of parenthood on workforce participation for gender G , net of the effects of the covariate factors.

To examine whether the effects of parenthood for males and females differed with age, the above models were extended to include the parenthood \times age interaction (nested within gender). None of the interaction terms were statistically significant, suggesting that the effects of parenthood on workforce participation were similar at ages 25 and 30 and that a pooled model across both ages was therefore appropriate.

Fixed Effects Models for Covariate Adjustment

Next, the regression analysis described above was extended by fitting conditional fixed effects models to the data. These models take into account non-observed sources of confounding subject to the assumption that these non-observed sources exert a fixed and enduring effect on the outcome measures (Hamerle and Ronning 1995). These models were of the form:

$$f(Y_{it}) = \alpha_i + B_1 X_{it} \tag{5}$$

In this model α_i are individual-specific terms that are assumed to reflect the effects of all fixed sources of variation in the outcome Y_{it} . The fixed effects α_i are assumed to be constant over time and to be correlated with other predictors in the model. To take into account the interactive properties of the data, separate models were fitted for males and females.

Testing the Gender Gap in Income

To examine the gender gap in income, data were fitted with a linear regression model (using a GEE approach similar to that described above) in which income was modelled as a function of gender. The general model was of the form:

$$Y_{it} = B_0 + B_1^G i + B_2 X_{it} + U_{it} \tag{6}$$

where Y_{it} was the annual income for the i th participant in time period t ($t = 25, 30$), and G was gender for the i th participant, and X_i was the age of the i th participant at time t (included to allow for inflation in wages over time). In this model the coefficient B_1 provides an estimate of the size of the gender gap in income.

To examine the impact of gender differences in parenthood on the gender income gap, the model above was extended to include parenthood, and the parenthood \times gender interaction. The extended model was of the form:

$$Y_{it} = B_0 + B_1^G i + B_2 X_{it} + B_3 P_{it} + B_4 I_{it} + U_{it} \tag{7}$$

where P_{it} was parenthood for participant i at time t , I_{it} was the parenthood \times gender interaction for individual i at time t , and all other variables have interpretations similar to those described in the previous model. In this model the coefficient B_1 provides an estimate of the component of the gender gap in income that was not explained by the effects of parenthood and the parenthood \times gender interaction.

Additional Analyses

In addition to the above analyses, all analyses were repeated with the sample restricted to those individuals who were parents of biological children, and excluding those individuals who were parents of step-children only.

Sample Size and Sample Bias

Over the course of the study there has been a gradual loss of participants due to participant refusal, death, and inability to trace participants. The present analyses were based on the samples at age 25 ($N = 1,003$) and 30 ($N = 987$) which represent between 81.3 and 80.2 % of the remaining live sample at those ages. The gradual loss of participants over the course of the study raises questions about the extent to which the results of this paper may be influenced by sample bias due to non-random sample loss. To examine this, missing data were imputed using methods of multiple imputation (Rubin 1987; Schafer 1999). This was achieved using the PROC MI and PROC MIANALYZE procedures in SAS 9.1, which use methods of multiple imputation to impute missing data and then use these data in the analysis to adjust standard error estimates under the assumption that

there was no bias in the estimation of the missing data. The variables employed in the multiple imputation procedure included all outcomes, predictors, and covariate factors listed above. The results of this re-analysis were not substantively different to those of the original analysis and, in all cases, led to the same conclusions. These findings provide some reassurance that non-random sample loss was not a threat to study validity. Nonetheless it should be borne in mind that the multiple imputation methodology does not take into account non-observed sources of sample bias.

Results

Parenthood in the CHDS Sample

Table 1 shows the number and percentage of participants who had dependent children living with them at ages 25 and 30. These percentages are shown for males, females, and the total sample. For those participants who were parents, the table shows the age of the youngest child, classified as: under 1; 1–4; and 5 years or older. Overall, 19.0 % of participants were parents at age 25, and 35.7 % at age 30. At both ages, females were more likely to be parents than males, with 26.2 % of females being parents at age 25 and 43.4 % at age 30, compared to 11.5 and 27.4 % for males. At both ages, the majority of parents had preschool children aged under 5 years old. At age 25, 83.8 % of parents had a youngest child under 5 years old, and 72.4 % at age 30. Compared to males, females were more likely to have older children. By age 30, 16.4 % of male parents and 34.1 % of female parents had a youngest child aged 5 years or older.

Parenthood and Workforce Participation

Table 2 reports the associations between parenthood and workforce participation for males and females. Two measures of workforce participation were considered: (1) whether or not the participant worked in paid employment;

and (2) the mean number of weekly hours worked in paid employment.

The table also reports the results of nested regression models in which the workforce participation measure was modelled as a function of parenthood nested within gender for the pooled sample (see “Methods” section). The table shows:

- (1) For males parenthood was not associated with a decrease in workforce participation. For the employment measure there was no significant difference between the employment rates of male parents and male non-parents ($p > .10$). For the hours worked measure, however, male parents worked longer hours than male non-parents (41.89 vs 37.76 h, $p < .05$).
- (2) For females there were clear and consistent tendencies for female parents to have lower rates of workforce participation than female non-parents. Female parents were less likely to be employed and worked fewer hours per week than female non-parents. These trends are illustrated in the pooled results which show overall that female parents worked an average of 15.03 h compared to 35.35 h for female non-parents ($p < .0001$), and had an employment rate of 54.8 % compared to 89.1 % for female non-parents ($p < .0001$).

Factors Associated with Parenthood

One explanation of the findings in Table 2 is that they could be related to covariate factors that are associated with parenthood. To address this Table 3 examined the factors related to parenthood for males and females. For the purposes of data display, these factors have been presented in the table as dichotomous measures; however, the analyses were performed on the original scales as described in the “Method” section (above). Also, the table displays the associations for parenthood at age 30 only, as congruent results were obtained for parenthood at age 25. The table shows:

Table 1 Parenthood in the CHDS sample

Age 25	Males ($N = 488$)	Females ($N = 515$)	Total ($N = 1003$)
% parents	11.5 ($N = 56$)	26.2 ($N = 135$)	19.0 ($N = 191$)
% of parents with youngest child under 1	33.3	17.2	21.2
% of parents with youngest child aged 1–5	62.2	62.7	62.6
% of parents with youngest child aged 5 or older	4.4	20.2	16.2
Age 30	Males ($N = 478$)	Females ($N = 509$)	Total ($N = 987$)
% parents	27.4 ($N = 131$)	43.4 ($N = 221$)	35.7 ($N = 352$)
% of parents with youngest child under 1	31.3	20.5	24.4
% of parents with youngest child aged 1–5	52.3	45.5	48.0
% of parents with youngest child aged 5 or older	16.4	34.1	27.6

Table 2 Associations between parenthood and workforce participation, for males and females

Measure	Males			Females		
	Not parents	Parents	B (SE)	Not parents	Parents	B (SE)
Paid employment (%)						
Age 25	86.8	87.5		88.2	50.4	
Age 30	89.3	94.7		90.3	57.5	
Pooled	87.9	92.5	0.37 (0.30)	89.1	54.8	−2.05 (0.18)****
Weekly hours worked (mean, SD)						
Age 25	36.63 (18.10)	39.11 (17.86)		34.07 (16.20)	12.96 (16.29)	
Age 30	39.16 (17.87)	43.08 (14.37)		37.03 (15.06)	16.29 (17.54)	
Pooled	37.76 (18.02)	41.89 (15.56)	2.63 (1.29)*	35.35 (15.77)	15.03 (17.13)	−20.98 (1.19)****
N age 25	432	56		380	135	
N age 30	347	131		288	221	

* $p < .05$; **** $p < .0001$

Table 3 Associations between parenthood at age 30 and covariate factors

Measure	Males		Females	
	Not parent ($N = 328$)	Parent ($N = 121$)	Not parent ($N = 275$)	Parent ($N = 207$)
IQ age 8/9 highest quartile (%)	33.7	22.9*	29.5	19.5**
Academic progress age 11–13 highest quartile (%)	19.2	14.1	39.6	24.2****
Family living standards age 0–10, lowest quartile (%)	21.2	29.7	13.9	32.7****
Childhood adversity, highest quartile (%)	17.7	28.8**	10.2	35.9****
Unskilled/manual paternal occupation (%)	20.5	38.2****	15.3	33.0****
Sexual abuse <age 16 (%)	4.9	5.3	13.5	24.0**
Partner age 30 (%)	53.6	93.9****	60.1	76.5****
University degree by age 30 (%)	30.0	14.5***	46.9	16.7****

* $p < .05$; ** $p < .01$; *** $p < .001$; **** $p < .0001$

- (1) For both males and females, parenthood at age 30 was significantly associated with: lower IQ ($p < .05$), higher levels of childhood adversity ($p < .01$), childhood family SES (unskilled/manual paternal occupation) ($p < .0001$), higher likelihood of having a cohabiting partner ($p < .0001$), and lower levels of educational attainment (university degree by age 30) ($p < .001$).
- (2) For females, parenthood at age 30 was also significantly associated with: lower academic progress at age 11–13 ($p < .001$), lower family living standards ($p < .0001$), and higher likelihood of childhood sexual abuse ($p < .01$).

Regression Results

To take account of the covariate factors identified in Table 3, the analysis in Table 2 was extended to include these factors in the regression models (see “Methods” section). Table 4

reports the regression coefficients (B) and standard errors (SE) for parenthood and significant ($p < .05$) covariate factors for the models pooled over 25 and 30 years. Separate (nested) GEE models were fitted for males and females (see “Methods” section). The results in Table 4 show that after covariate adjustment:

- (1) For males, parenthood was unrelated to both the likelihood of being in paid employment and the number of hours worked (both comparisons $p > .10$).
- (2) For females there were consistent trends for female parents to have lower levels of workforce participation than female non-parents. The parameters of the adjusted pooled model imply that female non-parents had odds of being in paid employment that were 7.02 (95 % CI 4.66–10.59) times greater than female parents and that, on average, female non-parents worked 20.13 (95 % CI 17.73–22.53) more hours per week than female parents.

Table 4 Covariate-adjusted associations between parenthood and workforce participation, for males and females (pooled over ages 25 and 30)

	Males B (SE)	Females B (SE)
Paid employment		
Parenthood	0.14 (0.34)	-1.95**** (0.21)
IQ ages 8–9	-0.02 (0.01)	0.02* (0.01)
Academic progress ages 11–13	-0.44* (0.22)	0.14 (0.16)
Childhood adversity	-0.07** (0.02)	-0.01 (0.02)
Sexual abuse <age 16	-0.41* (0.18)	0.04 (0.09)
Cohabiting partner ages 25, 30	0.85*** (0.26)	0.38* (0.19)
Weekly hours worked		
Parenthood	1.35 (1.35)	-20.13**** (1.23)
IQ ages 8–9	-0.07 (0.07)	0.17** (0.06)
Academic progress ages 11–13	-2.31* (1.15)	0.77 (0.96)
Sexual abuse <age 16	-3.73* (1.49)	0.15 (0.62)
Cohabiting partner ages 25, 30	5.77**** (1.23)	3.68*** (1.02)

NB analyses include a dummy variable to account for age of observation (t = 25, 30 years)

* $p < .05$; ** $p < .01$; *** $p < .001$; **** $p < .0001$

Fixed Effects Regression

In order to examine the influence of possible non-observed sources of confounding on the associations between parenthood and workforce outcomes, the data in Table 4 were fitted to conditional fixed effects models, with separate models fitted for males and females (see “Methods” section). The results of these models were similar to those presented in Table 4, suggesting that accounting for non-observed sources of confounding did not materially alter the conclusions drawn from the analyses using observed covariate factors.

- (1) For males, parenthood was unrelated to both the likelihood of being in paid employment ($B = 0.21$; $SE = 0.60$; $p > .70$) and the number of hours worked ($B = 0.04$; $SE = 2.11$; $p > .90$), after adjustment for non-observed sources of confounding.
- (2) For females, parenthood was significantly associated with the likelihood of paid employment ($B = -3.46$; $SE = 0.76$; $p < .0001$) and the number of hours of worked ($B = -21.46$; $SE = 2.07$; $p < .0001$), after adjustment for non-observed sources of confounding.

Parenthood and the Gender Gap in Income

Further analysis examined the extent to which gender differences in parenthood explained the gender gap in income. This analysis showed:

- (1) At age 25 the annual gender earnings gap between males and females was \$4,797, and at age 30 it was \$13,099. The pooled model revealed an overall gender gap across the two ages of \$8,837 ($p < .0001$).
- (2) Adjustment for parenthood using regression models that included a main effect for parenthood and a gender by parenthood interaction (see “Methods” section) reduced these gaps to \$581 at age 25, \$1,127 at age 30, and \$609 in the pooled model ($p > .60$).

These findings implied that gender differences in workforce participation due to parenthood accounted for between 87.9 and 93.1 % of the total gender gap in earnings, and that accounting for parenthood reduced the gender difference in earnings to statistical non-significance ($p > .60$).

A parallel analysis examining the effect of parenthood on the gender gap in earnings for employed males (age 25 $N = 424$, age 30 $N = 434$) and females (age 25 $N = 403$, age 30 $N = 387$) showed that the total unadjusted gender income gap was \$6,320, which reduced to \$1,136 after adjustment for parenthood and the parenthood by gender interaction. Amongst employed individuals gender differences in workforce participation due to parenthood accounted for 63.1–83.8 % of the total gender income gap. Again, this difference was not statistically significant after accounting for the effects of parenthood ($p > .30$).

Biological and Step-Children

All analyses described above were repeated excluding those participants who only had step-children. The findings of these analyses did not materially differ from the results reported above.

Discussion

This paper examines the effects of parenthood on workforce participation for men and women in a New Zealand birth cohort studied to age 30. The principal aim of this research is to estimate the effects of parenthood in a contemporary cohort of young adults who were reared over the period during which there has been increasing emphasis on gender equality in parenthood and workforce participation. Indeed, the primary contribution of the present research is

to demonstrate that, despite significant effort and investment over the past 25 years at reducing gender inequality in workforce participation and earnings in New Zealand via government policies and programs (New Zealand Government 1987, 2007; New Zealand Ministry of Education 2011), the evidence suggests that these forms of gender inequality remain.

The findings of the present study reveal marked gender differences in the effects of parenthood on workforce participation that persist even after control for a range of covariate factors related to parenthood, and after controlling for non-observed sources of confounding using fixed effects regression. For females, becoming a parent is associated with a substantial decrease in workforce participation. Compared to women who are parents, women who are not parents are 6.7 times more likely to be employed (95 % CI: 4.5–11.0) and work 20.1 more hours per week (95 % CI: 17.7–22.5) after adjustment for confounding. However, for males, parenthood is not associated with a decrease in workforce participation and, in some cases, is associated with a slight increase in the number of hours worked. The findings were confirmed by fixed effects regression models which controlled for non-observed sources of confounding. All models fitted led to the common conclusions that parenthood for males had no effect on workforce participation, whereas for females parenthood had substantial impact on both workforce participation and hours worked.

An important application of these findings was to estimate the impact of parenthood on the gender gap in earnings. As would be expected, gender differences in workforce participation due to parenthood for this cohort prove to be a major driver of the gender income gap. For the entire cohort the gender gap in earnings is \$8,837 per annum in favour of males. Gender differences in the workforce participation of male and female parents explain 87.9–93.1 % of these differences. For those individuals in the workforce the gender gap in earnings is \$6,320 with 63.1–83.8 % of this gap being explained by the differences in the workforce participation of males and females.

These findings are consistent with a differential life course explanation of the gender gap in workforce participation and earnings, in which becoming a parent entails very different life course outcomes for males and females in terms of work and income. The findings are in general agreement with a range of previous research which shows that becoming a mother is associated with a substantial reduction in workforce participation and income for women (Anderson et al. 2003; Gangl and Ziefle 2009; Joshi and Paci 1998; Joshi et al. 1999; Waldfogel 1998) whereas becoming a father entails little change for men (Astone et al. 2010; Dommermuth and Kitterød 2009; Petersen et al. 2007). However, the present study contributes to the

continuing debates on the gender gap in workforce participation and earnings in a number of ways.

An important feature of the present study is that the analyses are able to estimate the associations between parenthood and workforce participation and income net of a wide range of social, background, and family factors that may have confounded the associations between parenthood and employment outcomes. Previous studies examining the effects of parenthood on employment outcomes generally use large datasets with a more limited range of possible covariate factors (Joshi and Paci 1998; Joshi et al. 1999; Waldfogel 1998), or do not make direct comparisons between females and males (Anderson et al. 2003; Astone et al. 2010; Dommermuth and Kitterød 2009; Gangl and Ziefle 2009). The longitudinal design also permitted the use of fixed effects regression models to take into account non-observed fixed sources of confounding. Both adjustment for observed covariates, and fixed effects regression, led to similar conclusions about the effects of parenthood on workforce participation.

The principal finding of this study is that despite investments made in encouraging more equal participation of males and females in both the workforce and parenthood (The World Bank 2012), there is clear evidence that the majority of individuals in this study followed traditional gender role patterns in which parenthood for females is associated with a marked drop in work force participation, whereas for males parenthood is associated with a modest increase in work force participation. These findings suggest that most individuals in this cohort choose to organise their lives in a way that leads to a clear gender based division of labour in the way resources are allocated to parenthood and work force participation. What is of particular interest is that these traditional role choices appear to persist in a social environment in which substantial policy investments have been made in reducing the barriers to work force participation for women with children. These provisions include widespread access to government-subsidised childcare (New Zealand Ministry of Education 2011), paid and unpaid parental leave (New Zealand Government 1987), and a statutory right for all parents to request flexible working hours from their employers (New Zealand Government 2007).

Despite the policy debates that surround the issues of male and female participation in parenthood and work, the findings indicate that for this age cohort there have been relatively few changes in the ways males and females manage these role choices. In particular comparison of the present findings with research into cohorts born in the 1950s and 1960s suggests that there has been relatively little change in the role choices made by male and female parents of preschool children. For example, Joshi et al. (1996) reported employment rates for mothers in the National Child

Development Study (NCDS), a longitudinal study of a British cohort born in 1958. In the NCDS cohort, 60.3 % of mothers were in paid employment at age 33, compared to 92.5 % of women who were not mothers. These figures are not dissimilar to the employment rates for women in the current cohort, which at age 30 were 57.5 % for mothers and 90.3 % for women who were not mothers.

The most likely explanation of the findings for this cohort relate to the age of the children, with the majority of these being within the preschool age range (under 5 years). The preschool years are likely to be the time during which parenthood has the maximum impact on workforce participation. What the findings suggest is that for this cohort, women overwhelmingly take the major responsibility for childrearing during the preschool years and that these decisions translate into a very large gap in rates of work force participation by males and females, with male parents working an average of nearly 42 h per week whereas females parents work an average of 15 h per week. An important issue raised by these findings concerns the extent to which these patterns of work force participation will change as the children of this cohort become older. Future studies of the current cohort may examine this issue as the cohort and their children age. However, the present findings do suggest that for this cohort parenthood created a major hiatus in the working lives of female parents. The extent to which this hiatus in work force participation for female parents leads to permanent differences in the workforce participation trajectories of men and women and the extent to which these differences decrease with the passage of time remains to be established.

One important implication of the present results is that achieving the goal of income equity will require substantial changes in the workforce and parenting choices made by males and females. While evidence suggests that changes of this nature may be taking place in some Scandinavian societies (Dribe and Stanfors 2009; Petersen et al. 2007), it is clear that these changes are not universal, and that any shift in attitudes and behaviors with respect to household division of labour have not been sufficient to completely narrow the gap between male and female workforce participation and earnings. Whether major changes in these choices can be achieved remains open to debate.

While the present data suggest that parenthood plays a key role in the gender gap in workforce participation and earnings, the data do not rule out the possibility that other factors contribute to the gap. These factors may include differential education and job training outcomes for females and males, and discrimination against female employees that limits their opportunities for equal advancement and pay (Inglehart and Norris 2003; Macpherson and Hirsch 1995), as noted above. However, the strength of the associations between parenthood and

employment outcomes in the present study, and in particular the findings that approximately 90 % of the gender gap in income can be attributed to gender differences in workforce participation resulting from parenthood, would suggest that discrimination against women in the workforce and related factors play a much smaller role in determining employment outcomes than parenthood.

Finally, the present study has a number of limitations that should be recognised. Most importantly, the findings apply to a specific cohort born in Christchurch, New Zealand in 1977. The extent to which the behaviour and experiences of this cohort generalize to other cohorts and other social settings is not clear. Second, the study examines the impact of the parenthood on workforce participation for a group of parents who had predominantly preschool children. The extent to which similar trends will be evident for parents of older children is also by no means clear.

These limitations notwithstanding, the findings of the present study show that for this cohort parenthood has profoundly different consequences for the workforce participation of males and females. For females, parenthood leads to a sharp reduction in work force participation, whereas for males parenthood is associated with a modest increase in working hours. These differences in the response to parenthood explain up to 93 % of the earnings gaps for males and females in this cohort. These clear gender differences in the response to parenthood suggest that New Zealand as a society is a long way from achieving equitable gender distributions in the areas of workforce participation and child rearing. The extent to which such equitable distribution is achievable remains a matter for debate given the clearly gendered role choices made by members of this birth cohort.

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