Effect of motherhood on pay – methodology and full results

June 2016 quarter

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1 Purpose and background

This report presents the methodology and analysis we used in our investigation of a 'motherhood penalty' in New Zealand. It is intended for those interested in the technical details behind the findings we present in Effect of motherhood on pay – summary of results.

This analysis provides initial insight that identified a need for further, more thorough investigation.

Feedback

Throughout this report we refer to the difference between the gender pay gap for parents and the gender pay gap for non-parents as the 'motherhood penalty'.

We're keen to hear your feedback to guide future research on the motherhood penalty. Email info@stats.govt.nz to give us your comments.

Research questions

This report addresses the following research questions:

- Is there a gender pay gap when controlling for age?
- Is there a motherhood penalty?
- If a motherhood penalty exists, does it differ between full-time and part-time work?

Background to the gender pay gap

The difference in earnings between men and women, known as the gender pay gap, has been observed for many years in New Zealand. Statistics NZ publishes statistics about income and the gender pay gap using information from the Household Labour Force Survey (HLFS). In these statistics, the gender pay gap is the percentage difference between the median pay for men and the median pay for women.

Results show the size of the gender pay gap has generally been decreasing since 1998 (see figure 1).

See Measuring the gender pay gap for more information about these statistics.

Figure 1

Gender pay gap
June 1998–2016 quarters

Source: Statistics New Zealand

The gender pay gap is caused partly by men and women working in different occupations and industries, or by interrupted and changing working patterns due to parenthood. For example, parents (especially mothers) may take time out of the workforce or move to part-time work to care for their children.

The Ministry for Women has been investigating the underlying drivers of the gender pay gap. It indicated to Statistics NZ that the motherhood penalty has an ongoing effect on the gender pay gap and this was understudied in New Zealand. This prompted collaboration with Statistics NZ to investigate the motherhood penalty.

Background to this report

For our analysis here, we considered the contribution parenthood makes to the gender pay gap, particularly whether there is a difference between the gender pay gap for parents and the gender pay gap for non-parents.

This report presents the results from early investigations with HLFS data – using an Analysis of Covariance (ANCOVA). The model allows comparisons between groups, such as parents/non-parents and full-time/part-time employees, while controlling for factors such as age. Using ANCOVA allows us to provide further insight into the information available on the gender pay gap.

The different methods used to calculate the gender pay gap mean the results in this report should not be compared with the existing measure of the gender pay gap from the HLFS.

Findings from international and New Zealand studies

International studies indicate a persistent motherhood penalty in the pay for women with children, compared with women without children (Joshi, Paci, & Waldfogel, 1999, UK population; Waldfogel, 1997, US population). Men suffer no such penalty – their wages are either unaffected (Loh, 1996) or even increase after having a child (Lundberg & Rose, 2000).

The motherhood pay gap: A review of the issues, theory and international evidence (PDF, 82p) from the International Labour Office acknowledges variations in measurement of the motherhood penalty concept internationally and provides a global overview.

Budig and England (2001) summarise explanations for the association between motherhood and lower wages.

- Many women spend time at home caring for children, which interrupts their job, or at least interrupts full-time employment (a 'work experience' explanation).

- Mothers may trade higher wages for 'mother-friendly' jobs that are easier to combine with parenting (a 'trading for flexibility' explanation).

- Mothers may earn less because the needs of their children leave them exhausted or distracted at work, making them less productive (a 'lower productivity' explanation); however, to our knowledge no studies have explored this.

- Employers may discriminate against mothers, either consciously or unconsciously (an 'unconscious bias or discrimination' explanation).

The Institute for Fiscal Studies (2016) in the UK highlighted the continuing importance of the motherhood penalty as a contributor to the gender pay gap. Their report indicated a gradual but continual increase in the wage gap for employed mothers after having their first child, which led to women's hourly wages being one-third below men's by the time their first child was aged 12.

In New Zealand, Dixon (2000) studied the effects of motherhood on earnings. She developed a model that predicted the hourly earnings penalty was 7 percent for having one child. Having two or more children increased the penalty to 10 percent.

The analysis took into account women's level of education and age, and concluded mothers earn less than would be expected if they had not had children. The penalty for having children decreased when controlling for years spent in the workforce. This supports the theory that the effects of having children on women's earnings come largely from work breaks and reduced work experience.

The results also differed by whether women were partnered or not, with partnered mothers experiencing a smaller penalty than sole mothers. Dixon concluded the results explained about one-third of the total gender pay gap.

When we examine the explanations for the motherhood penalty suggested by Budig and England (2001), there is no strong evidence in New Zealand to show mothers trade higher wages for 'mother-friendly' jobs that are easier to combine with parenting. Flynn and Harris (2015) found the distribution of women aged 25–49 years across industries was much the same, regardless of their parental status.

Partnered mothers and women without children had similar occupational distributions too (the two groups varied by 4 percent or less). However, it remains possible that occupational variation could contribute to a motherhood penalty.

Flynn and Harris also looked at the highest level of occupations, such as managers and professionals. Within these occupation groups it is not possible to identify specific positions. For example, a mother could be a supervisor and a non-mother could be an executive, but both are classified as managers. Therefore, it is possible that mothers may be selecting 'mother-friendly' jobs, but to know this we would need to look at more-detailed occupational data (which is beyond the scope of this report).

2 Methodology

This section outlines the methodology we used to calculate the gender pay gaps for parents and non-parents.

Data source and definitions

For this report we used data from the weighted Household Labour Force Survey (HLFS) earnings data for the June 2016 quarter.

The HLFS is a suitable source of data for assessing the motherhood penalty because it collects information about individual hourly earnings from respondents. It also gathers other demographic and socio-economic characteristics such as age, sex, occupation, and qualifications. However, because HLFS data are cross-sectional rather than longitudinal, it is difficult to correct for any cohort effects that may be present (see Limitations).

The population used in this analysis was individuals aged 15 years and over living in households and earning a wage or salary.

Individuals are identified as parents or non-parents, and full-time or part-time workers.

A parent is defined as a person with a dependent child living in the same house, and who defines themselves as a parent in their family. A dependent child is a child aged under 15 years, or a child under 18 who does not have full-time work. Parents whose children have left home, or sole parents whose children are living with the other parent at the time of the survey, are not identifiable in the HLFS and therefore not included in the parent group for this analysis.

Full-time employment is 30 hours or more a week; part-time employment is less than 30 hours a week.

Many characteristics of the population may affect the size of the gender pay gap so we also used the following variables in our analysis:

- sex
- age
- ethnicity – to maintain sample sizes large enough for meaningful analysis we prioritised ethnic group responses to one per individual; this is not Statistics NZ's normal practice, but we considered it the most appropriate for this report
- occupation (level 1 of the Australian and New Zealand Standard Classification of Occupations).
- industry (level 1 of the Australian and New Zealand Standard Industrial Classification).
- qualification.

Analysis

We used an analysis of covariance (ANCOVA). This is a standard general linear model that combines regression with analysis of variance. We selected this technique because it allowed us to remove the effect of variables such as age when comparing the earnings of groups of people (eg parents and non-parents). Within the ANCOVA model we also controlled for an ethnicity-by-age interaction to account for different age distributions within each ethnicity.

The distribution of earnings is generally skewed (many people earn around the median and only a few people earn increasingly large amounts), so we had to transform the data to use an ANCOVA. We transformed the earnings distribution using the natural log (ln) of hourly earnings.

Using an ANCOVA, we first compared earnings of male and female employees, removing the effect of age, ethnicity, occupation, industry, and qualification level. Next we compared the earnings of male parents with female parents, and male non-parents with female non-parents. Finally, we compared the gender pay gaps of parents and non-parents for full-time and part-time work.

Presenting the results

To present our results we converted the logarithmic averages and confidence intervals produced by our ANCOVA model into dollar amounts.

Due to the nature of this analysis, we are reporting means corrected for age rather than medians. Unfortunately we cannot produce means corrected for other factors as ANCOVA only produces means corrected for continuous variables.

Means should only be used to represent the patterns between groups, not the size of the difference.

3   Results

This section presents our findings for the research questions about the 'motherhood penalty'.

Is there a gender pay gap?

For the June 2016 quarter, we found a significant difference between the hourly earnings of female and male employees after we applied controls ($F[1,54]=116.57$, $p<0.001$).

When comparing means controlled for age we found that women were paid an average of $22.40 an hour. Men were paid significantly more: an average of $25.24 an hour.

Using the methods outlined above the gender pay gap was 11 percent. While this is broadly consistent with the existing measure of the gender pay gap from the HLFS, the different methods used to calculate the gender pay gap mean the two figures should not be compared.

Note: Data and survey limitations make it difficult to control for categorical variables such as industry when producing means.

See table 1 in the appendix for mean hourly earnings and confidence intervals.

Is there a motherhood penalty?

After confirming the presence of a significant gender pay gap, our analysis showed the gender pay gap for parents was larger than the gender pay gap for non-parents.

We found that parents in general get paid much more than non-parents, but there is a significantly larger pay gap between male parents and female parents than there is between male non-parents and female non-parents. This difference is the motherhood penalty.

Note: the motherhood penalty can be calculated in several ways. Elsewhere it is sometimes calculated as the pay gap between women with children and women without children.

Figure 2 shows the gender pay gap, represented by the steepness of each line, for parents and non-parents. The motherhood penalty is shown by the significantly steeper line between male and female parents, compared with that for male and female non-parents ($F[1,54]=39.79$, $p<0.001$).

Figure 2

Average hourly earnings
By sex and parent status
June 2016 quarter
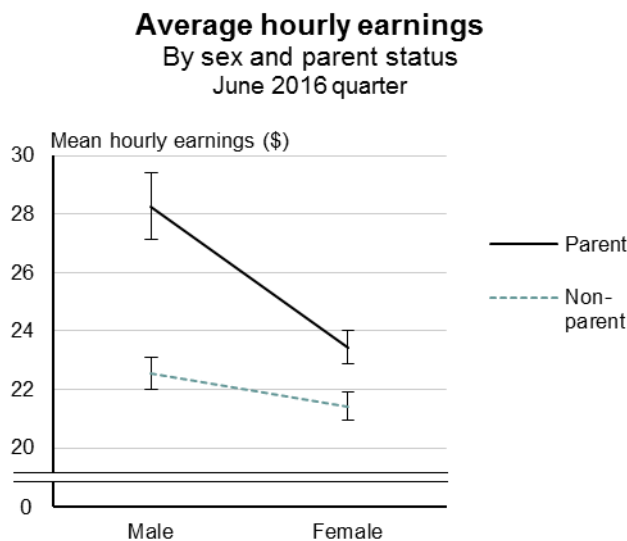
Note: Error bars are 95% confidence intervals.
Source: Statistics New Zealand

The higher pay for parents than for non-parents may be due to cohort effects that cannot be fully corrected – due to the 'point-in-time' nature of this survey. Examples of cohort effects are: legislative changes that affect different populations differently; or when dependent children leave home and mothers rejoin the workforce at lower pay rates – in the HLFS we do not define these people as parents.

Another example of a cohort effect is that younger people without children are generally in lower-paying occupations and are newer to the workforce. In this example, the difference in earnings would be controlled within our occupation variable and not captured in an effect of chronological age. Therefore, we would observe lower earnings in non-parents even when correcting for age.

Despite the possible cohort effects, the conclusions we draw from our analysis about the motherhood penalty still indicate reliable patterns in the data. This is because the comparisons we make are between men and women with children, and men and women without children. That is, we are assessing the between-subjects (parents vs non-parents) difference in gender pay gap, which is a within-subjects measure (men vs women for each parent status).

Does the motherhood penalty differ for full-time and part-time workers?

In the final stage of our analysis we considered whether the motherhood penalty differed depending on whether mothers worked full time or part time. We found it did differ, supported by a significant three-way interaction, $F_{(3,54)}=13.88$ $p<0.001$.

In figures 3 and 4, we see the gender pay gap between parents is similar for full-time and part-time workers (ie the line in each graph is of a similar angle).

The gender pay gap for non-parents who worked full time was larger than for non-parents who worked part time (ie the line is steeper for full-time work than it is for part-time work).

The large variance in the pay gap for fathers who work part time means the true average for the whole population is likely to vary from our average. We would need further

investigation to understand if this variance arises because of a small sample size relative to other groups (ie relatively few fathers work part time).

We found support for the motherhood penalty being larger for mothers working part time than for those working full time (ie the lines diverge more in figure 4 than they do in figure 3). However, we suggest this is due to a very low gender pay gap for non-parents working part-time.

Figure 3

Full-time workers' average hourly earnings
By sex and parent status
June 2016 quarter
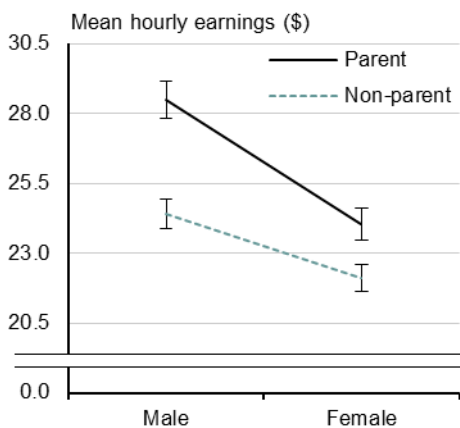
Note: Error bars are 95% confidence intervals.
Source: Statistics New Zealand

Figure 4

Part-time workers' average hourly earnings
By sex and parent status
June 2016 quarter

Note: Error bars are 95% confidence intervals.
Source: Statistics New Zealand

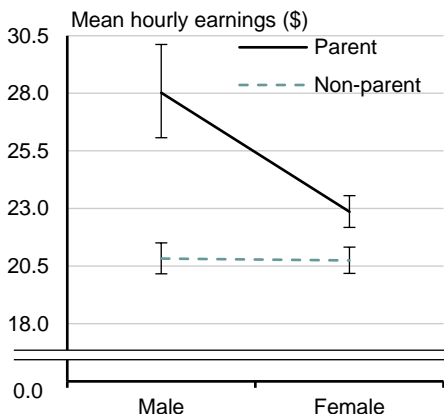# 4   Conclusions

Our analysis of Household Labour Force Survey (HLFS) earnings data indicated a gender pay gap existed, even after controlling for confounding factors such as occupation, industry, and age.

We then found the gender pay gap is greater for parents than it is for non-parents, which we defined as a motherhood penalty. A statistically significant motherhood penalty exists. That is, women with children are paid disproportionately less than men with children, compared with the pay difference between women without children and men without children. This finding aligns with international and national literature in this area.

Lastly, we found the motherhood penalty was greater for mothers working part time than for those working full time. However, we suggest this is due to there being a very small gender pay gap for non-parents who work part time and an equal gender pay gap between full-time and part-time work for parents.

We also found that parents (regardless of sex) are paid more than non-parents. Despite this being a consistent finding in HLFS earnings data, we do not fully understand how this difference arises. We assume it is a cohort effect between the populations that we have not fully controlled for – due to the point-in-time nature of the HLFS.

If this is the case, one possible explanation is that non-parents are more likely to be in the early stages of their working lives and therefore have lower earnings. However, we hesitate to draw any firm conclusions from this difference until we can isolate its cause. Instead, we focus on the pattern between sexes within the population of parents and non-parents.

We also observed a significant difference in the gender pay gap between full-time non-parents and part-time non-parents. In contrast, we saw no evidence of a difference in the gender pay gap between full-time parents and part-time parents.

Further work

Further investigation with longitudinal data could distinguish the effect of lost work experience on mothers' earnings, relative to any effect caused by mothers trading higher wages for 'mother-friendly' jobs. It could also look at subconscious or conscious discrimination against mothers from employers.

This further investigation is needed before firm conclusions can be drawn to assist with policy interventions addressing the gender pay gap.

5 Limitations

The main limitation around the conclusions possible from this analysis is the cross-sectional nature of the HLFS data. This means it is not possible to account for changes over time that may influence earnings of particular groups. For example, legislation that took effect from a certain moment in time may have affected some age groups but not others.

A further limitation results from the size of the HLFS sample. The relatively small sample size, particularly for groups such as part-time fathers, means the numbers we report do have uncertainty associated with them. Because of this, we advise looking at the patterns rather than focusing on specific numbers, which vary between HLFS quarters.

Some limitations also arise from the particular information captured by the HLFS. For example, it is only possible to reliably identify parents with dependent children living in the same home. We are not able to identify parents whose children have left home, or sole parents whose children are living with the other parent at the time of the survey.

Because we designed this work as a brief, initial analysis to identify potential (and a need) for further, more thorough investigation, the number of factors we investigated was deliberately narrow. For example, we did not control for household income and household composition. This would mean we would not identify where, for example, a high-earning spouse within a household could relieve pressure for the other partner to gain employment with high earning potential.

6   Future directions

Longitudinal work is the logical next step, and some work is already underway. Statistics NZ is currently investigating the different effects on labour market participation for mothers and fathers after the birth of their first child – using the longitudinal Survey of Family, Income, and Employment data.

This report directs and promotes future work in this area, which ideally involves longitudinal work. One means to achieve this is to use the Integrated Data Infrastructure, a large database that links information from many different administrative data and survey sources.

Our report allows us to generate rigorous hypotheses and well-designed follow-up work using integrated data.

Ideally, future longitudinal research on this topic would investigate:

- the effects of a gender pay gap over time (duration), by measuring lifetime earnings
- relative effects on earnings for female and male employees with children following the birth of their first child, and how the gaps in earnings progress; and:
  o how these effects on earnings differ by part-time and full-time work
  o how these effects differ from the earnings of female employees without children
- whether there is any evidence of mothers trading earnings for flexibility following the birth of their first child, either by changing occupations or employer
- when controlling for productivity differences as much as possible, are there differences in the earnings of female employees with children – relative to male employees with children and female employees without children? If so, how do these differences change over time?
- the gender pay gap and motherhood penalty across ethnicities.

7   References

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Appendix: Mean hourly earnings and confidence intervals

These tables show mean hourly earnings by sex, parent status, and full-time / part-time employment status along with associated confidence intervals.

The mean hourly earnings estimates here are produced using the statistical model described in this report (see Methodology). Therefore they differ from the median hourly earnings estimates published from the HLFS and available in NZ.Stat.

Table 1

Hourly earnings by sex, June 2016 quarter

Sex	Mean hourly earnings ($)	95% confidence interval	
		Lower	Upper
Male	25.24	24.57	25.92
Female	22.40	21.93	22.89

Source: Statistics New Zealand

Table 2

Hourly earnings by parent status, June 2016 quarter

Parent status	Mean hourly earnings ($)	95% confidence interval	
		Lower	Upper
Non-parent	21.97	21.51	22.44
Parent	25.73	25.06	26.43

Source: Statistics New Zealand

Table 3

Hourly earnings by sex and parent status, June 2016 quarter

Parent status/sex	Mean hourly earnings ($)	95% confidence interval	
		Lower	Upper
Non-parents			
Male	22.54	22.02	23.08
Female	21.41	20.94	21.90
Parents			
Male	28.25	27.15	29.40
Female	23.44	22.89	24.00

Source: Statistics New Zealand

Table 4

Hourly earnings by sex, parent status, and full-time / part-time employment status, June 2016 quarter

Parent status/sex	Mean hourly earnings ($)	95% confidence interval	
		Lower	Upper
Employed full time			
Non-parents			
Male	24.40	23.88	24.94
Female	22.10	21.61	22.59
Parents			
Male	28.48	27.83	29.15
Female	24.03	23.44	24.63
Employed part time			
Non-parents			
Male	20.83	20.17	21.51
Female	20.75	20.19	21.33
Parents			
Male	28.02	26.07	30.12
Female	22.86	22.18	23.56

Source: Statistics New Zealand