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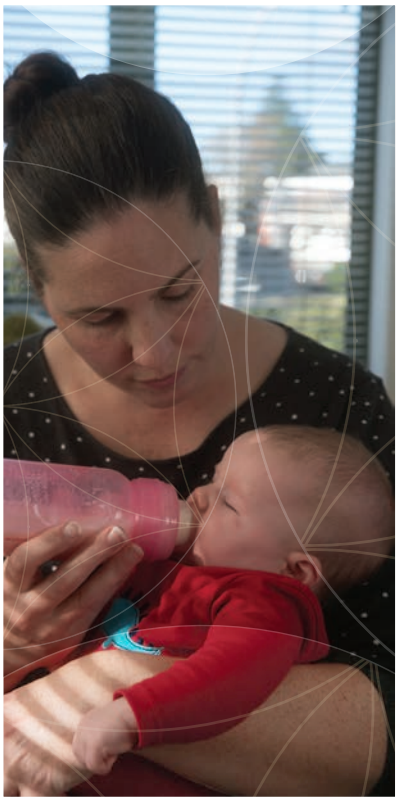

Parenthood and labour market outcomes

May 2018

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Summary of main findings

This study combines administrative monthly earnings data, birth records, and survey data on hours worked and earnings to describe the labour market outcomes of men and women as they have children, and how parenthood contributes to the gender pay gap in New Zealand. We consider the hourly earnings and hours worked in 2006-15 of a sample of non-parents and parents who had their first child in 2003-10, and the monthly earnings and employment in 2000-15 of the population of parents who had their first child in 2005.

Hourly earnings

- Women on average experience a 4.4 percent decrease in hourly wages upon becoming mothers. The decrease is smaller for those who return to work within six months and larger for those who return to work more slowly. Among mothers who take longer than 12 months to return to work, the average decrease is 8.3 percent.
- Men, in contrast, experience no significant decrease in hourly wages upon becoming fathers. Parenthood thus increases the gender gap in hourly wages.
- Some but not all of the decrease in hourly wages experienced by mothers can be explained by them taking jobs in lower-paying industries or occupations post-children.

Hours worked

- Among those who are employed, women decrease the weekly hours they work from a median of 40 hours pre-parenthood to 27 hours post.
- Women who are out of work for longer after having children tend to work fewer hours each week upon their return to employment.
- Median hours worked by men remain constant at 41 hours when they become parents.
- Nearly all the gender difference in propensity to work part-time is driven by mothers being more likely than fathers or non-parents of either gender to work part-time.

Monthly earnings

- The average monthly earnings of employed women fall dramatically when they become parents, driven by the combination of fewer hours and lower hourly wages. Their monthly earnings do not return to their pre-parenthood trends within ten years, meaning their lifetime earnings are substantially reduced.
- Decreases are greater for mothers who had higher income before becoming parents and for those who are out of work for longer.
- High-income women who return to work quickly experience slower growth in monthly earnings post parenthood than they did before becoming parents.
- Men's monthly incomes continue to increase smoothly as they become parents, increasing their average earnings advantage over women.

Employment

- After 12 months, 61% of women have returned to work for at least one month[1]; by 24 months, the percentage has increased to 69%.
- Women of all income groups are less likely to be employed after becoming parents.
- Women with higher earnings before becoming parents return to employment more quickly post-children and are more likely to subsequently remain employed.
- Men show no tendency to decrease their employment post parenthood regardless of prior earnings. Parenthood thus increases employment gaps between men and women.

1 Paid parental leave for those who are eligible is currently 18 weeks, so this statistic indicates that many mothers are away from work for much longer than the duration of their government-paid leave.

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Acknowledgements

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1 Introduction

This paper is an initial exploration of what we can learn regarding the drivers of the gender pay gap in New Zealand (NZ) from combining administrative wage data, birth records, and survey data on hours worked and earnings. Our particular focus is the role of parenthood penalties in this pay gap.

The gender pay gap in NZ has generally been decreasing since 1998 (Ministry for Women, 2017), and in the 2017 June quarter fell to 9.7%, its lowest since 2012 (Statistics NZ, 2017b). However, the gap is still a long way from zero, and a high proportion of it cannot be explained by differences in observable characteristics (Pacheco, Li, and Cochrane, 2017). Furthermore, recent research by Sin, Stillman, and Fabling (2017) suggests the gap cannot be explained by differences in productivity between males and females.

In NZ, as internationally, the gender pay gap is larger among parents than non-parents, though the mechanisms driving this relationship are not entirely clear.[2] In NZ, Dixon (2000) finds a 7% hourly wage penalty of having one child, which rises to 10% for two or more children. As Wilner (2016) discusses, four main hypotheses have been proposed for the "motherhood penalty": human capital depreciation while mothers are on parental leave; unobservable differences between parents and non-parents; mothers choosing to work in lower-paying, family-friendly firms; and discrimination.

In relation to the first hypothesis, the length of time a mother takes out of employment is affected by a range of factors including the opportunity cost of time out of work that she faces, her access to and cost of childcare, her parental leave entitlements, and her willingness to return to the workforce. These factors will be influenced by legislation; we now provide context on the relevant institutional settings in NZ.

In 2002, government funded paid parental leave was introduced, which allowed mothers who met certain employment requirements to take up to twelve weeks of paid parental leave. For the duration of leave, mothers would receive government transfers equal to their prior weekly wage, up to a maximum amount, which was pegged at the NZ average wage (NZ Parliament, 2002). Since then, the duration of paid leave has increased incrementally and now stands at 18 weeks. There are also forthcoming changes in this space as the new government has recently announced plans to increase this to 22 weeks by July 2018 and 26 weeks by July 2020 (NZ Herald, 2017).

The other relevant area of legislation is provision of early childcare education (ECE). In July 2007, the government introduced 20 hours per week of free ECE for all three and four year olds in community-based and teacher-led services.

With these NZ context specific settings in mind, we begin our analysis with a population-level view. We use administrative wage data to describe the distribution of how long women are out of paid employment after having their first child and how this differs with pre-parenthood income. We then look at employment rates and wage earnings among employed women each month in the five years before and ten years after birth of their first child.

We also compare women who spend different lengths of time out of employment both overall and within each pre-parenthood earnings quartile. Although this does not strictly isolate the causal effect of length of time out of employment on subsequent monthly earnings, it does show how, within earnings quartiles, women who return quickly to work increase their earnings lead over those who return more slowly.

2 See, for example Statistics NZ (2017a) and Dixon (2000) for NZ evidence and Gough and Noonan (2013), Wilner (2016), Anderson, Binder, and Krause (2002), Budig and England (2001), and Gangl and Ziefle (2009) internationally.

A major limitation of the tax data from the Integrated Data Infrastructure used in this analysis is that they do not collect hours worked or hourly wages. We therefore next move to data from the Household Labour Force Survey (HLFS) to study the correlates of hourly wages among those who are employed. First, we focus on investigating the contribution of parental status to the observed gender differences in hourly wages. However, this analysis does not account for selection into parenthood or into work among parents. We thus next add controls for whether the individual ever becomes a parent and among parents for pre-parenthood income quartile (as a proxy for earnings potential). These help address the two selection issues affecting our estimates of the effect of parenthood on wages for men and women.

The structure of our study is as follows: Section 2 outlines the data used in the population-level descriptive analysis and in the survey-level regression analysis; Section 3 presents findings from this empirical work; while Section 4 concludes with a summary of key results and directions for future research.

2 Data

For our empirical analysis, we use administrative data from Statistics NZ's Integrated Data Infrastructure (IDI). The IDI is a large research database containing microdata about both individuals and households in NZ. It includes numerous Statistics NZ surveys, as well as data derived from both government and non-government agencies. Each individual in the IDI is assigned a unique identifier (snz_uid) that permits linkages across datasets. For example, we are able to link parental status information (from birth records) to employment data (from tax records). Our analysis begins with a whole population view and then narrows down to those in the Income Supplement of the Household Labour Force Survey, because the latter includes hourly wage information.

The datasets employed from the IDI include:

- Personal details
- Tax data from Inland Revenue (IR)
- Household Labour Force Survey (HLFS)
- Income Survey (IS) – supplement to the HLFS
- Birth and death records from the Department of Internal Affairs (DIA)
- Education data from the 2013 Census
- Data on overseas spells from the Ministry of Business, Innovation and Employment

2.1 First child sample

Given our research objectives in this study, we focus on parents in NZ having their first child. We construct a sample of parents' first births using Life Events data from the DIA that incorporates birth and death information of NZ residents. These DIA data contain confidentialised unique identifiers for both parents (as well as the child), which can be used to identify parents' labour market outcomes in the IR data.

The DIA data also contain additional information including the ethnicities of both parents and whether they are partners at the time of the child's birth. We determine first birth based on DIA births data from 1990 onwards, but focus on first births in 2003-10 only.

Our data set of first births:

- Excludes stillbirths and children who died before age 10 (based on DIA births and deaths data), because these are expected to have different effects on parents' subsequent labour market choices;
- Excludes parents who die before their first live child turns 10 in order to create a consistent sample of parents at each date relative to the birth of the child; and
- Excludes parents who were ever out of NZ for 60 or more days in one calendar year between five years before and ten years after the child's birth because we do not have information on employment or earnings if they occur overseas.

For the graphical analysis using the IDI and the regression analysis using the HLFS, we additionally restrict these data in various ways. Details are provided in the forthcoming sub-sections.

2.2 IDI data for graphical analysis

For our graphical analysis using the IDI, we restrict our sample to parents who had their first child in 2005. This means the data allow us to look at the labour market outcomes of exactly the same set of parents from five years before and up to ten years after the birth of their first child. We also drop parents born in 1986 or later, who are younger than about 20 at the birth of their first child. This is because the labour market outcomes of very young parents in the few years before their child's birth tend not to be good measures of their earnings potential (as many may still be in education).

In each month relative to the birth of the first child, we have two main labour market outcomes of interest. The first is whether a parent appears as an employee earning a positive wage in the tax data. The second is total monthly wage and salary earnings from all employers based on the same data set. These earnings are converted to real 2005 dollars using an annual CPI deflator. All monthly earnings over $15,000 (which is well above the 99th percentile) are coded as $15,000.

One major point of interest is how long a new parent was off work before returning to paid employment. For simplicity, our preferred measure of when a parent returned to work is the first month after the month of the child's birth in which the parent is observed earning a positive wage. Alternatively, we consider the date of return to work to be the first month after the child's birth in which the parent earned a positive wage both that month and the two subsequent months. We consider time out of employment as an outcome and also look at how it relates to subsequent labour market outcomes.

In order to examine how outcomes vary for parents with different characteristics, we use various other IDI sources to categorise parents. We begin by employing two alternative measures of skill level or earning potential. The first is level of education as at the 2013 census, categorized into four groups: no qualifications, school qualifications, post-school qualifications, and bachelor's degree and above. This census occurred eight years after the birth of the child. While the education of older people is likely to have been stable between 2005 and 2013, younger parents may have gained additional education over this period. Education in 2013 is thus likely to be an imperfect measure of parental education at the time of childbirth for younger parents, but will still capture personal attributes that are correlated with propensity to pursue education, such as innate ability and motivation.

The second measure of earnings potential is income quartile in 2003, the second year before the birth of the first child in 2005. For parents who earned positive wages in at least four months in 2003, we calculate average monthly earnings in the months worked. We then use these average monthly earnings to classify these parents into four earnings quartiles, which are calculated among the full population (parent and non-parent) within gender and single year of age. Parents who earned wages in three or fewer months in 2003 are put in a fifth group.

We also categorise parents by the gap between birth of their first live child and second, age at birth of their first child, ethnicity, and whether they were partnered with the other parent at time of the child's birth. These variables, except age, were sourced from DIA data.

Table 1 shows the distribution of characteristics of the 13,653 mothers who had their first children in 2005 and who are included in our sample. The majority of mothers (83%) are partners with the father of their first child at the time of its birth. In terms of age, 29% are under 25 years old, 54% are 25 to 34, and 17% are 35 to 44. Within the subsequent five years, 64% have a second child.

Table 1 also shows that in terms of ethnicity, 68% are European only, 9% Māori only, and 9% mixed Māori and European. 11% of the sample have no school qualifications, while at the other end of the educational attainment spectrum, 28% have a bachelor's degree or higher. Finally, and of direct interest to our research objectives at hand, at least 80% return to work within 120 months of having their first child, with the average returning in the 16th month.

Table 1: Descriptive statistics of IDI sample

	Observations
Parents are partners	
No	1,404
Yes	6,861
Age at birth of first child	
Age: <=24	3,897
Age: 25-34	7,380
Age: 35-44	2,319
Timing of next child	
Not within 10 years	3,840
In 6-10 years	1,029
Within 5 years	8,784
Ethnicity	
Asian	537
Pasifika	759
Māori	1,191
European	9,345
Maori/European	1,185
Other ethnicity	636
Qualifications in 2013	
None	1,206
School	4,137
Post-school	2,736
Degree	3,120
Income quartile 2 years before first child's birth	
Worked <4 months	3,045
First quartile	1,083
Second quartile	2,190
Third quartile	3,474
Fourth quartile	3,858
Ever returned to work	
Returned to work by month 121	11,583
Returned to work for 3 months by month 121	10,968
Returned to work earning $500+ by month 121	11,160
Total	13,653

	Mean (Std Dev)
Average month of return to work	16.0
	(24.8)
Average month of return to work for 3 months	23.1
	(29.2)
Average month of return to work earning $500+	20.1
	(28.2)

Notes: The top panel of this table presents population counts for different subpopulations of mothers who had their first child in 2005. Totals don't add up because of rounding and omitted "missing" categories. The lower panel gives the mean and standard deviation of number of months (by three definitions) the mothers took to return to work, among those who returned within 120 months.

The biggest limitation of the wage data in the IDI is that there is no associated measure of hours worked, making it impossible to measure hourly earnings. To supplement the graphical IDI analysis of employment and monthly earnings, we thus add graphical analysis of hours worked from the HLFS.[3] Because the number of observations here is much fewer, we include parents from our first child data set whose first child was born in 2003 to 2010. We use actual hours worked in the week, and code responses over 80 hours as 80 hours.

2.3 HLFS data for regression analysis

To complement the graphical analysis outlined in Section 2.2 we employ regression analysis to explore how hourly earnings among those employed vary between genders and with parenthood for the period 2006-15. To perform our analysis, we link the sample of parents identified in Section 2.1 to the IS data. These individuals are classed as parents in the regressions if the IS survey date falls after the date of birth of their first child (obtained from DIA birth data).

Next, we construct a sample of individuals who are never parents to combine with our sample of parents. We begin with all adults in the IS, and use DIA births data from 1970 onwards to remove anyone who is ever a biological parent. We then use IS information on household type code and family group code[4] to remove all individuals living as parents at the time of the survey (even though they are not biologically related to the children).

Finally, we combine the parents and non-parents and restrict to people aged 20 to 49 to obtain our broadest regression sample. Our regressions predicting employment use this full sample of 62,445 person-years, those predicting working full time use the employed individuals in this sample (47,022 person-years), and those predicting hourly wages use the employed individuals with non-missing hourly wage data (41,778 person-years). Table 2 presents the descriptive statistics for the sample used in the hourly wage regressions. The average hourly wage at main job is 19.4 real 2005 dollars, and employed individuals work an average of 37.5 hours each week. Just under half the individuals are female, they have an average age of 31.9, and 12.6% of observations are parents.

3 We experimented with combining HLFS data on hours worked with IDI data on earnings to construct hourly earnings, but results were too sensitive to the assumptions used to be informative.

4 We use the HLFS's non-parent categories of the household type code including 'couple only', 'couple only and others' (excluding dependent children), and 'one-person household' and family group code such as child (may include adults who live with their parents) and members whose roles are not assigned (including visitors) and those who live in one-member household.

Table 2: Descriptive statistics of HLFS sample

Variables	Mean (Std. Dev.)
Usual hourly wage at main job (in 2005 NZD)	19.410 (10.069)
Hours/week worked at main job	37.495 (12.025)
Working full-time	0.834 (0.379)✓
Whether employed	0.774 (0.418)✓✓
Female	0.492 (0.500)
Parental Status	0.126 (0.331)
Age	31.899 (8.567)
Highest education level (omitted category: no qualification)	
School qualification	0.253 (0.435)
Post-school qualification	0.311 (0.463)
Bachelor's degreee (including Honors)	0.257 (0.437)
Post-graduate degree	0.053 (0.223)
Ethnicity (omitted category: Others)	
European	0.749 (0.433)
Māori	0.059 (0.236)
Pacific peoples	0.060 (0.238)
Asian	0.104 (0.305)
MELAA	0.007 (0.082)
Partnership status (omitted category: never married)	
Married	0.476 (0.499)
Separated/Divorced	0.037 (0.188)
Widowed	0.002 (0.049)
Sample size (log of hourly wage at the first job)	41,778
Sample size (whether employed)	62,445✓
Sample size (whether working full-time)	47,022✓✓

✓✓ *Based on broader sample that includes employed and non-employed.*
✓ *Based on regression sample used in Section 3.3 (Table 6) to analyse whether motherhood (using indicators of multiple childbirths) is related to probability of being a full-time worker.*

Table 3: Comparing female parents and non-parents – in the HLFS sample

	Employed		Not employed		Not in labour force	
Characteristics	**Mothers**	**Non-mothers**	**Mothers**	**Non-mothers**	**Mothers**	**Non-mothers**
Age	33.16	32.22***	29.39	29.94***	29.47	30.28***
Not qualified	0.12	0.11***	0.25	0.23	0.25	0.25
School	0.24	0.25	0.28	0.36***	0.28	0.38***
Post-school	0.31	0.28***	0.31	0.21***	0.30	0.19***
Bachelors	0.28	0.30***	0.12	0.15***	0.13	0.15**
Post-graduate	0.05	0.06*	0.04	0.04	0.04	0.04
European	0.81	0.74***	0.72	0.53***	0.74	0.53***
Māori	0.09	0.06***	0.17	0.12***	0.16	0.11***
Pacific peoples	0.04	0.06***	0.08	0.14***	0.07	0.14***
Asian	0.04	0.11***	0.02	0.17***	0.02	0.17***
MELAA	0.00	0.01***	0.00	0.01***	0.00	0.01***
Married	0.77	0.47***	0.59	0.30***	0.61	0.31***
Unmarried	0.18	0.49***	0.37	0.65***	0.34	0.64***
Divorced	0.04	0.04	0.05	0.04	0.04	0.04
Widowed	0.00	0.00*	0.00	0.01***	0.00	0.01***
Sample size	**3,123**	**19,860**	**2,619**	**5,454**	**2,322**	**4,248**

*Notes: ***, **, * denote that differences in the mean values of comparable groups of mothers and non-mothers are statistically significant at the 1%, 5%, and 10% levels, respectively. Not employed includes not in the labour force and unemployed individuals.*

Table 3 compares the distribution of characteristics of mothers and non-mothers who are either employed, not employed, or not in the labour force. A couple of points should be noted. First, the parents in this sample are not representative of parents overall:
they are limited to those who had their first child in 2003 to 2010, who appear in the IS in the period 2006 to 2015, who were never overseas for 60 days or more in a calendar year, and so on as described in Section 2.1. Second, the number of unemployed mothers is small, so the characteristics of mothers who are not employed are dominated by those not in the labour force.

Table 3 shows that the characteristics of mothers of each type are different to those of non-mothers on several dimensions. In particular, employed mothers are slightly older than employed non-mothers, whereas mothers who are not employed are slightly younger; mothers in each group are substantially less likely than non-mothers to have school qualifications and more likely to have post-school qualifications; mothers are more likely to be European or Māori and less likely to be Pacific or Asian; and mothers are more likely to be married. Among mothers, those who are employed are on average older, more educated, more likely to be European, and more likely to be legally married.

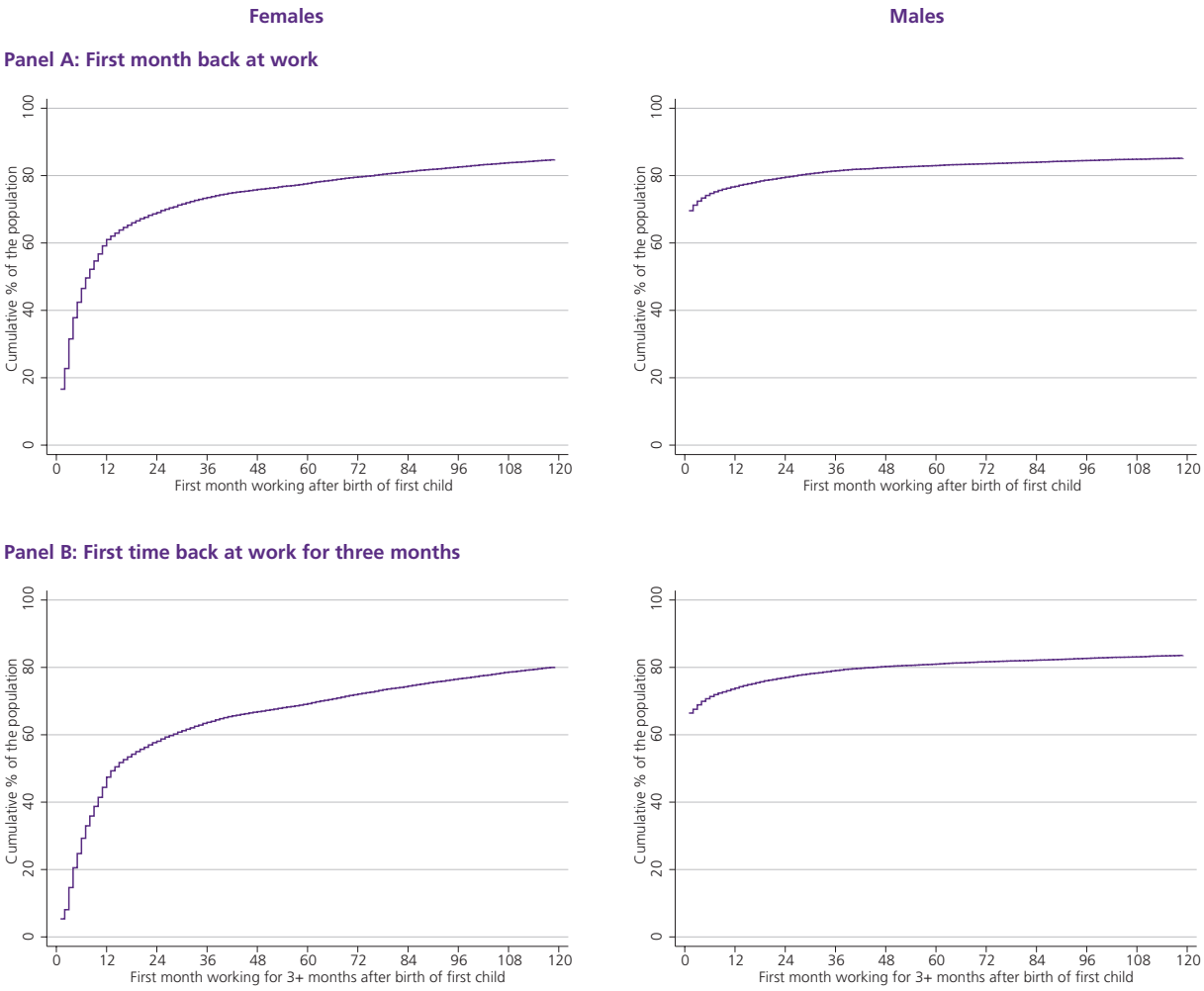
3 Empirical strategy and results

3.1 Duration of time out of employment

Using the data described in Section 2.2 we examine the length of time out of employment for NZ mothers. Prior studies have shown very few men take substantial amounts of time out of employment, and our data confirm this pattern (Tanaka & Waldfogel 2007; Lammi-Taskula 2008; Geisler & Kreyenfeld 2011).

Figure 1 shows for all parents who had their first child in 2005 the length of time before returning to work. Panel A shows results when defining returning to work as earning positive wages in a month; Panel B shows results when defining it as earning positive wages in three consecutive months. Both show a high proportion of men work from the month immediately after birth of their first child. For women, return to work is much more gradual, although it is fastest in the first 12 months after the child's birth. After 12 months, 61% of women have returned to work in at least one month[5]; by 24 months, the percentage has increased to 69%.

Figure 1: Length of time out of employment after birth of first child



Notes: Panel A of this figure presents the cumulative distributions of men and women who have earned wage income in at least once month after birth of their first child. Panel B replicates Panel A, but instead asks the cumulative distribution of parents who have earned wage income in that month and the two consecutive months. The population is as described in Section 2.2.

5 Paid parental leave for those who are eligible is currently 18 weeks, so this statistic indicates that many mothers are away from work for much longer than the duration of their government-paid leave.

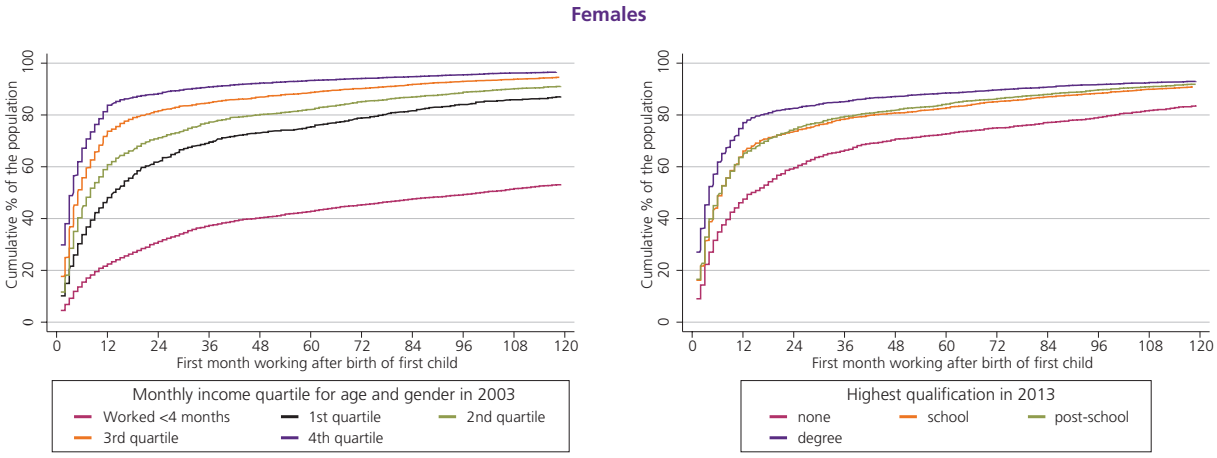
Here and subsequently, we define returning to work as working for at least one month; results using the three-month rule tell a similar story, though all groups return to work more slowly.

The population averages shown in Figure 1 conceal considerable variation. The left hand panel of Figure 2 shows women who were higher earners prior to having children return to work sooner. As expected, women who were less attached to the labour force prior to having children, as evidenced by working fewer than four months in 2003, also have low rates of working after having children.

The right hand panel of Figure 2 shows mothers' return to work disaggregated by education. The story here is similar: more educated women return to work more quickly after having children.

These results show that women who are more attached to the labour force, who have invested more in their human capital and whose opportunity cost of time out of employment is higher, return to work more quickly after the birth of their first child. This finding is expected, and it confirms that women observed working shortly after having children are not representative of the female population with young children: they are disproportionately those who would be expected to have high earnings. The cost of childcare is likely to be an influence here: women with low earnings potential might wish to return to work quickly but might not be able to earn enough by doing so to justify the cost of the childcare that becomes necessary.

Figure 2: Length of time out of employment by income quartile and education



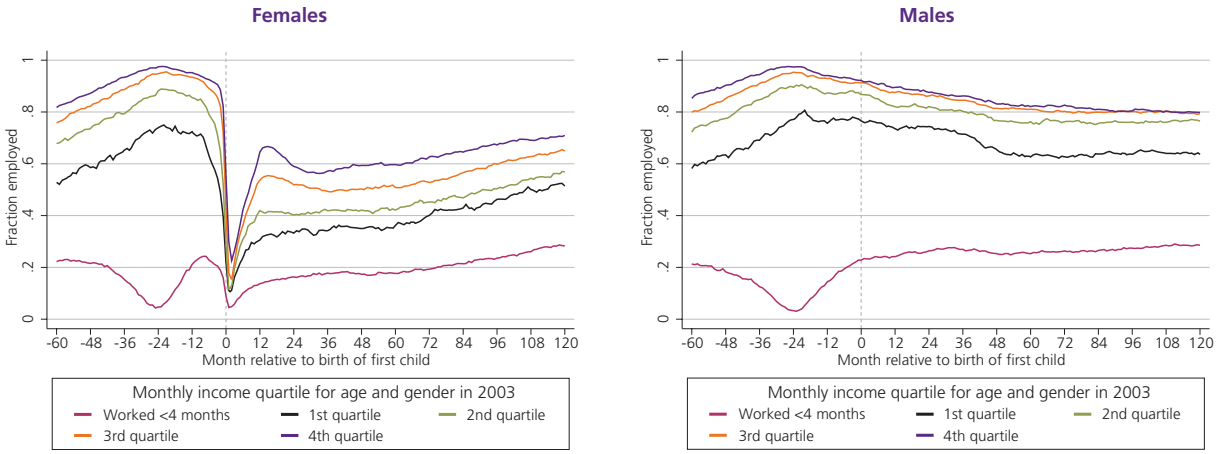
Notes: Both figures present cumulative distributions of women who have earned wage income in at least one month after the birth of their first child. For the figure on the left, the five lines show the cumulative distributions for the four monthly income quartiles in 2003 and a fifth group that worked fewer than 4 months in 2003. For the figure on the right, the four lines show the cumulative distributions for the four education groups based on 2013 census data. The population is as described in Section 2.2.

3.2 Employment and monthly earnings

Figure 3 presents proportions of employed individuals by month relative to childbirth for females and males who had their first child in 2005. For each gender, the population is broken down by pre-parenthood income quartile.

For women, we find that the proportions decline sharply around childbirth before they start rising again. Moreover, with the exception of those who worked fewer than four months in 2003, women's employment post-childbirth does not appear to return to pre-birth trends. In contrast, male employment does not show a decrease around the birth of the first child for any of the income quartiles, instead evolving smoothly.[6]

Figure 3: Employment rates by pre-parenthood income quartile

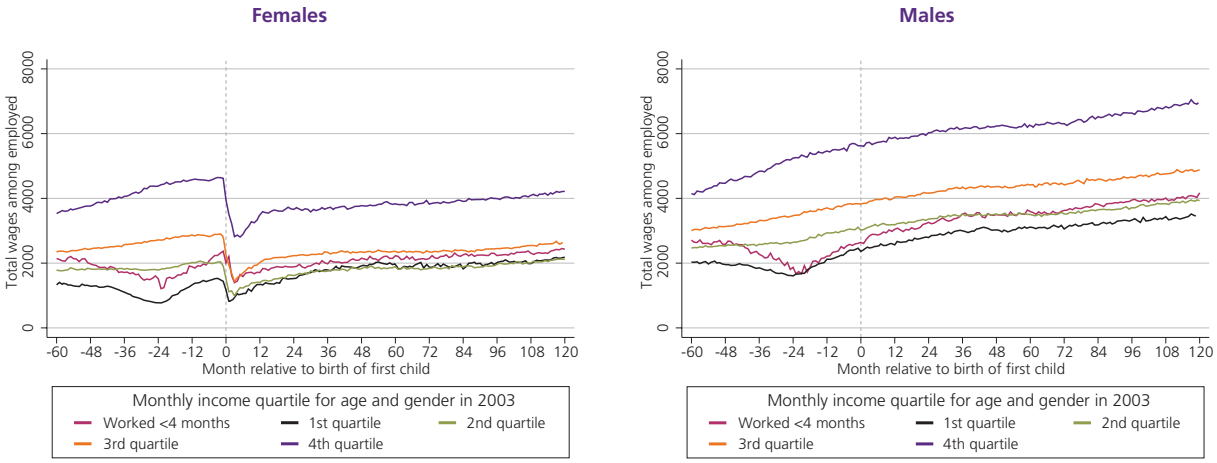


Notes: This figure presents employment rates, disaggregated by income quartile in 2003. The population is as described in Section 2.2.

We next explore how monthly wage and salary earnings among those who are employed change across pre- and post-childbirth months. Figure 4 presents income quartile-specific averages for females and males. Across all income quartiles, women's earnings fall with childbirth whereas males' continue to growth smoothly over time.

6 For both males and females, the differences in employment rates between those who worked fewer than four months and others are greatest 24 months before the birth of the child. This is a mechanical result caused by the facts that income quartile is calculated based on earnings two years before the birth of the child and the population exhibits regression to the mean.

Figure 4: Monthly earnings by pre-parenthood income quartile



Notes: This figure presents the average monthly wage and salary earnings of those employed, disaggregated by income quartile. The population is as described in Section 2.2..

We next investigate how women's monthly earnings after returning to work vary with their length of time out of employment. Differences in monthly earnings may be driven by differences in hours worked or hourly wages; unfortunately the IR data in the IDI do not provide hours worked information, so here we are not able to distinguish the two. However, we subsequently show using HLFS data that women who return to employment more slowly also work fewer hours upon returning than women who return to employment more quickly.

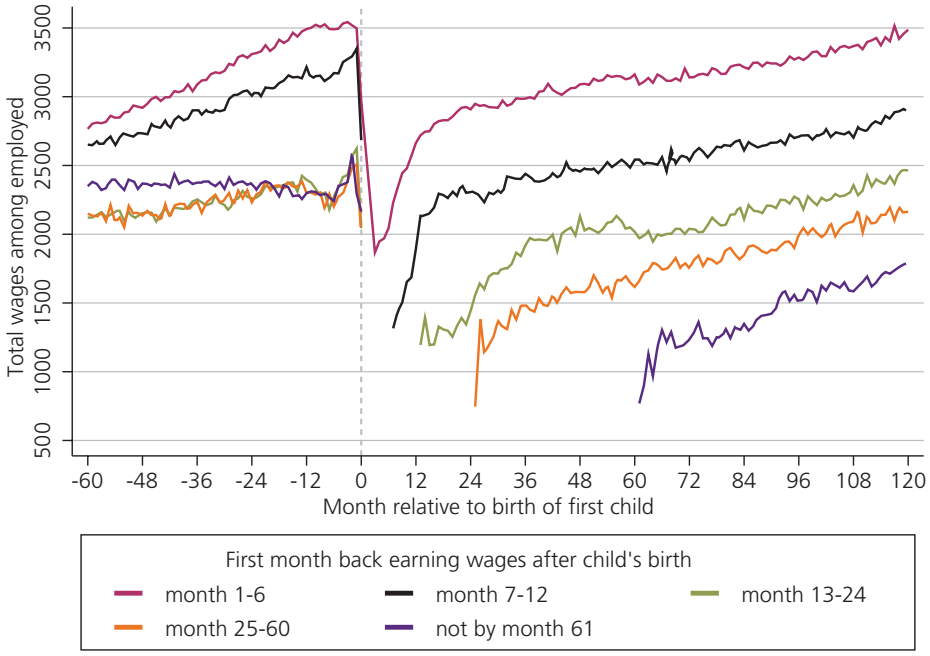
Importantly, where women who took longer out of employment earn less after returning to work this could be driven by several mechanisms. First, the women who choose to take less leave are likely to be higher-earning types, with more education and skills that are valued in the labour market. Second, less-skilled women with lower earning potential may take longer to find a job after choosing to return to the labour force. Third, being out of the labour force for longer may negatively affect earning potential after returning, as skills depreciate or employers' perceptions of skills decrease.

Figure 5 presents average monthly earnings of mothers over time by length of time out of employment; it does not attempt to disentangle the potential drivers of the relationship. The average monthly earnings presented are among those with positive earnings only, so should be interpreted in light of potential changes over time in selection into employment.[7] The fraction of women in each group who are employed is presented in Appendix Figure 1A, which shows that even after returning to work, many mothers leave again, and employment rates for each category remain lower than prior to parenthood.

The employment rate of mothers who returned to work within a year shows a sharp drop after its initial increase, much of which is likely to be driven by having a second child. By ten years after the birth of the first child, the employment rates of all the categories have returned to their levels five years before having children.

On the earnings side, Figure 5 shows that mothers who return to work within six months of having their first child are the highest earners prior to having children, followed by those who return to work in months seven to 12. These two groups also exhibit strong earnings growth prior to having children. Mothers who return to work in months 13 to 24 have similar pre-parenthood earnings to those who return in months 25 to 60. These earnings are substantially lower than the earnings of the previous two groups, and show slower growth pre-parenthood. Mothers who do not return to work by month 61 do not exhibit earnings growth in the five years before having their first child, and by the year before the birth of their first child have similar earnings to those who return in months 13 to 60. Overall, women with higher income and faster income growth before having children return more quickly to work.

Figure 5: Monthly earnings of mothers by length of time out of employment



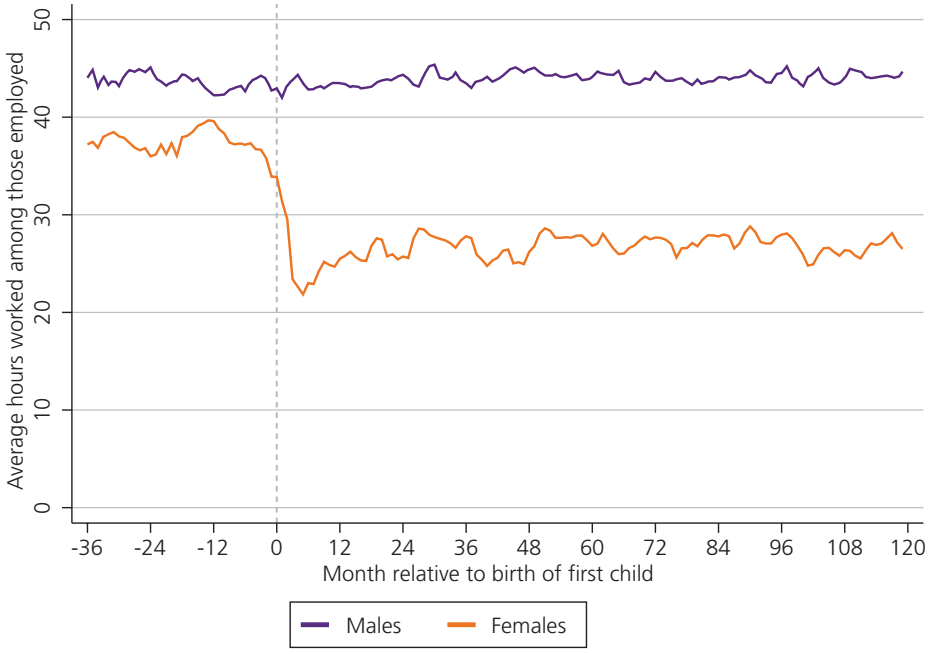
Notes: This figure presents the average monthly wage incomes of those employed, disaggregated by the length of time out of employment. The population is as described in Section 2.2.

7 As Appendix Figure 1A shows, employment rates are higher both before and after childbearing for women who return to work more quickly. If within each return to work category women with higher earnings potential are more likely to work, then the true earnings differences between the groups may be even greater than the figure suggests.

Finally, Figure 5 shows that longer time out of employment is associated with lower monthly earnings after having children, and the differences between mothers who are out of the workforce for different lengths of time are greater than can be explained by plausible extrapolation of the trends in earnings pre parenthood. This is consistent with longer absences from work decreasing the ability of mothers to secure high-paying jobs upon their return to the labour force. However, several alternative mechanisms could also result in such a pattern. For instance, women who leave the labour force for longer might be less committed to work and choose to work fewer hours after they become parents, or women who because of unobservable differences spend a long time unemployed after re-entering the labour force may be forced to accept lower-paying jobs. Regardless of their cause, these earnings gaps appear to be a long-term phenomenon: they show limited signs of closing within ten years of the first child's birth.

Because the IDI do not contain data on hours worked, we are unable to show similarly how hourly wages evolve. However, we next use HLFS data described in Section 2.2 to show how actual weekly hours worked varies over time for a more aggregated group of return to work categories.

Figure 6: Hours worked by mothers and fathers



Notes: This figure presents the average actual hours worked among those employed each month, disaggregated by gender. The population is as described in Section 2.3.

Figure 6 compares average hours worked by employed males and females before and after childbirth. The sample is limited to parents who had their first child in 2003-10 when they were aged 20 or over. While we do not observe any substantial change in hours worked by males, who maintain a median of 41 hours both before and after parenthood, women's hours worked decline steeply during pregnancy. Further, the 40 median weekly hours worked by women pre-pregnancy falls to only 27 from the second year post-childbirth onwards.[8]

Figure 7 presents weekly hours worked over time for women in three categories: those who return

8 Hours pre parenthood are calculated for months 13 to 48 prior to the birth of the first child; hours post parenthood are calculated for months 13 to 120 after the birth of the first child.

to work in months one to six, those who return in months seven to 12, and those who have not returned by month 13. Because of the much smaller sample size in the HLFS coupled with the disaggregation by time out of work, these data are noisier. The figure shows clearly that women in all three categories work fewer hours on average after having children, and women who take a longer time out of employment tend to work fewer weekly hours, particularly after returning to work. In fact, prior to parenthood the median weekly hours worked is 40 for all three groups, though the 75th percentile of hours worked is 43 for the fastest-returning group compared with 42 for the next group and 40 for the slowest-returning group. Post-parenthood, women who return in months one to six work a median of 30 hours per week compared with 27 hours for women who return in months seven to 12 and 22 hours for women who return in month 13 or later. These differences in hours worked are likely to contribute to the differences in earnings post-childbearing but may not be sufficient to fully explain them.[9]

Figure 7: Mothers' hours worked by time out of employment

Notes: This figure presents the average actual hours worked among those employed each month, disaggregated by the length of time out of employment. Points are smoothed using MA3 for presentational purposes. The population is as described in Section 2.2..

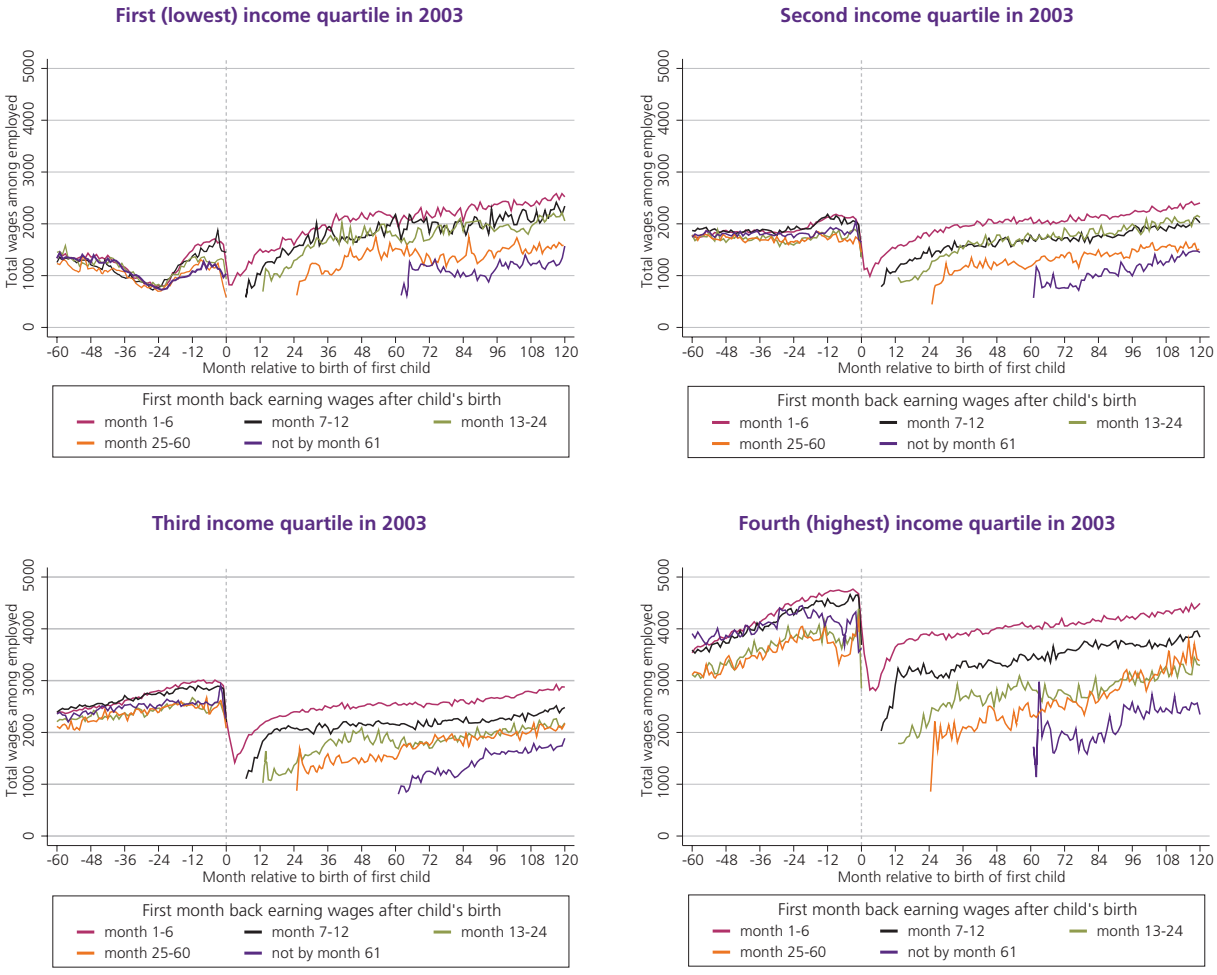
Although these results suggest taking more time out of employment depresses earnings upon returning to the labour force, the graphs confound the effects of skill or education and time out of work. To delve further into the relative importance of earnings potential and length of time out of employment for post-parenthood earnings, we next examine employment and earnings patterns separately for each income quartile based on earnings two years before having children.

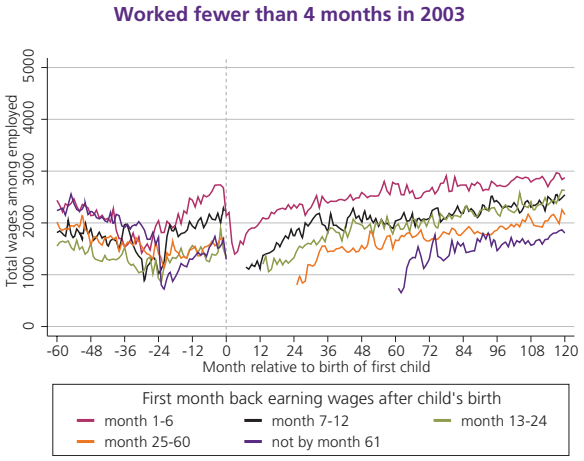
9 The IDI and HLFS data are not comparable enough to perform hourly wage calculations based on IDI monthly earnings and HLFS hours worked. The following section analyses hourly wages using IS data.

Figure 8 shows for each 2003 income quartile how women's monthly earnings evolve around childbearing for each different length of time to return to work. It shows that all high-income women re-enter the labour market with lower monthly earnings than before they had children, though some low-income women and women with low attachment to the labour market face minimal decreases in monthly earnings. High-income women, particularly those who return to work quickly, also seem to experience slower income growth after having children than before.

Figure 8 also shows that within each pre-parenthood earnings quartile the story is relatively similar: women who return to work quickly after having children tend to earn more prior to having children, but the size of the income difference is much greater after childbearing than before it. The income gaps between women who take differing lengths of time out of employment are greater for those in higher income quartiles. For income quartiles 1 and 2, these gaps close relatively little over time back in employment. The higher two income quartiles show more evidence that the disadvantage of waiting 25 to 60 months to return to work decreases over time.

Figure 8: Monthly earnings of mothers by income quartile and time out of employment





Notes: The four panels of this figure present average monthly wage income among the employed each month. The panels each present results for a different 2003 income quartile, and within that disaggregated by length of time out of employment. The population is as described in Section 2.2.

This figure strongly suggests mothers who are away from work for longer suffer an earnings penalty upon return relative to women with similar pre-parenthood earnings who return to work more quickly. Note, however, that the comparison groups we use are for long periods out of work relative to the current 18 weeks (4.1 months) of paid parental leave, and this finding does not imply increasing paid parental leave will further disadvantage mothers when they return to the labour force.[10]

The average monthly earnings shown in Figure 8 are calculated for employed women only. Appendix Figure 2A shows the employment rates for each group. It shows employment rates vary by group and over time, so wages of those who are employed should be interpreted in light of this. In particular, employment rates after childbearing are lower for women who were out of work for longer. Under the reasonable assumption that within any income quartile and length of time out of employment, women who would earn lower incomes are less likely to choose to be employed, this would mean the graphs underestimate the post-child earnings gaps between the varying return to work lengths.

The data in Figure 8 and Appendix Figure 2A are summarised in Appendix Tables 1A and 1B. For example, this table shows how, among women in the fourth income quartile, the earnings of those who returned to work after 25 to 60 months changes as a percentage of the earnings of those who returned to work within six months. In the second year before the child's birth, the former group earned 84% of the income of the latter; in the third year after the child's birth this had fallen to 51%, but by the 10th year it had increased to 79%. Furthermore, by the 10th year, the income difference within the top earnings quartile between those who returned to work in months 13 to 24 and those who returned in months 25 to 60 had disappeared entirely.

Appendix Figures 3A and 4A replicate Figure 5 and Appendix Figure 2A, but break the population down by education measured in 2013 rather than by income quartile. These figures tell a similar story: for any given qualification level, higher-income women return to work more quickly than lower-income women, and their subsequent monthly earnings pull more ahead of their peers who return to work more slowly. These data are summarised in Appendix Tables 2A and 2B.

10 Our analysis is not designed to capture the effect of the length of paid parental leave on mothers' subsequent labour market outcomes, which could occur through many channels including the choices made by mothers about return to work and their ability to return to their previous jobs.

Similarly, Appendix Table 3A shows how employment rates and monthly earnings vary over time relative to the birth of the first child for various alternative subpopulations. It shows that younger parents have lower employment rates before having children – likely partly because many are still in education and partly because the unemployment rates are much higher for young people – and employment rates are highest pre-parenthood for those who have children when aged 35 to 44. After becoming parents, the youngest group maintains a much lower employment rate than the older groups, though all groups show employment growth.

When considering different ethnicities, Appendix Table 3A shows the employment rate before having children is very different for the different ethnicities. The employment rate two years before becoming a parent ranges from 55.8% for sole Asians and 55.9% for sole Māori to 79.4% percent for sole Europeans. If Māori tend to be younger when they have children, these differences may exaggerate employment differences in the population. After becoming parents, ethnic differences in employment are lower, primarily because the ethnicities with higher pre-parenthood employment face bigger decreases.

Women who recently had a second child have substantially lower employment rates than those who have one child only, regardless of the gap between the children. Finally, mothers who are partners with the father of their children at the time of the children's birth have persistently higher employment rates than those who are not, which may be partly due to being older.

Appendix Table 3B shows how monthly earnings vary over time for the same alternative subpopulations. It shows that when they have children younger women face smaller decreases in average monthly earnings than do older women, conditional on being employed. However, they also have lower levels of income. It also shows that upon having children, average income for employed European women decreases substantially more than does income for the other ethnicities, though Asian and European women pre-parenthood have relatively similar monthly earnings. Those who have another child within five years show a smaller decrease in average earnings when they have children, potentially because they tend to be younger. They also have lower levels of income. Finally, women who are not partnered with their child's father have lower incomes and smaller decreases in income when they have children. The smaller decreases may be through necessity if they need to keep working full time to afford to care for their children.

Overall these tables show the change in employment and earnings women experience upon having children differs substantially for different segments of the population. Women with lower income seem to face smaller income decreases, but this could be driven by the necessity of continuing to work long hours after having children in order to support their families, or could result from underemployment before having children.

3.3 Hourly wage regressions

3.3.1 Hourly wage empirical strategy

To study the relationship between hourly wages, gender, and parenthood, we use IS data and run ordinary least squares regressions of hourly wages on personal and job characteristics including gender, a parent dummy, and their interaction. Our simplest regressions take the form:

$$Y_{it} = \beta_0 + \beta_1(\text{Female}_i * \text{Parent}_{it}) + \beta_2 . \text{Female}_i + \beta_3 . \text{Parent}_{it} + X_{it}'\beta_4 + \gamma_t + \varepsilon_{it} \qquad (1)$$

where, Y_{it} is the log hourly wage at main job of individual i at time t, Female_i is an indicator for being female, Parent_{it} is an indicator for the individual having had his or her first child as of time t, and X_{it} is a vector of individual and job-related characteristics. The regression also includes year fixed effects, γ_t; ε_{it} is the error term. In some specifications we also include various interactions between gender, age, and parental status. These allow the parenthood penalty to vary by age and gender or by age, gender, and the interaction of the two. Throughout, we correct for heteroscedasticity by using robust standard errors.

In all specifications X_{it} includes a quadratic in age and fixed effects for highest qualification. In more saturated specifications it also includes ethnicity, marital status, country of birth, industry, occupation, and region fixed effects.

These first regressions do not attempt to adjust for the selection of individuals into paid employment. The coefficients on *Female, Parent,* and their interaction should thus be interpreted as informative about the contribution of parents and non-parents to the observed gender difference in hourly wages.[11] They should not be interpreted as capturing the causal effect of parenthood on earnings for the two genders.

However, the combination of IDI data and HLFS does allow us to come closer to estimating the causal effect of parenthood on hourly wages. To do so we must account for two types of selection: of those who ever become parents and within parents of those who choose to work. To deal with the selection of those who ever become parents we include an indicator for whether the individual becomes a parent based on our "first child" data set described in Section 2.1 and the interaction of this indicator with *female*. To deal with selection into work among parents we include controls for the income quartile of parents two years before the birth of their first child, as described in Section 2.2. Individuals who are never observed as parents in the IDI are assigned to a sixth group. These income quartile variables act as (imperfect) controls for potential earnings in the counterfactual where the parents had not had children. This helps to correct for the fact that less skilled women are more likely to exit the labour market after having children. The gender-specific parenthood penalties estimated in these regressions are closer to the causal effect of parenthood on hourly wages.

We also estimate some specifications that either include additional controls that capture the number of children a parent has, or that instead use as the dependent variable an indicator for being employed or, in a regression limited to those who are employed, an indicator for being employed full-time.

11 Furthermore, the fact that parenthood is not random and may be correlated with unobservable characteristics that affect earning potential limits the causal inferences that can be drawn from this analysis.

3.3.2 Hourly wage results

Table 4 presents our first set of results from regressions of hourly wages on gender, parenthood status, and other characteristics for individuals aged 20 to 49.[12] The first column is a parsimonious regression that controls for gender, a quadratic in age, education, and year fixed effects only. The statistically significant coefficient of -0.070 on female shows that within the regression sample women on average earn 6.8% lower hourly wages than men of the same age and education. This is a relatively low estimate of the gender hourly wage gap compared with those found in the literature (Pacheco, Li, and Cochrane, 2017), likely driven by the fact that, for data availability reasons and comparability with the IDI results, our sample of parents is not representative of the full population of parents.[13]

Table 4: Hourly wage regressions

Dependent variable:	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Usual hourly earnings in main job (ln)					
Female	-0.070***	-0.059***	-0.198***	-0.175***	-0.042
	(0.004)	(0.004)	(0.055)	(0.057)	(0.053)
Age	0.076***	0.071***	0.066***	0.067***	0.050***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
Age squared (/100)	-0.092***	-0.085***	-0.076***	-0.078***	-0.058***
	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
Parent		0.103***	0.103***	0.034	-0.049
		(0.008)	(0.008)	(0.154)	(0.113)
Female x Parent		-0.074***	-0.078***	-0.067	-0.040***
		(0.011)	(0.011)	(0.239)	(0.011)
Female x Age			0.010***	0.009**	0.001
			(0.004)	(0.004)	(0.003)
Female x Age squared (/100)			-0.017***	-0.016***	-0.003
			(0.005)	(0.006)	(0.005)
Age x Parent				-0.000	0.002
				(0.009)	(0.007)
Age squared (/100) x Parent				0.006	0.004
				(0.014)	(0.011)
Female x Age x Parent				-0.005	
				(0.015)	
Female x Age squared (/100) x Parent				0.013	
				(0.023)	
Year FE	Yes	Yes	Yes	Yes	Yes
Education FE	Yes	Yes	Yes	Yes	Yes
Other FE					Yes
Sample size	43,854	43,854	43,854	43,854	42,426
R-squared	0.225	0.228	0.229	0.230	0.352

*Notes: ***, **, * denote effects that are statistically significant at the 1%, 5%, and 10% levels, respectively. Each column of this table presents the results from a regression model of log hourly wage on person and job characteristics for those aged 20 to 49.* Other fixed effects *include: ethnicity, occupation, industry, region, country of birth, and marital status. The omitted income quartile is the fourth quartile. Robust standard errors are in parentheses.*

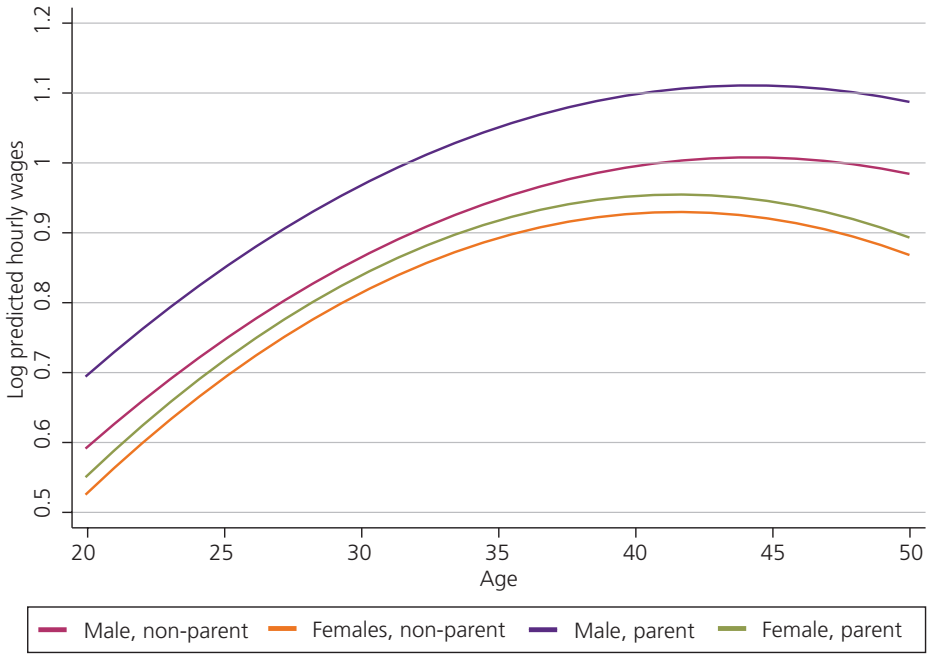
12 The dependent variable is log hourly wages in the main job. Instead using log hourly wages in all jobs has almost no effect on the results, so we do not present these regressions.

13 Note in particular that the only parents we include had their first child in 2003-10, and the survey years used are 2006 to 2015. Thus all the parents in our sample have children who are 12 years old or younger.

Column (2) of the table adds controls for being a parent and for being a female parent. The coefficient on *female* here is -0.059 and on *female*parent* is -0.074; both are significant at the 1 percent level. This shows that the gender wage gap between parents is more than twice as large as the gender wage gap between non parents. While the former is the bigger contributor to the gender pay gap observed in the economy, the latter also plays a role.

Column (3) adds controls for *female* interacted with a quadratic in age, thus allowing the gender wage gap to vary with age but still constraining the gender-specific parenthood penalties to be age-invariant. Figure 9 shows how predicted log hourly wages vary by age for men and women who are and are not parents. Predicted wages are normalized to be 1 for 40-year-old males who are not parents. As shown by raw comparisons of median hourly earnings by gender in Statistics NZ's Income Tables,[14] we also find that the gender wage gap is larger at older ages. Men on average earn considerably more if they are parents, and women earn slightly more.[15] Recall, however, that these are not the causal effects of parenthood. The individuals who have children may not be representative of the population, and this analysis makes no account for the fact that many women with low earning potential leave the labour market for a long period after having children, as Section 3.2 shows.

Figure 9: Variation in the predicted gender wage gap by age



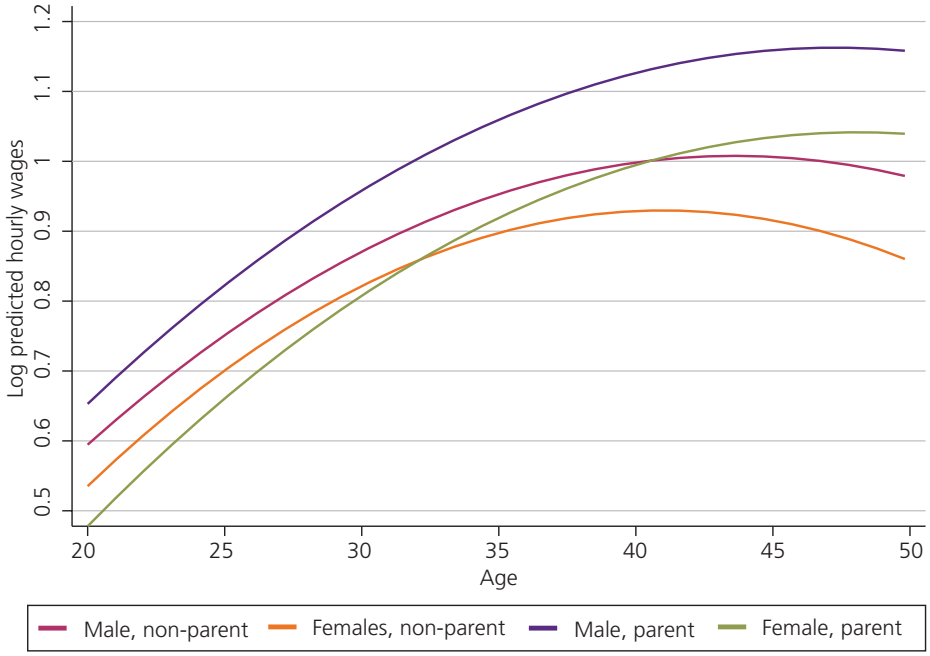
Notes: This figure plots predicted log hourly wages for male and female parents and non-parents based on column (3) of Table 4. Wages are normalised to be 1 for male non-parents aged 40.

Column (4) of Table 4 allows wages to vary according to a different quadratic for each combination of gender and parenthood. Figure 10 uses its coefficients to plot predicted log hourly wages for men and women who are and are not parents. Again, log wages are normalised to 1 for non-parent men who are 40 years old.

14 See http://m.stats.govt.nz/tools_and_services/nzdotstat/tables-by-subject/income-tables.aspx

15 Note this differs from the previous column because the age distributions of parents and non-parents in the sample differ.

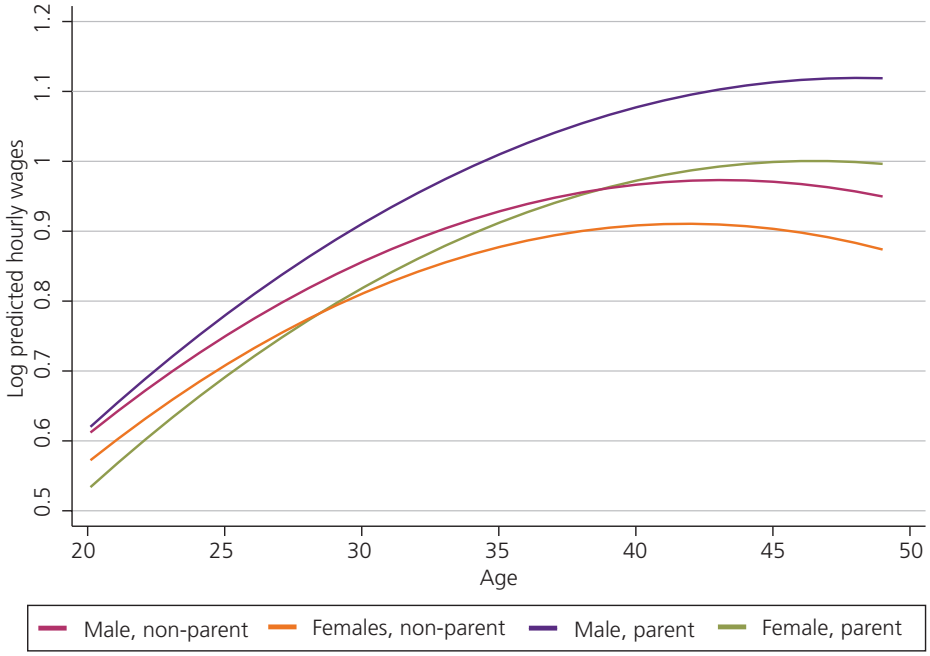
Figure 10: Variation in the predicted gender wage gap by age, flexible specification



Notes: This figure plots predicted log hourly wages for male and female parents and non-parents based on column (4) of Table 4. Wages are normalised to be 1 for male non-parents aged 40.

Figure 10 shows the male parenthood advantage observed in the labour market grows with age, as does the female parenthood advantage. While male parents earn more than male non-parents at every age, young female parents earn less than female non-parents of the same age, whereas older female parents earn more than female non-parents of the same age, and in fact overtake male non-parents by about age 40. Column (5) controls for a wide range of person and job characteristics. Figure 11 plots its predictions and tells a similar story.

Figure 11: Variation in the predicted gender wage gap by age, full controls



Notes: This figure plots predicted log hourly wages for male and female parents and non-parents based on column (5) of Table 4, which includes a full set of controls for person and job characteristics. Wages are normalised to be 1 for male non-parents aged 40.

In Table 5 we move away from describing the gender wage gap and parenthood wage penalties and attempt to estimate the causal effect of parenthood on males' and females' hourly wages. All specifications here allow wages to vary with age according to a quadratic function that differs for men and women. Column (1) also controls for whether the individual is ever a parent, whether he or she is currently a parent, and the interactions of these two variables with *female*. The coefficient on *ever a parent* is 0.134 and is significant at the 1 percent level. This captures the selection of men who become parents, and suggests men who will in future become parents earn on average 14.3 percent higher hourly wages than men of the same age who will not become parents.[16] That is, fathers are strongly positively selected from the male population as a whole. The coefficient on *ever a parent*female* is -0.059 and is also significant at the 1 percent level, suggesting women who become parents are positively selected from the female population but the selection is less strong than that of men who become fathers.[17] Specifically, future mothers earn 7.8 percent higher hourly wages than women of the same age who will not become mothers.[18]

Column (1) does not attempt to account for the different selection into work before and after parenthood. The coefficient of -0.030 on *parent* here thus tells us that fathers who work earn hourly wages that are 3.0 percent lower on average than the wages of men of the same age who will become parents. This coefficient is significant at the 10% level. When combined with the point estimate of -0.019 on *female*parent*, the coefficient tells us mothers who work earn hourly wages that are 4.8 percent lower than the wages of women of the same age who will become mothers in the future.

16 exp(0.134) – 1 = 14.3%

17 Note income quartiles are calculated pooling parents and non-parents of the same age, so the decrease in income that women experience when they become mothers means the positive selection estimated here for females may be an overestimate.

18 exp(0.134 – 0.059) – 1 = 7.8%

This estimated "motherhood penalty" is significantly different to zero at the 1 percent level, but the difference between the "motherhood penalty" and the "fatherhood penalty" estimated here is not significantly different to zero.

Table 5: Hourly wage regressions accounting for selection

Dependent variable:	(1)	(2)	(3)	(4)
Usual hourly earnings in main job (ln)				
Female * Parent	-0.019	-0.036		
	(0.024)	(0.022)		
Female * Parent * Returned in months 1 to 6			-0.013	0.033
			(0.025)	(0.024)
Female * Parent * Returned in months 7 to 12			-0.058	-0.016
			(0.038)	(0.037)
Female * Parent * Returned in months 13+			-0.077**	-0.019
			(0.036)	(0.036)
Parent	-0.030*	-0.009	-0.010	-0.030*
	(0.018)	(0.016)	(0.016)	(0.016)
Female * Ever a parent	-0.059***	-0.070***	-0.070***	-0.098***
	(0.022)	(0.020)	(0.022)	(0.022)
Female * Returned in months 7 to 12			0.025	0.029
			(0.035)	(0.034)
Female * Returned in months 13+			-0.018	-0.002
			(0.033)	(0.034)
Ever a parent	0.134***	0.302***	0.299***	0.267***
	(0.017)	(0.016)	(0.016)	(0.016)
Ever a parent * Worked <4 months 2 yrs before 1st child's birth		-0.243***	-0.226***	-0.194***
		(0.020)	(0.021)	(0.020)
Ever a parent * Income quartile 1 2 yrs before 1st child's birth		-0.397***	-0.386***	-0.307***
		(0.017)	(0.017)	(0.017)
Ever a parent * Income quartile 2 2 yrs before 1st child's birth		-0.317***	-0.311***	-0.251***
		(0.012)	(0.012)	(0.012)
Ever a parent * Income quartile 3 2 yrs before 1st child's birth		-0.183***	-0.180***	-0.141***
		(0.011)	(0.011)	(0.011)
Age quadratic interacted with gender	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Education FE	Yes	Yes	Yes	Yes
Occupation FE (8 categories)				Yes
Industry FE (18 categories)				Yes
Sample size	42,597	42,597	42,597	42,597
R-squared	0.231	0.248	0.248	0.342

*Notes: ***, **, * denote effects that are statistically significant at the 1%, 5%, and 10% levels, respectively. Each column of this table presents the results from a regression model of log hourly wage on person and job characteristics for those aged 20 to 49. The omitted income quartile is the fourth quartile. Robust standard errors are in parentheses.*

Column (2) of Table 5 adds to the specification in column (1) controls for pre-parenthood income quartile to control for earnings potential absent children.[19] The fatherhood penalty shrinks to near zero and becomes insignificant, consistent with fatherhood having no causal effect on hourly earnings. The point estimate for the motherhood penalty decreases to 4.4 percent, which is significant at the 1% level. In column (3) we allow the motherhood penalty (but not the fatherhood penalty) to vary with length of time out of employment.[20] Here we find men face a statistically insignificant 1.0 percent fatherhood penalty and woman face an additional motherhood penalty that increases with time out of work and ranges from an insignificant 1.3 percent for those who return to work within six months to a significant 7.4 percent for those who return in month 13 or later.

Finally, in column (4) of Table 5 we add industry and occupation fixed effects to the column (3) specification to examine the extent to which the motherhood penalties result from women returning to work in industries or occupations that are lower-paying than where they previously worked. For all three time-out-of-work categories, the point estimate of the motherhood penalty decreases, and the decrease is greatest for those who are slowest to return to work. However, for those away from work for seven months or more, a significant motherhood penalty remains. This suggests women who return to work do tend to return in lower-paying roles than they held before having children, more so for those who are out of work for longer. However, for women who are slower to return to work, trading down industry or occupation is unlikely to explain the entire motherhood penalty.[21]

Taken together with the results on employment and monthly income from the IDI data, these results suggest that women who work shortly after having children, who are disproportionately skilled and educated, decrease their hours worked and earn substantially lower monthly incomes than do similar women without children. However, motherhood brings lower hourly wages only for women who remain out of work for longer periods, with women who return within six months experiencing insignificant decreases.

In Table 6 we present results from additional regressions to investigate the role multiple children play, as well as examine the relationships between parenthood and working full time within the employed population and between parenthood and being employed for the full population.

In column (1) of Table 6, we replace the parenthood indicator with dummies for having at least one, two, three, or four children, and interact these variables with female. The coefficient on first child is 0.046, which is significant at the 5% level. This shows that men with one child have average hourly wages that are 4.7% higher than similar men with no children.

A number of factors are likely to play a role in this, including the unobservable characteristics of men with one child and the extra incentive a father has to work and support his child, especially given his partner (if any) is less likely to be working. The coefficient on *second child*, which takes the value 1 if the individual has at least two children, is positive and significant, though somewhat smaller in magnitude, showing men with two children have higher hourly wages on average than similar men with only one child. The coefficients on third child and fourth child are not significantly different to zero.

The coefficients on the interactions of *female* with the child number variables are all negative, though they are imprecisely estimated, especially for higher order children, and none are statistically significant.

19 We tried specifications in which income quartiles were interacted with *female*, but the coefficients on the interactions were mostly small and statistically insignificant, and including them didn't substantially change the results.

20 We also tried regressions that allowed the motherhood penalty to vary with income quartile, but the statistical power was too low for useful results.

21 It should be noted that the industry and occupation fixed effects we include are fairly aggregated due to the small sample size. More disaggregate industry and occupation controls would likely explain a somewhat higher proportion of the motherhood penalty.

Table 6: Multiple children and other labour market outcomes

Dependent variable:	(1)	(2)	(3)
	Hourly wage (ln)	Employed	Working full time
Female	-0.0550	-0.114**	-0.427***
	(0.0531)	(0.0528)	(0.0582)
Age	0.0486***	0.0358***	0.0351***
	(0.00256)	(0.0023)	(0.00209)
Female*Age	0.00159	0.00405	0.0243***
	(0.00339)	(0.0033)	(0.00350)
Age^2 (/100)	-0.0557***	-0.0502***	-0.0479***
	(0.00383)	(0.0033)	(0.00298)
Female* Age^2	-0.00472	-0.00337	-0.0361***
	(0.00508)	(0.0047)	(0.00502)
First child	0.0459***	0.0305***	0.00418
	(0.0109)	(0.0075)	(0.00564)
Female* First child	-0.0240	-0.258***	-0.305***
	(0.0149)	(0.0122)	(0.0141)
Second child	0.0360**	0.0087	-0.00403
	(0.0142)	(0.0088)	(0.00660)
Female* Second child	-0.0313	-0.0911***	-0.150***
	(0.0211)	(0.016)	(0.0197)
Third child	0.0008	-0.0 241*	-0.0188*
	(0.0219)	(0.0136)	(0.00993)
Female* Third child	-0.0126	-0.0691***	-0.0501
	(0.0361)	(0.0253)	(0.0346)
Fourth child	0.0311	0.0225	-0.0256
	(0.0463)	(0.0309)	(0.0203)
Female* Fourth child	-0.0614	-0.140***	0.116
	(0.0910)	(0.0477)	(0.0768)
Constant	1.462***	0.0262	0.205***
	(0.0464)	(0.0405)	(0.0396)
Observations	41,778	62,445	47,022
R-squared	0.352	0.139	0.190
Educ. Control	Yes	Yes	Yes
Ethnicity. Control	Yes	Yes	Yes
Marital status control	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Region FE	Yes	Yes	Yes
Birth country FE	Yes	Yes	Yes

*Notes: ***, **, * denote effects that are statistically significant at the 1%, 5%, and 10% levels respectively. The three columns of this table present results from a regression studying the hourly wages among employed individuals using the employed population with non-missing data (column 1), whether employed full-time among those employed (column 2), and whether employed using the full population (column 3). The regression models related to the first two columns include industry and occupation fixed effects. The samples are described in more details in Section 2.3, and all include people aged 20-49. Robust standard errors are in parentheses.*

Column (2) of Table 6 presents the results of a linear probability regression of employment on a gender-specific quadratic in age, a gender-specific parenthood penalty that varies by number of children, and other controls. It shows that for females, having the first child is associated with a substantial drop in the probability of being employed. When a female has multiple children, her employment propensity declines with each child, though the drops are smaller in percentage point terms for subsequent children than for the first child. The increasing cost of childcare with each subsequent child is likely to be an important driver of this pattern.

Column (3) of Table 6 restricts the sample to those who are employed and examines the correlates of being employed full time. The patterns are similar to those for employment. The likelihood of working full time, conditional on being employed, is substantially lower for females once they become parents.

Overall, the regressions in columns (2) and (3) suggest that the majority of the gender differences observed in the population in employment rate and propensity to work part time are driven by mothers.

4 Conclusions

We use administrative wage data, birth records, and survey data on hours worked and earnings to study how the labour market outcomes of parents evolve as they have their first child and for the subsequent decade. The aim of this research is to investigate the importance of parenthood wage penalties for observed gender differences in earnings.

For the first half of our analysis, we employ a population-level view and use monthly earnings information alongside birth records. We find that for women, working while having a young child is strongly associated with having high earnings potential; women with higher incomes before having children and those with higher education return to work more quickly. In contrast, few men take significant time away from work when they have children. This means analyses of how earnings of men and women are affected by parenthood that don't control well for selection into working will underestimate the motherhood penalty.

We next examine how monthly income of those employed evolves for men and women with different pre-parenthood incomes. Women in all income quartiles experience decreases in income upon becoming parents, with the magnitude of the decrease larger for higher-income groups. In contrast, men's incomes continue to increase steadily when they become fathers, causing their monthly incomes to pull further ahead of those of mothers. We show that one of the drivers is that women tend to work fewer hours after having children than before (a median of 27 down from 40) whereas men continue to work a median of 41 hours per week.

To see the relationship between length of time out of work and subsequent income, we then disaggregate women by pre-parenthood income and length of time out of employment. Nearly all groups face a decrease in monthly earnings upon having children, but these decreases are larger for higher-income women and for those who are out of employment for longer. Several explanations are consistent with the smaller monthly earnings penalty from parenthood experienced by low-income women: they may have less human capital to depreciate, they may need to keep working long hours to support their children, or they may have been underemployed before having children. The decrease in mothers' earnings with length of time out of employment is consistent with a human capital depreciation story: either women's skills deteriorate or employers' perceptions of their skills decline the longer they are out of the labour market. Regardless of the cause, our results suggest a woman who takes longer time out of employment can expect to be at an earnings disadvantage when she reenters the labour market.

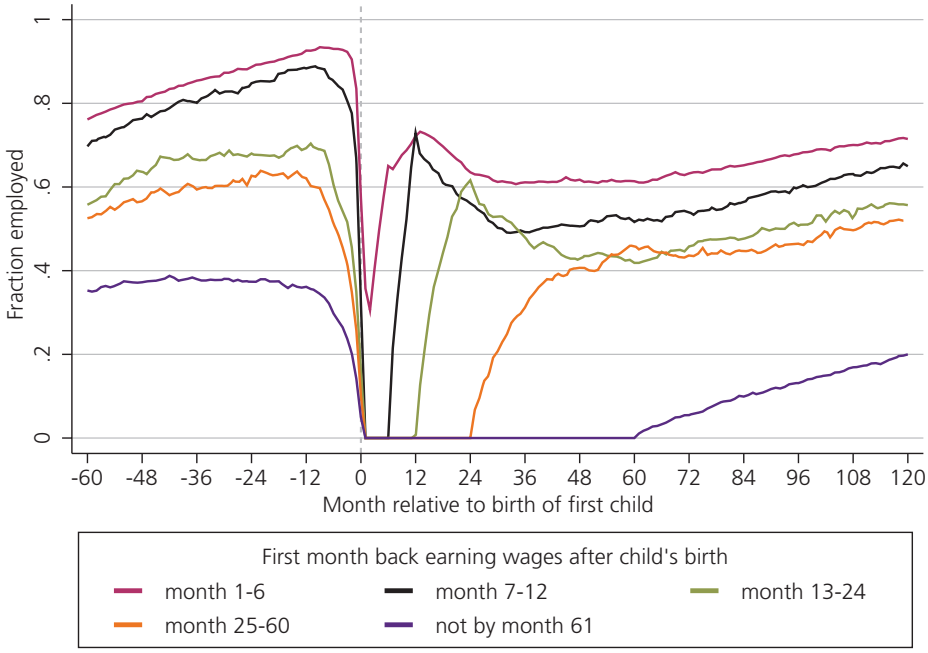
We also find that high-income women who return quickly to work experience slower growth in monthly earnings after becoming parents than before they had children. One possible explanation is that they work fewer hours after having children and so advance proportionately slower.

In the second half of our research we run regressions of log hourly wages for parents and non-parents on *Female, Parent*, their interaction, and other controls, initially without attempting to control for selection into parenthood or work. We find women on average in our sample (which is not representative of the population) earn 6.8% lower wages than men of the same age and education, but the difference between men and women is more than twice as large for parents as for non-parents.

We then add controls for whether individuals ever become parents (to deal with selection into parenthood) and for income quartile before having children as a proxy for earnings potential (to reduce the effect of selection into work on our results). We find parents of both genders earn above average hourly wages for their gender and age prior to parenthood, but becoming a mother is associated with a 4.4 percent decrease in hourly wages on average. We don't find a significant effect of becoming a father on hourly wages. The decrease in hourly wages for mothers is larger for those who are away from work for longer, with women who are away from work for more than 12 months experiencing an 8.3 percent decrease. Adding industry and occupation fixed effect reveals that some but not all of the motherhood hourly wage penalties are explained by women returning to work in lower-paid industries or occupations. Overall, the reduced hourly wages of women could result from depreciation of their human capital while they are on maternity leave, but could also be driven by women trading off wages for flexibility in working hours or suffering reduced bargaining power as they attempt to reenter the labour market.

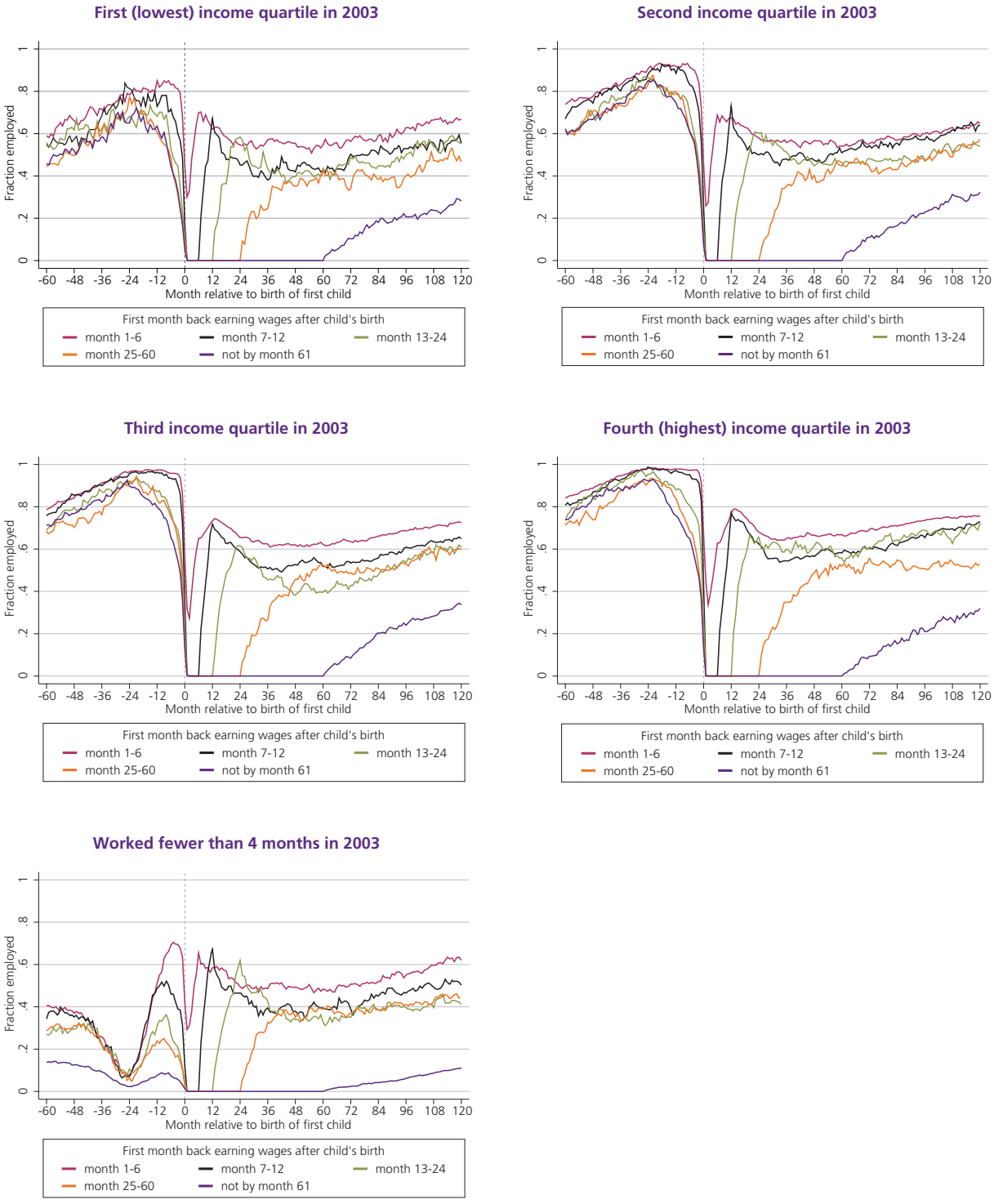
5 Appendix

Figure 1A: Employment rates of mothers by time out of employment



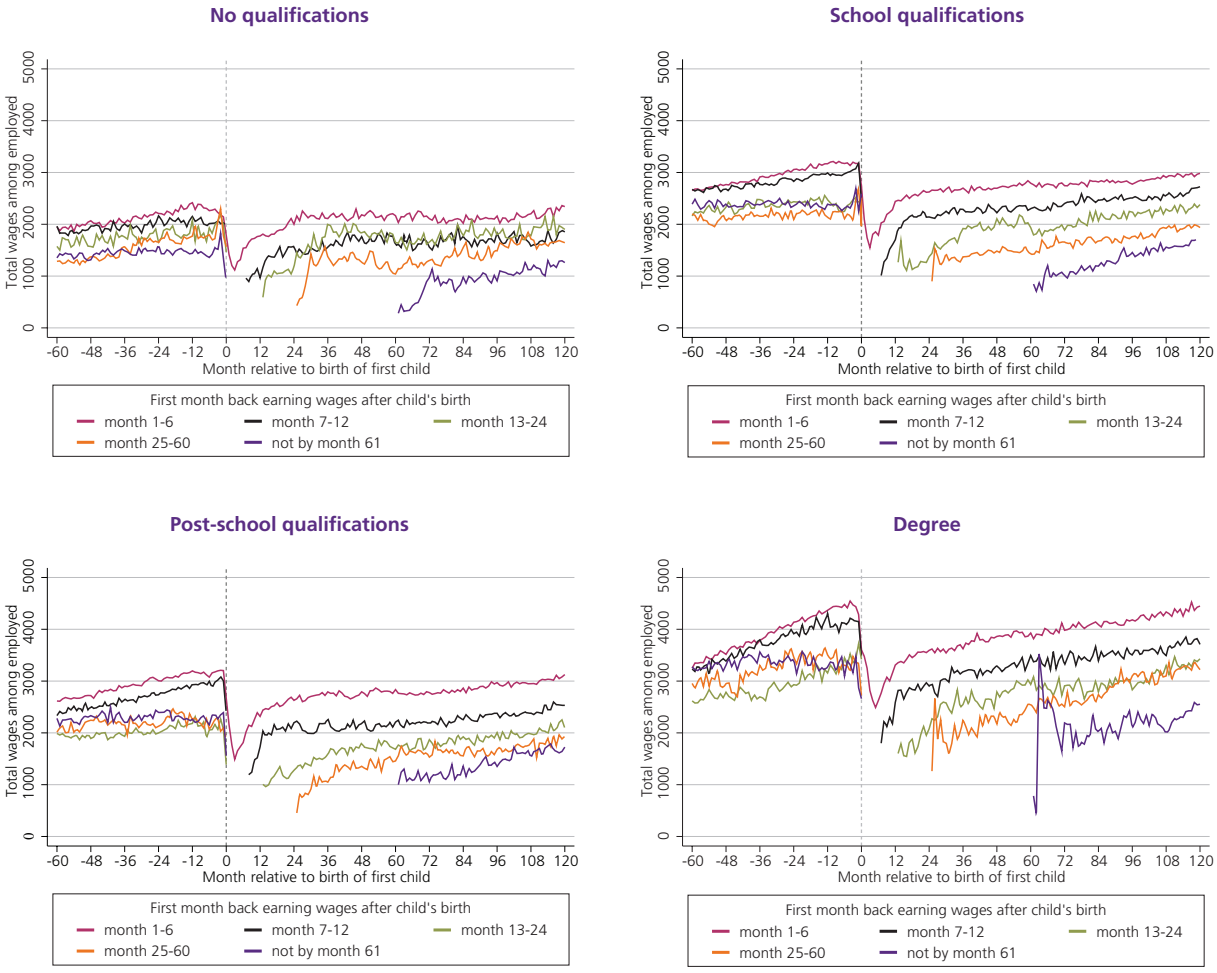
Notes: This figure presents monthly employment rates for women by the length of time until they first returned to work. The population is as described in Section 2.2.

Figure 2A: Employment rates of mothers by income quartile and time out of employment



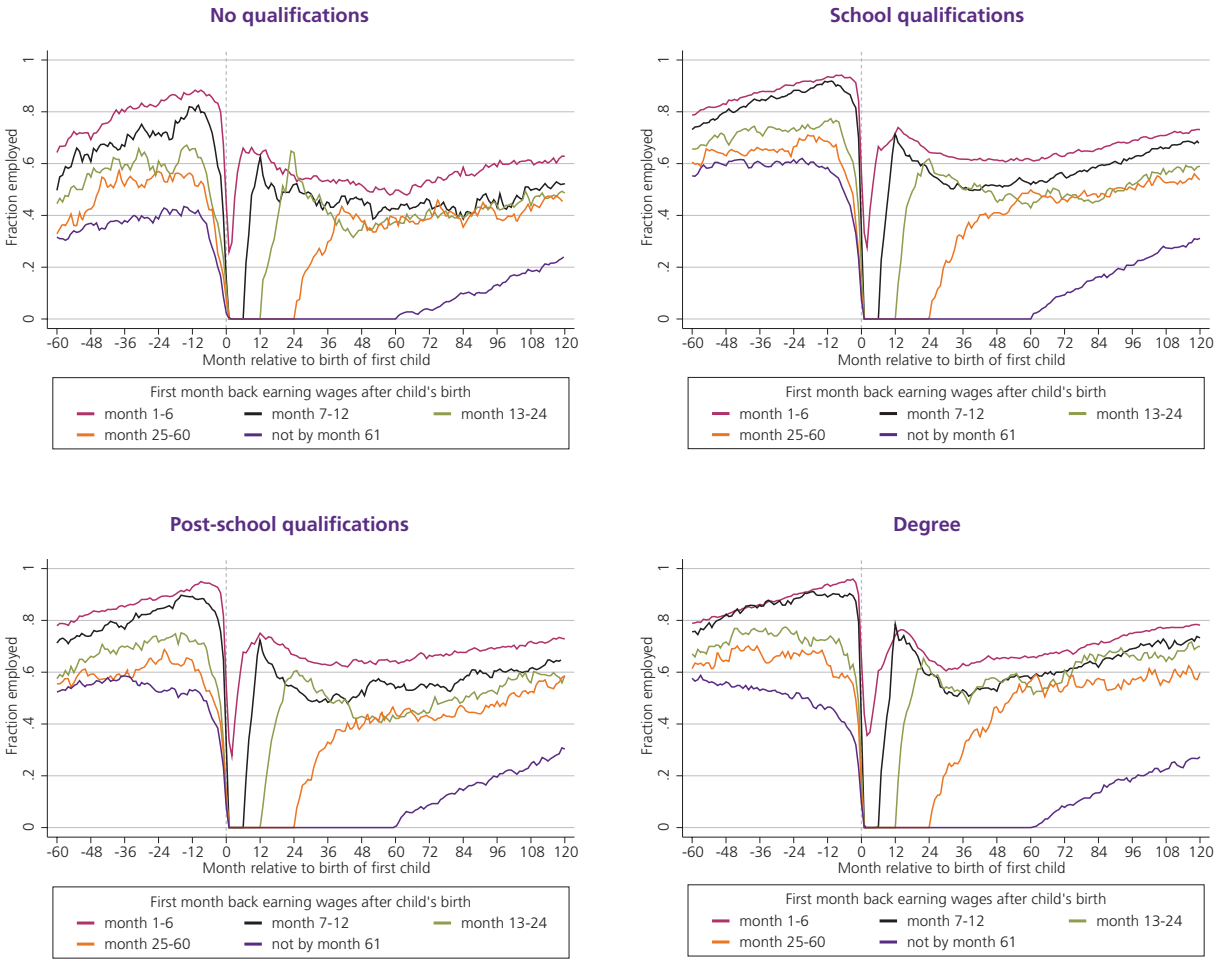
Notes: This figure presents monthly employment rates for women. Each panel presents data for a 2003 income quartile, and within panels, each line is for women who were away from work for a given length of time. The population is as described in Section 2.2.

Figure 3A: Monthly earnings of mothers by education and time out of employment



Notes: This figure presents the average monthly earnings among employed women. Each panel presents data for a 2013 education level, and within panels, each line is for women who were away from work for a given length of time. The population is as described in Section 2.2.

Figure 4A: Employment rates of mothers by education and time out of employment



Notes: This figure presents the employment rates of women whose first children were born in 2005. Each panel presents data for a 2013 education level, and within panels each line is for women who were away from work for a given length of time. The population is described in Section 2.2

Table 1A: Mothers' outcomes by income quartile and time out of employment

Panel A: Employment

			Employment rate in year:						
Income quartile in 2003	Return to work	Individuals	5th year before child's birth	2nd year before child's birth	1st year after child's birth	2nd year after child's birth	3rd year after child's birth	5th year after child's birth	10th year after child's birth
Worked <4 mon	Month 1-6	471	39.2	24.5	51.7	55.0	49.0	48.5	61.9
	Month 7-12	213	37.1	25.4	23.9	49.8	40.6	38.7	50.8
	Month 13-24	264	28.6	16.4	0.0	37.9	47.9	34.2	42.9
	Month 25-60	357	30.2	13.5	0.0	0.0	20.9	37.2	44.9
	Not by month 61	1,740	13.6	4.4	0.0	0.0	0.0	0.0	10.0
1st quartile	Month 1-6	366	63.3	80.3	58.2	58.5	54.8	53.5	66.3
	Month 7-12	153	55.8	76.9	22.6	51.1	41.9	44.4	55.6
	Month 13-24	153	57.0	68.5	0.0	40.7	47.9	41.2	55.4
	Month 25-60	141	47.7	69.9	0.0	0.0	19.9	38.2	48.4
	Not by month 61	267	49.7	65.9	0.0	0.0	0.0	0.0	25.6
2nd quartile	Month 1-6	987	76.0	92.1	56.9	62.3	56.5	55.4	63.3
	Month 7-12	348	72.9	90.7	24.1	55.0	48.4	49.2	63.3
	Month 13-24	228	63.6	81.7	0.0	42.8	55.3	45.7	54.1
	Month 25-60	240	63.7	82.4	0.0	0.0	21.1	41.9	54.5
	Not by month 61	390	63.1	81.3	0.0	0.0	0.0	0.0	30.2
3rd quartile	Month 1-6	1,938	81.7	97.0	57.5	70.4	63.9	62.0	71.8
	Month 7-12	624	80.0	96.2	24.2	63.7	53.2	54.0	64.2
	Month 13-24	273	74.6	90.8	0.0	44.6	52.9	41.0	60.4
	Month 25-60	249	70.8	89.3	0.0	0.0	19.3	48.8	59.1
	Not by month 61	390	74.0	85.7	0.0	0.0	0.0	0.0	31.6
4th quartile	Month 1-6	2,592	86.4	98.0	58.3	74.3	65.2	66.6	75.3
	Month 7-12	639	82.8	97.4	24.0	69.1	56.0	58.7	71.0
	Month 13-24	174	80.7	92.8	0.0	52.9	61.1	59.3	68.8
	Month 25-60	195	73.8	90.8	0.0	0.0	22.9	50.3	52.2
	Not by month 61	258	78.2	86.7	0.0	0.0	0.0	0.0	28.9

This table presents employment rates for women who had their first child in 2005, described in Section 2.2, for various subpopulations.

Panel B: Monthly earnings

			Average monthly income in year:						
Income quartile in 2003	Return to work	Individuals	5th year before child's birth	2nd year before child's birth	1st year after child's birth	2nd year after child's birth	3rd year after child's birth	5th year after child's birth	10th year after child's birth
Worked <4 mon	Month 1-6	471	2,337	2,124	1,779	2,219	2,353	2,604	2,853
	Month 7-12	213	1,822	1,786	1,167	1,573	1,962	2,024	2,424
	Month 13-24	264	1,552	1,317		1,249	1,611	1,934	2,422
	Month 25-60	357	1,930	1,390			1,287	1,623	2,050
	Not by month 61	1,740	2,295	1,100					1,739
1st quartile	Month 1-6	366	1,367	1,061	1,175	1,564	1,862	2,169	2,479
	Month 7-12	153	1,303	1,059	900	1,349	1,701	1,902	2,206
	Month 13-24	153	1,329	1,024		1,092	1,543	1,862	2,116
	Month 25-60	141	1,206	896			1,077	1,492	1,558
	Not by month 61	267	1,344	871					1,265
2nd quartile	Month 1-6	987	1,798	1,964	1,334	1,682	1,909	2,068	2,356
	Month 7-12	348	1,880	1,969	1,025	1,313	1,518	1,675	1,986
	Month 13-24	228	1,745	1,714		995	1,402	1,702	2,070
	Month 25-60	240	1,747	1,726			1,042	1,211	1,557
	Not by month 61	390	1,796	1,799					1,402
3rd quartile	Month 1-6	1,938	2,414	2,883	1,858	2,290	2,437	2,543	2,830
	Month 7-12	624	2,471	2,803	1,455	2,021	2,078	2,165	2,415
	Month 13-24	273	2,257	2,521		1,233	1,608	1,864	2,147
	Month 25-60	249	2,141	2,512			1,356	1,503	2,092
	Not by month 61	390	2,342	2,568					1,733
4th quartile	Month 1-6	2,592	3,708	4,592	3,240	3,801	3,879	4,055	4,384
	Month 7-12	639	3,636	4,426	2,509	3,177	3,174	3,379	3,827
	Month 13-24	174	3,192	3,904		2,023	2,566	2,848	3,224
	Month 25-60	195	3,147	3,862			1,964	2,310	3,444
	Not by month 61	258	3,837	4,292					2,469

This table presents average monthly wage income among the employed for women who had their first child in 2005, described in Section 2.2, for various subpopulations.

Table 2A: Mothers' outcomes by education and time out of employment

Panel A: Employment

Highest qualification in 2013	Return to work	Individuals	Employment rate in year: 5th year before child's birth	2nd year before child's birth	1st year after child's birth	2nd year after child's birth	3rd year after child's birth	5th year after child's birth	10th year after child's birth
None	Month 1-6	420	69.6	85.6	56.1	59.3	54.0	49.5	61.1
	Month 7-12	153	59.8	74.3	22.7	50.2	46.9	42.3	51.3
	Month 13-24	147	49.5	61.0	0.0	40.1	47.8	36.6	47.8
	Month 25-60	159	37.8	55.2	0.0	0.0	20.6	36.2	45.7
	Not by month 61	327	33.1	41.6	0.0	0.0	0.0	0.0	21.1
School	Month 1-6	2,019	81.1	91.7	57.4	69.1	62.9	61.4	72.3
	Month 7-12	714	76.2	89.1	23.9	62.0	52.3	52.4	67.7
	Month 13-24	315	68.5	74.1	0.0	46.3	54.7	46.0	58.1
	Month 25-60	372	62.9	69.2	0.0	0.0	20.8	44.9	53.5
	Not by month 61	714	58.3	60.1	0.0	0.0	0.0	0.0	28.8
Post-school	Month 1-6	1,359	79.9	90.2	58.9	70.8	64.2	64.1	72.2
	Month 7-12	429	73.1	86.9	24.1	59.4	49.9	55.4	63.4
	Month 13-24	255	61.4	73.1	0.0	41.0	55.1	42.0	58.8
	Month 25-60	261	57.6	64.6	0.0	0.0	21.9	42.9	55.6
	Not by month 61	432	54.3	52.4	0.0	0.0	0.0	0.0	27.1
Degree	Month 1-6	1,929	80.4	91.4	56.7	71.7	62.2	65.6	77.7
	Month 7-12	474	77.8	89.7	24.4	67.1	53.9	57.8	71.6
	Month 13-24	174	68.8	72.5	0.0	50.1	54.9	56.9	68.4
	Month 25-60	186	63.5	67.4	0.0	0.0	19.7	51.1	59.2
	Not by month 61	360	56.4	48.9	0.0	0.0	0.0	0.0	25.2

This table presents employment rates for women who had their first child in 2005, described in Section 2.2, for various subpopulations.

Panel B: Monthly earnings

Highest qualification in 2013	Return to work	Individuals	Average monthly income in year: 5th year before child's birth	2nd year before child's birth	1st year after child's birth	2nd year after child's birth	3rd year after child's birth	5th year after child's birth	10th year after child's birth
None	Month 1-6	420	1,954	2,261	1,538	1,888	2,150	2,175	2,243
	Month 7-12	153	1,857	2,064	1,020	1,424	1,500	1,709	1,728
	Month 13-24	147	1,653	1,815		1,063	1,585	1,786	1,956
	Month 25-60	159	1,278	1,705			1,196	1,226	1,634
	Not by month 61	327	1,388	1,480					1,194
School	Month 1-6	2,019	2,704	3,099	2,043	2,552	2,666	2,757	2,951
	Month 7-12	714	2,672	2,910	1,488	2,106	2,220	2,316	2,615
	Month 13-24	315	2,257	2,452		1,256	1,655	2,030	2,308
	Month 25-60	372	2,088	2,214			1,322	1,488	1,942
	Not by month 61	714	2,389	2,371					1,618
Post-school	Month 1-6	1,359	2,669	3,086	2,032	2,545	2,705	2,799	3,034
	Month 7-12	429	2,443	2,830	1,472	2,063	2,108	2,134	2,479
	Month 13-24	255	1,941	2,111		1,179	1,440	1,741	2,074
	Month 25-60	261	2,091	2,300			976	1,415	1,824
	Not by month 61	432	2,244	2,329					1,673
Degree	Month 1-6	1,929	3,428	4,233	2,969	3,479	3,614	3,901	4,368
	Month 7-12	474	3,300	4,020	2,280	2,840	3,029	3,313	3,736
	Month 13-24	174	2,678	3,095		1,840	2,482	2,877	3,323
	Month 25-60	186	2,994	3,466			1,957	2,342	3,248
	Not by month 61	360	3,272	3,337					2,368

This table presents average monthly wage income among the employed for women who had their first child in 2005, described in Section 2.2, for various subpopulations.

Table 3A: Mothers' outcomes for other subpopulations

Panel A: Employment

Subpopulation		Individuals	Employment rate in year: 5th year before child's birth	2nd year before child's birth	1st year after child's birth	2nd year after child's birth	3rd year after child's birth	5th year after child's birth	10th year after child's birth
Return to work	Month 1-6	6,351	78.5	90.3	57.4	68.9	61.7	61.3	70.8
	Month 7-12	1,980	73.1	86.5	24.0	61.4	51.1	52.3	64.1
	Month 13-24	1,095	59.7	68.1		43.4	52.8	43.3	55.5
	Month 25-60	1,182	54.8	63.0			20.8	42.9	51.5
	Not by month 61	3,045	36.3	37.0					18.3
Income quartile	Worked <4 months	3,048	22.5	11.1	9.7	15.3	17.0	17.5	27.8
	1st quartile	1,083	56.0	73.2	22.9	32.9	34.0	35.3	50.9
	2nd quartile	2,193	70.6	87.8	29.4	41.2	41.2	42.1	55.5
	3rd quartile	3,474	79.2	94.5	36.4	54.2	50.7	50.9	64.1
	4th quartile	3,858	84.4	96.5	43.2	63.8	57.0	59.7	70.0
Highest qualification	None	1,206	51.8	65.2	22.4	31.9	33.2	31.8	45.3
	School	4,137	73.7	82.4	32.1	48.0	45.8	46.6	61.2
	Post-school	2,736	70.9	79.7	33.0	48.3	46.9	48.5	60.9
	Degree	3,120	75.6	83.8	38.7	57.3	50.8	55.5	69.1
Parent's age	<=24	3,897	41.8	63.9	23.4	34.2	36.1	34.5	46.5
	25-34	7,377	74.8	79.1	33.9	49.8	44.9	46.9	59.0
	35-44	2,319	71.5	73.2	29.7	44.8	43.4	46.5	58.2
Ethnicity	Asian	537	45.3	55.8	25.2	38.1	37.5	37.2	43.5
	Pacific	762	40.2	57.5	26.0	36.3	39.0	36.5	41.3
	Māori	1,191	35.5	55.9	20.7	30.5	33.5	32.9	45.1
	European	9,345	73.2	79.4	32.5	48.0	43.9	46.0	59.1
	Maori/European	1,185	59.3	71.2	28.4	41.7	43.0	41.8	53.6
	Other	636	51.6	62.2	25.7	39.2	37.8	39.6	47.2
Timing of subsequent child	Within 5 years	8,784	69.3	78.2	31.6	44.9	38.6	40.2	56.3
	In 6-10 years	1,029	56.5	72.8	30.5	50.4	57.3	59.0	50.0
	Not within 10 years	3,843	56.8	63.6	26.6	41.8	46.2	46.2	54.2
Parents are partners	No	1,404	44.4	59.4	19.9	31.4	35.1	34.7	45.7
	Yes	6,861	72.0	78.9	33.2	47.9	44.1	46.0	58.7

This table presents employment rates for women who had their first child in 2005, described in Section 2.2, for various subpopulations.

Panel B: Monthly earnings

Subpopulation		Individuals	Average monthly income in year: 5th year before child's birth	2nd year before child's birth	1st year after child's birth	2nd year after child's birth	3rd year after child's birth	5th year after child's birth	10th year after child's birth
Return to work	Month 1-6	6,351	2,851	3,386	2,306	2,830	2,950	3,131	3,421
	Month 7-12	1,980	2,689	3,087	1,649	2,248	2,340	2,497	2,833
	Month 13-24	1,095	2,138	2,336		1,322	1,732	2,056	2,391
	Month 25-60	1,182	2,138	2,335			1,349	1,631	2,131
	Not by month 61	3,045	2,362	2,330					1,706
Income quartile	Worked <4 months	3,048	2,112	1,630	1,672	1,862	1,953	2,157	2,360
	1st quartile	1,083	1,329	993	1,136	1,433	1,710	1,974	2,115
	2nd quartile	2,193	1,801	1,889	1,293	1,530	1,716	1,860	2,081
	3rd quartile	3,474	2,388	2,784	1,810	2,165	2,272	2,357	2,595
	4th quartile	3,858	3,657	4,482	3,173	3,622	3,662	3,816	4,151
Highest qualification	None	1,206	1,742	1,984	1,471	1,669	1,858	1,900	1,919
	School	4,137	2,576	2,860	1,972	2,357	2,430	2,506	2,652
	Post-school	2,736	2,478	2,819	1,968	2,345	2,390	2,478	2,655
	Degree	3,120	3,336	4,047	2,903	3,285	3,414	3,665	4,070
Parent's age	<=24	3,897	1,032	1,724	1,308	1,620	1,797	1,963	2,238
	25-34	7,377	2,845	3,391	2,388	2,759	2,815	2,954	3,196
	35-44	2,319	3,617	3,875	2,867	3,254	3,290	3,365	3,429
Ethnicity	Asian	537	2,503	3,119	2,848	3,274	3,264	3,463	3,703
	Pacific	762	1,982	2,259	2,053	2,369	2,506	2,691	2,799
	Māori	1,191	1,785	2,003	1,869	2,120	2,223	2,373	2,435
	European	9,345	2,806	3,258	2,246	2,614	2,670	2,819	3,054
	Maori/European	1,185	2,234	2,698	2,211	2,605	2,642	2,745	2,936
	Other	636	2,378	2,770	2,222	2,626	2,740	2,959	3,022
Timing of subsequent child	Within 5 years	8,784	2,710	3,168	2,221	2,592	2,612	2,736	2,959
	In 6-10 years	1,029	1,928	2,359	1,953	2,305	2,447	2,634	2,813
	Not within 10 years	3,843	2,711	2,977	2,341	2,698	2,795	3,001	3,173
Parents are partners	No	1,404	1,667	1,980	1,688	1,862	1,944	2,073	2,295
	Yes	6,861	2,860	3,334	2,356	2,768	2,843	2,981	3,203

This table presents average monthly wage income among the employed for women who had their first child in 2005, described in Section 2.2, for various subpopulations.

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