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The Impact of Children on the Lifetime Earnings of Australian Women: Evidence from the 1990s

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Abstract

This article presents estimates of the impact of child rearing on the lifetime earnings of Australian women using 1997 cross-sectional data. It is found that women with children have substantially lower lifetime incomes than do childless women. For example, women with a secondary education with one child have lifetime after tax earnings around $160000 lower than is the case for childless women. Additional children are associated with much lower cumulative earnings. The article shows that the impact of having children on women's lifetime earnings decreased over the period 1986–1997. Explanations for the observed decrease are not directly investigated in the article. However, we canvass several possibilities including the increased availability of child care places which may have allowed women with pre-school children to return to the labour force much earlier than previous cohorts.

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1. Introduction and Motivation

There are both benefits and costs associated with raising children. In this article we concentrate on some of the issues surrounding the costs of having children. We choose this focus primarily because many of the benefits of child bearing and rearing are personal and/or psychological in nature, and not easily observable. It is also the case that in public policy terms it is costs, rather than benefits, that generate greater policy interest. In the past, public policy was mostly concerned with the *direct* costs of having children in the form of outlays on food, shelter, clothing, health and education. These direct costs were partly subsidised by child benefits and public provision of health, housing and education. The policy rationale for these subsidies was usually expressed in terms of the preservation of horizontal equity, and less explicitly, in terms of national goals concerning population growth, human capital development and general improvement in family living standards.[1]

What is of greater policy interest in the present is the *indirect* costs of children, in particular, the opportunity cost that parents (usually mothers) face due to the loss of income as a result of the time spent out of the labour force caring for children. This shift in focus towards the opportunity costs—described here as forgone earnings—faced by women with children

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is a reflection of several social and economic changes that have taken place over the past twenty years.

These include the increased participation of women in paid work and the increased rewards from work, in particular occupational superannuation; related changes in social expectations about the role of women as breadwinners; the increased prevalence of divorce and sole parenthood; and changed consequences for the economic well-being of women and their dependent children (Mitchell 1998; Shaver 1998). In the wake of these changes, public policy shifted away from addressing concerns about direct costs (for example, the introduction of means tests on child benefits and the severe curtailing of the provision of public housing) towards policies that reduce indirect costs (for example, child care subsidies) and enable women to maintain their labour force attachment while caring for preschool age children. These shifts highlight the importance of empirical research on the indirect costs of having children and can be illustrated by reference to two policy arenas in which providing estimates of these costs may make a substantive contribution to future policy directions.

One issue concerns the outcome of the interplay between the perceived costs and benefits of having children by prospective mothers and their partners. If costs are perceived to far outweigh benefits, then we would observe many women (couples) delaying their childbearing or choosing not to have children at all. The demographic evidence of declining fertility in Australia today is consistent with these trends. Concerns about declining fertility and the economic consequences of ageing have led some researchers to advocate a return to family income policies that aim to address the implications of these direct costs.[2]

Second, and partly related to the above, is that there may be a greater awareness on the part of young married women with respect to the economic consequences of divorce. Currently over 40 per cent of marriages end in divorce and this often means that sole parents are likely to face difficult income circumstances. Consequently the costs of raising children—both direct and indirect—figure prominently in divorce settlements and child support determinations by government agencies.[3]

There has been a great deal of research on the direct costs of raising children (see, for example, Australian Institute of Family Studies 2000). However, the associated opportunity costs—forgone earnings—have received much less attention, even though they are potentially very high. The only existing estimates for Australia are reported in Beggs and Chapman (1988). This research suggested that in 1986 having a child was associated with a lifetime (after tax) earnings loss of about $435000 (in 1997 terms) for women with average levels of education. Second and third children were associated with lower lifetime earnings of an additional $75000 and $55000 respectively. While the results of this research retain a methodological interest, it would be expected that the size of these forgone earnings estimates, not to mention the immediate policy implications, are certainly dated.

What follows updates and improves the Beggs and Chapman analysis. The updating takes the form of using a new cross-sectional 1997 data set. We also offer technical improvements which involve the use of more sophisticated econometric approaches.

There are good reasons to suspect that the Beggs and Chapman estimates are no longer an accurate reflection of the forgone earnings associated with child rearing. Most importantly, in recent times Australian women have increasingly combined employment with motherhood. For example, between 1986 and 2000 the rate of employment of women with a youngest child aged less than 5 years increased from 35.7 to 45.0 per cent. There has been a similar increase in the employment rate of women with a youngest child aged 5 to 15 years from 58.4 to 66.8 per cent (ABS Cat. no. 6224.0). Changing wage rates for women and policy shifts in areas such as child care are also likely to have had an impact on forgone earnings estimates.

In the following section, we set out the methodology adopted in this study and discuss the data to be used. Section 3 describes the model specifications and application to the data. The results indicate that in the late 1990s the level

of lifetime (after tax) forgone earnings from child rearing is around $160000 for a first child, and about $12000–$15000 for each additional child. This suggests that since the mid-1980s there has been a substantial fall in the forgone earnings from child rearing and Section 4 provides a series of simulations to illustrate these changes for women with differing levels of educational attainment and numbers of children. These results are then compared with the findings of Beggs and Chapman. Section 5 concludes with some possible explanations and areas for future research that follow from the observed changes.

2. Methodology and Data

The question addressed is, what are the lifetime earnings of women with children compared to women without children? Since it is important that variables associated with decisions to have children and decisions concerning employment are taken into account, controls for such factors are critical, and these are typically only available from cross-sectional data. If this is not done properly, comparisons of earnings differences between women with and without children will reflect the influence of economic and behavioural factors in fertility and employment decisions that do not accurately represent the forgone earnings of child rearing for a 'typical' woman.

The basic idea is that since raising children takes time, families make choices concerning the hours a parent spends in this activity compared to being in paid employment. The choice made will thus have implications for annual household earnings, which are affected by three things: whether or not a person chooses to participate in paid employment; the number of hours worked; and the hourly wage rate received.[4]

Since what a woman would have earned had she never had children is unknown, forgone earnings are defined as the difference between what a woman with a particular pattern of bearing earns and what an otherwise similar childless woman earns. Empirically this is achieved using an earnings equation framework augmented with variables capturing the number and age of children. This allows for the effects of measurable characteristics that are related to earnings to be taken into account. Characteristics include educational attainment, partner's income and labour market experience.

Of more significance are unmeasured variables, and what they might mean for labour market and fertility choices. There are a host of these, and they have the potential to reduce the interpretation of income differences as mere reflections of the presence and number of children. They are as follows.

First, the decision to have one or more children may reflect a woman's interest in and capacity to spend time rearing offspring versus time spent in the labour market. In other words, fertility decisions may reflect women's innate capacities and interests. From this perspective, women best suited to labour market activity will take this into account in choices made with respect to children.

Some published exercises attempt to model the simultaneity of the fertility and paid work decision, with mixed results (Joshi, Paci and Waldfogel 1999; Tommaso 1999). However, data limitations have meant that the literature concerning the forgone earnings from child rearing does not usually address this issue (Joshi 1990; Calhoun and Espenshade 1988). Our approach similarly does not explicitly take into account the endogeneity of the fertility decision, mainly because using the Negotiating the Life Course Survey (NLCS) does not have suitable variables to identify these effects.[5] However, we do attempt to account for other selection effects, and these are considered below.

A second conceptual issue is that a woman's choice to participate in paid work, and the number of hours chosen, will be conditioned in part by her comparative advantage in paid employment. In what follows this is taken into account through the estimation of a Heckman sample selection correction model. While the NLCS has available some useful information to facilitate and strengthen this approach, there will always be concerns with the method that the data are not rich enough to allow full confidence that this critical selection issue has been adequately handled.

Third, fertility, child rearing and labour market decisions must be understood as reflections not only of the mother's decision, but also as choices made in the context of the household. There are (at least) two reasons for this:[6]

(i) A woman's choices will be conditioned in part by the characteristics of her partner. Usually these characteristics are ignored in simple analyses of forgone earnings from child rearing, but should affect our interpretation of the effect of children on a woman's earnings.

(ii) A father's labour market decisions may be influenced by the labour market decisions of his wife. In particular, if the mother chooses to do less paid work because of a desire to spend time rearing children, it is highly probable that her decision will impact on the father's choice concerning both market time allocation and commitment in other ways to paid employment. Indeed, fertility and market time allocation decisions for the household are a dynamic and ongoing process.

The broad point is that estimates of the 'forgone earnings from child rearing' should not be interpreted only as the market opportunity cost of children for the general population. Fertility is not an exogenous event, and work decisions reflect highly significant factors that are very difficult to model and control for. Further, whether or not to have children, and the number to have, depends on other household choices, and these are not modelled. As in all areas of labour market analysis, circumspection with respect to the meaning of results is mandatory.

2.1 The Negotiating the Life Course Survey

The data are from the first wave of an Australian random sample panel study conducted by the Research School of Social Sciences at the Australian National University and the University of Queensland, known as the NLCS. The survey began in 1997 with the sample numbering approximately 2400 people, who were then aged between 18 and 54. While the plan is to follow this group over a 10-year period, at the time of writing there was only one wave available, meaning that the exercise in this article uses a single cross-section of data.

The survey is a national simple random sample of private households in Australia. While there are no geographic limitations upon the sample or any form of stratification, as a White Pages sample, it does not include households without telephones or with unlisted numbers. Only one eligible person in each household was interviewed, with she/he being selected randomly on the basis of having the most recent birthday. Because only one person per household is interviewed, the sample underrepresents households with more than one eligible respondent. In other respects the data set is representative of the population.

The NLCS gathered information on both individual level and household variables and contains almost 300 questions on a range of issues including educational attainment, family structure, employment status, income and sources of income of respondents and their partners.[7]

2.2 Sample Description

The sample used in the estimates of the impact of child rearing upon women's annual earnings consists of 981 women aged 18 to 55 in 1997. Throughout the article the self-employed are excluded due to the difficulties in interpreting income data for this group.[8] Age cohorts exhibit different characteristics in terms of their employment status, work hours and annual earnings, a point illustrated in Table 1 which shows a U-shaped relationship between age and the proportion of women in paid employment. Amongst those who worked, women aged less than 25 years worked the longest hours—about 37 hours per week on average.

Table 2 presents aggregate data on the major characteristics for women with and without children, with 28.8 per cent of the total sample being childless. The data suggest that women with children are different to those without children in terms of age, education, employment status and source of income.

Table 1 Characteristics of Different Age Cohorts

	Age cohort (years)			
	Under 25	*25 to 34*	*35 to 44*	*Over 44*
Employed (per cent)	69.7	62.4	65.9	68.7
Hours worked if employed	37.0	33.8	30.7	32.0
Annual wage and salary earnings ($ after tax)	16834	21303	19813	20750
Number of observations	155	356	405	252

Source: NLCS (1997).

Table 2 Major Characteristics of the Sample by Number of Children

	Number of children			
	Zero	*One*	*Two*	*Three*
Average age (years)	28.8	34.5	38.9	41.8
Employed (per cent)	80.9	60.9	60.2	56.6
After tax earnings[a] ($)	18292	12352	10840	9933
Number of observations	346	151	322	304

Note: (a) After tax earnings include zeros.

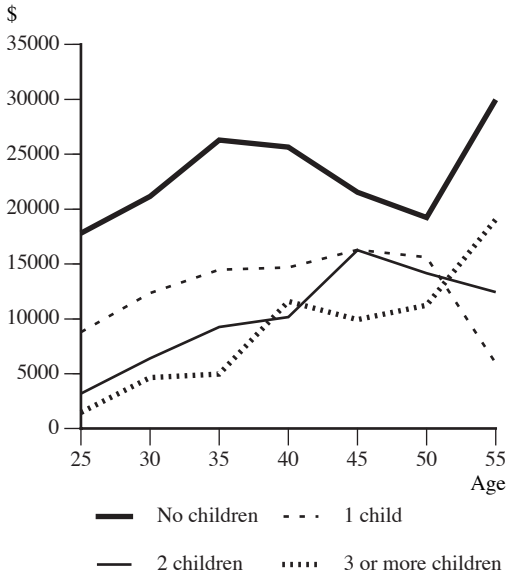
Source: NLCS (1997).

As the number of children increases, the average age of respondents increases. Women with no children had an average age of 28.8 years, which increased to 41.8 years for women with three or more children. As expected, the proportion of women employed decreases as the number of children increases. For example, 80.9 per cent of women with no children were employed, 60.9 and 60.2 per cent of women with one or two children respectively were employed and just 56.6 per cent of women with three or more children were employed.

In this sample, the data suggest that average annual after tax earnings decrease with the number of children. Women with no children had the highest average annual earnings of $18292. There is a large drop in average annual earnings of about $6000 between a childless woman and those with one child. Women with two or more children earned, on average, slightly less than did women with one child.

Figure 1 presents average after tax annual earnings for five-year age cohorts for women with no children, one child, two children and three or more children. These averages are indicative of the earnings patterns over the life course as there is clearly an association, particularly at younger ages, between annual earnings and fertility choices. For example, for the cohort of women aged between 30 and 34, those with three or more children earn around

Figure 1 Average Net Annual Earnings, by Number of Children and Age



Source: NLCS (1997).

19 per cent of the income of women with no children. The relationship between earnings and the number of children for older cohorts is less clear. This is partly related to smaller sample sizes in the older age groups. It could also be a reflection of the fact that among this age group, some women will have started to leave the labour force or reduced their hours as a transition to retirement. The households of women over 45 are also a mix of 'empty nests' and some where there are 'adult children' still resident.

3. Model Specification

The impact of child rearing on annual earnings is estimated in two steps. We first estimate the impact on the probability of employment and second, for women who are employed, the impact on annual earnings. The total effect of child rearing on annual earnings can then be derived as the combination of the impact of these two factors.

In principle, the effect of child rearing on the annual earnings of employed women can be further broken down into an effect on annual working hours and on hourly wage rates. However, this is not possible using the NLCS data because although earnings are recorded in annual terms, the number of weeks worked in the year is not known; thus it is not possible to estimate hourly wage rates.[9] Given that our primary interest is the impact of child rearing on annual earnings, this is not a serious limitation.

3.1 The Probability of Employment Equation

The determinants of the probability of employment are modelled using probit estimation. Economic theory suggests that a range of economic and demographic variables are determinants. The theoretical basis underlying these relationships is well known and will not be discussed in detail here.[10] All explanatory variables included in our models are set out in Appendix 1 and the key variables are briefly described below.

Actual labour market experience (EXP) is included because it influences a person's wage and thus reflects the opportunity cost of not taking a job. Experience squared (EXP^2) is included to allow for a non-linear relationship between experience and the probability of employment. The actual labour market experience variable is constructed using retrospective information on labour market experience since leaving full-time education.

Age cohort variables are included to allow for structural changes in the relationship between child rearing, labour market participation and earnings over time.[11] Specifically there are dummy variables for being aged 24 years or less (AGE24) and 25 to 34 years (AGE34). Controls are also included for marital status (MAR), and highest educational attainment level: completed secondary education (YR12); a trade qualification (TRADE); and a degree/diploma level qualification (DEGREE/DIPLOMA). Theoretical models suggest, and empirical work shows, that the income of a woman's partner (P-INC) is an important determinant of her labour supply decision; consequently the estimation includes this variable.

The impact of child rearing on the probability of employment is captured in a number of ways. The permanent impact of the presence of a child is captured by a dummy variable that takes the value of one if a woman has ever had a child. In addition, there are a series of variables reflecting whether a woman has one child under 3 years of age; two or more children under the age of 3; one child between the ages of 3 and 15; two children between the ages of 3 and 15; and three or more children between the ages of 3 and 15.

The impact of children on the probability of employment will also be captured via the impact of child rearing on labour market experience. The extent to which women with children spend more time out of employment compared to childless women will be reflected in having less labour market experience at any given age. Part of the impact of children upon earnings will therefore be captured through the experience variable.

Two variables capturing attitudes about combining work and family are included. These are dummy variables reflecting the strength of respondents' agreement with views on this issue.[12]

In the analysis presented below the omitted categories are having less than Year 12 education; not being married or de facto; having children over 15 years of age; and older than 45 years. Appendix 2 presents the descriptive statistics of the estimation sample.

3.2 The Annual Earnings Estimation

The estimation of the determinants of earnings has an extensive literature, and the methodological framework of these studies is generally adopted here.[13] In this approach the natural logarithm of earnings is expressed as a function of labour market experience, the number of years of schooling and a number of other economic and demographic variables. The variables included in the earnings estimation are similar to those included in the probability of employment equation. The differences are that tenure (TEN) with the current employer is included to capture the impact of firm-related experience. Tenure squared (TEN^2) is included to allow for a non-linear relationship.

An important econometric issue relates to sample selection, which is important for the following reason. Women choosing employment are likely to be different to women not in employment, as a consequence of factors that are generally not observed. Thus if we want to draw inferences about the wider population, it is important to investigate whether the selection process leads to invalid conclusions.

Conventionally this type of selection problem is addressed by estimating the expected value of the error term and using this as an extra explanatory variable which will, in theory, eliminate potential biases from inferring the results to all women—the so-called Heckman sample selection correction approach (Greene 1997). A critical part of the sample selection correction is that the correction term can be identified separately from the other parameters in the model of interest.

The most problematic part of these sample selection corrections entails finding valid instruments that identify the sample selection process. However, for the instruments to be useful they must be related to the probability of employment but not to earnings for those employed, and this problem is rarely sorted out.

In this context, an innovation in our approach is that the NLCS data set has variables measuring respondents' attitudes with respect to the issue of women combining paid work with family responsibility. There is evidence from qualitative studies that similar variables measuring attitudes about combining work and family are strongly related to the probability of employment but not related to earnings (see Duncan and Rosalind 1999).[14]

3.3 Model Results

This section presents the results of the estimation of the probability of employment and annual earnings equation. We first discuss the estimates of the probability of employment and then annual earnings, paying particular attention to the impact of children. We then bring together the estimates of the impact of children upon the probability of employment and annual earnings if employed to estimate the impact of children upon lifetime earnings. The full estimation results are presented in Table 3. The probability of employment equation appears to be generally well specified and the coefficient estimates broadly consistent with expectations. We found no evidence of heteroscedasticity using a conventional Wald Test.

Because the effects of changes in the explanatory variables on the probability of employment vary with the value of *all* the explanatory variables in the model, simply reporting these coefficients conveys very little to the reader. We therefore illustrate the 'marginal effects' for each of these variables, using a hypothetical case described in the note to Table 4. The effects reported show the change in the predicted probability of employment for a ceteris paribus change in a variable.

The key results reported in these two tables are that labour market experience is positively related to the probability of employment and is statistically significant. Higher levels of educational attainment are also estimated to increase the probability of employment. For example, a degree/diploma level qualification or a trade

qualification is estimated to increase the probability of employment by 8.1 and 10.4 percentage points relative to those who completed Year 12. Non-completion of Year 12 is estimated to decrease the probability of employment by 8.0 percentage points.

An increase in partner's income is estimated to increase the probability of a woman working and is statistically significant. Being married is statistically insignificant. A cohort effect is found with the age cohorts less than 24 years and 25 to 34 years being more likely to be employed than the older age cohort (aged 35 years plus). This provides support for the proposition that women's labour market behaviour has been changing over time in ways not captured by the measured variables.

Table 3 Probability of Being Employed

	Coefficient	*t-value*
EXP	0.166	7.25
EXP^2	–0.003	–5.19
AGE24	0.790	3.52
AGE34	0.424	3.31
MAR	–0.059	–0.43
DEGREE/DIPLOMA	0.762	4.29
TRADE	0.977	3.34
YR12	0.302	3.12
NESB	–0.297	–1.65
Ever had a child	–0.267	–1.79
1 child aged under 3 years	–0.727	–5.04
2 children aged under 3 years	–1.599	–3.30
1 child aged 3 to 15 years	–0.068	–0.52
2 children aged 3 to 15 years	–0.117	–0.83
3 children aged 3 to 15 years	–0.099	–0.57
P-INC	0.000	2.23
Couple should contribute to the household income	0.390	4.18
Husband should be the main breadwinner	0.553	5.92
Constant	–1.763	–6.56
Number of observations	1077	
R-squared	0.21	
Log likelihood	–552.7	

Notes: The omitted categories are having incomplete secondary education, being aged 35 years or more, and being born in Australia or being an English speaking migrant.

For the definition of variables see Appendix 1.

The presence of children is estimated to have a negative impact on the probability of employment. The estimates reveal that having a child permanently reduces the probability of employment by 7.0 percentage points. The presence of young children has a very large negative effect upon the probability of employment. Having one child aged less than 3 years of age and two children less than 3 years of age are estimated to decrease the probability of employment by 22.6 and 56.1 percentage points respectively. Having children aged 3 to 15 years is estimated to have no additional effect upon the probability of employment.

Table 5 presents the estimates of the earnings equation. A complete set of estimates for the Heckman estimation is provided in Table A2 in Appendix 3. The coefficient estimates are generally consistent with expectations. An increase in labour market experience is estimated

Table 4 Marginal Effects on the Probability of Employment
(per cent)

	Marginal effect
EXP	1.6
AGE34	–10.0
MAR	–1.4
DEGREE/DIPLOMA	8.1
TRADE	10.4
Incomplete secondary education	–8.0
NESB	–7.9
Ever had a child	–7.0
1 child aged under 3 years	–22.6
2 children aged under 3 years	–56.1
1 child aged 3 to 15 years	–1.6
2 children aged 3 to 15 years	–2.8
3 children aged 3 to 15 years	–2.4
P-INC	0.3
Couple should contribute to the household income	7.2
Husband should be the main breadwinner	9.2

Note: Marginal effects are calculated relative to a base case woman who has 13 years of labour market experience, is aged less than 24 years, is not married, has a highest level of educational attainment of completed secondary school and never has had any children.

For the definition of variables see Appendix 1.

to increase annual earnings at a decreasing rate and the effect is statistically significant. Similarly, an increase in tenure is estimated to increase earnings at a decreasing rate. Increases in educational attainment are estimated to increase earnings.

Motherhood is estimated to permanently reduce the annual earnings of employed women by 26.8 percentage points. The coefficient on the variable measuring having one child under the age of 3 years is negative but statistically insignificant. However, having two or more children under the age reduces earnings by 62.5 percentage points and the effect is statistically significant. Variables associated with various numbers of children aged between 3 and 15 are negative but do not have a statistically significant impact on annual earnings.

The total impact of child rearing on annual and lifetime earnings will depend upon the combined effect of the impact upon the probability of employment and the impact upon annual earnings if employed. Section 4 uses a simulation-based approach to estimate the net impact effect of children upon lifetime earnings for several patterns of fertility over the life course.

The total impact of child rearing on annual earnings will depend upon the combined effect of the impact upon the probability of employment and the impact upon annual earnings if employed. Table 6 presents the total effects of different numbers and ages of children on annual earnings. There is a permanent effect on a mother's earnings from ever having had a child, in the order of $8444 per year. If a woman has one child under the age of 3 years her annual earnings are decreased by a further $17006 for every year that the child is aged less than 3. For every year a woman has two children under the age of 3, earnings are estimated to be reduced by $25046. Once children reach the age of 3, the extent of earnings reduction is $10472.

Table 5 Determinants of Net Annual Earnings, Sample Selection Correction Estimates

	Coefficient	*t-value*
EXP	0.070	5.34
EXP^2	–0.001	–3.68
TEN	0.030	2.94
TEN^2	–0.001	–2.29
AGE24	0.411	3.60
AGE34	0.309	4.21
MAR	–0.035	–0.47
DEGREE/DIPLOMA	0.551	9.10
TRADE	0.359	3.47
YR12	0.255	5.04
NESB	0.164	1.96
Ever had a child	–0.268	–4.44
1 child aged under 3 years	–0.142	–1.30
2 children aged under 3 years	–0.625	–3.57
1 child aged 3 to 15 years	–0.083	–1.14
2 children aged 3 to 15 years	–0.070	–0.89
3 children aged 3 to 15 years	–0.120	–1.10
P-INC	–1.25E-06	–0.78
Constant	8.904	56.61
Lambda	–0.025	–0.61
Number of censored observations	385	
Number of uncensored observations	679	
Log likelihood	–873.6	

Notes: The earnings equation is estimated using the Heckman two-step estimator. The Huber/White sandwich estimator of variance is used which results in standard errors that are robust to the presence of heteroscedasticity. The full Heckman estimates are presented in Appendix 3.

Table 6 Different Effects of Children on Net Annual Earnings

	Total effect on annual earnings ($)
Child older than 15 years	–8444
1 child aged under 3 years	–17006
2 children aged under 3 years	–25046
1 child aged 3 to 15 years	–10472
2 children aged 3 to 15 years	–10668
3 children aged 3 to 15 years	–11341

Notes: The effects on annual earnings are calculated for a woman with 13 years of labour market experience; with tenure of 5.9 years; aged less than 24 years; who is not married; who has a highest level of educational attainment of completed secondary school; and who was born in Australia. The effects shown reflect coefficient sizes irrespective of statistical significance.

4. Simulating Women's Earnings by the Number and Age of Children

The regression coefficients from the probability of employment and annual earnings modeling can be used to simulate the associations between child rearing and women's earnings, and these exercises are now reported. To simplify the presentation we consider four different scenarios with respect to children, with earnings being allowed to differ by three education levels: degree or diploma, completed secondary school, and incomplete secondary education.[15]

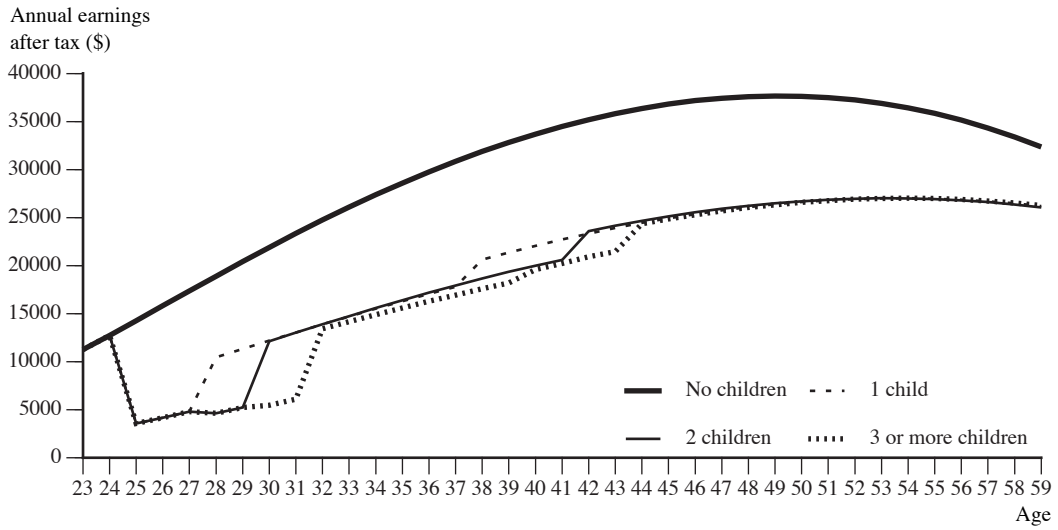
The hypothetical woman is assumed to marry at age 23 and face the decision of whether or not to have a child at age 25. If she decides not to have the child at this time, she remains childless. Women becoming mothers at age 25 then decide at age 27 whether or not to have a second child. Women not having a second child at age 27 are assumed to only ever have one child. Women with two children then face the choice of whether or not to have a third child, to be born at age 29. Women choosing not to do so are assumed to have only two children in their lifetime. Those women choosing a third child at age 29 do not have any further children.[16] In all cases the hypothetical woman is assumed to be in the cohort aged less than 25 years. Her partner's income is assumed to be $23409 (the mean of the data), and is assumed to stay constant over the woman's life.

4.1 Simulation Results

Figure 2 presents the simulated earnings profiles for the different scenarios associated with choices about children for women who have a highest level of educational attainment of Year 12. Clearly, having children has a marked negative and persistent influence on a woman's lifetime earnings profile. As expected, earnings decreases are greatest when the child or children are very young. Although earnings levels of women with older children are higher, they never reach the level of women who never had a child.

Tables 7 to 9 present the net present values (NPV) of lifetime earnings for each of the scenarios described above. The NPVs are calculated using two discount rates, 0 and 5 per cent. These calculations allow us to quantify the earnings loss for each scenario over the entire lifetime of a woman. There are several points worth noting from the tables, with the discussion now focusing only on figures for NPV calculated using a 5 per cent discount rate. First, for all education groups there is a considerable earnings reduction associated with having a

Figure 2 Lifetime Earnings Profiles of Women with Completed Secondary Education, by Number of Children



child. In percentage terms, using the 5 per cent discount rate, this amounts to 34.3, 37.4 and 38.8 per cent of total lifetime earnings for women with a degree/diploma, completed secondary and incomplete secondary education respectively.

Second, the absolute dollar amounts are large. For women with a degree/diploma, completed secondary education and incomplete secondary education respectively these figures are $221 350, $162 474 and $54 448.

Third, successive children are associated with much smaller earnings reductions. Taking only those women who have completed secondary school, the decrease in earnings from having a second and third (or more) child is respectively 2.6 and 6.0 per cent of the earnings of a woman with one child. In absolute dollar terms this translates into about $11 515 and $14 988 from the presence of both second and third children respectively.

It would be desirable for the estimates presented below to take account of social security payments, given that these subsidies affect income and are contingent on the presence and age of children. The estimates of forgone income were adjusted for the two types of family payments, which were related to the number and age of children: Basic Family Payments and Additional Family Payments. While the adjustment for the effects of children on family payments reduces the forgone income of children for the hypothetical women, in general the adjustments make relatively little difference to the magnitudes of the forgone income.[17] This finding is based upon the three 'hypothetical' women for whom the simulation exercise was conducted and further research is therefore

Table 7 NPV of Lifetime Earnings, Women with a Degree/Diploma

	NPV discount rate 0 per cent		*NPV discount rate 5 per cent*	
Number of children	*Lifetime earnings ($)*	*Per cent of childless earnings*	*Lifetime earnings ($)*	*Per cent of childless earnings*
Childless	1 624 151		645 211	
1 child	1 114 024	68.6	423 861	65.7
2 children	1 091 322	67.2	409 239	63.4
3 children	1 051 759	64.8	387 840	60.1

Table 8 NPV of Lifetime Earnings, Women Completing Secondary Schooling

	NPV discount rate 0 per cent		*NPV discount rate 5 per cent*	
Number of children	*Lifetime earnings ($)*	*Per cent of childless earnings*	*Lifetime earnings ($)*	*Per cent of childless earnings*
Childless	1 106 998		434 956	
1 child	733 031	66.2	272 484	62.6
2 children	714 529	64.5	260 969	60.0
3 children	687 146	62.1	245 981	56.6

Table 9 NPV of Lifetime Earnings, Women with Incomplete Secondary Education

	NPV discount rate 0 per cent		*NPV discount rate 5 per cent*	
Number of children	*Lifetime earnings ($)*	*Per cent of childless earnings*	*Lifetime earnings ($)*	*Per cent of childless earnings*
Childless	330 608		140 153	
1 child	214 134	64.8	85 705	61.2
2 children	205 725	62.2	80 620	57.5
3 children	197 235	59.7	75 644	54.0

needed to confirm these results in a more general setting. The simulation results are available from the authors on request.

4.2 Changes over Time: 1986 to 1997

Beggs and Chapman (1988) used data from 1986 to conduct a similar analysis to that presented here. Our approach differs slightly; the most important difference is that Beggs and Chapman used variables for having children aged less than 5 years and aged 5 to 15 years whereas our specification is for having children aged less than 3 years and aged 3 to 15 years. In order to allow direct comparison of the two studies, we have re-estimated forgone earnings for 1997 using the same specifications as Beggs and Chapman. These are reported in Table 10.

These estimates suggest that the cumulative loss in earnings due to child rearing have, in percentage terms, fallen dramatically between 1986 and 1997. This change is observed for all levels of educational attainment and numbers of children, with the differences varying from 15 to 30 percentage points. The main exception to this trend is women with a tertiary degree or diploma and only one child, whose forgone earnings changed by only 7 percentage points.

Most of the changes in the earnings–children relationships over the last decade or so are related to increased participation in the labour force amongst women with young children. For example, in 1986 a 26 year old woman who had completed high school and had one child under the age of 5 had a probability of employment of 15.4 per cent, whereas in 1997 an equivalent woman had a probability of employment of 39.5 per cent.[18] This change in labour force retention of women after the birth of children represents a significant shift from the patterns of previous cohorts. In the conclusion we discuss some of the factors underlying this shift and suggest areas for future research on forgone earnings.

5. Conclusion

This article has presented estimates of the relationship between child rearing and the lifetime earnings of Australian women. The results suggest that for women who have completed secondary education, having one child decreases after tax lifetime earnings by around $160000. The equivalent effect observed by Beggs and Chapman was $435000 (in 1997 dollars), a decrease of around $275000 in forgone earnings. We found that the decrease in forgone earnings also carried over to the impact of having additional children. In the 1986 study, the additional impact of a second child was estimated to be around $75000 and a third child around $55000. In 1997 the additional effects were found to be relatively small, in the order of $12000–$15000.

The critical factor implicated in these changes is the significant increase over the past ten years in the labour force participation of mothers, particularly those with young children. The participation rate of women with

Table 10 Comparison of the Estimated Impact of Children on Lifetime Earnings

	Educational attainment					
	Degree/diploma		*Completed Year 12*		*< Year 12*	
	1986	*1997*	*1986*	*1997*	*1986*	*1997*
Earnings loss	*Per cent of earnings of woman with no children*					
1 child	58.6	65.7	46.0	62.9	37.5	61.6
2 children	47.8	63.6	36.9	60.6	29.7	58.8
3 children	38.8	59.3	30.0	55.8	24.2	53.3

Notes: The estimates for 1997 are based estimates from the NLCS using a specification of children variables and hypothetical scenario of fertility which is consistent with that used by Beggs and Chapman (1988). The earnings losses are based upon the scenario of women having their first child when they are aged 25 years, women with two children having their second child at age 28 years, and those with three children having their third child at age 31. The full set of results is available from the authors on request.

pre-school children has risen by around one-third in the period between the two studies. This change in return-to-work patterns may be attributed to a number of causes which may vary in importance for individual women.

First, the increasing availability of part-time work in a range of service sector industries has provided labour force opportunities not available to previous cohorts of women. The ability to take advantage of these opportunities has been supported by increased availability of formal child care; subsidised child care places for low income families; and changed work place practices in respect of maternity leave and 'family friendly' leave arrangements.

Second, women's motivation and attitudes towards work are likely to have changed due to increasing levels of educational attainment; the impact of equal opportunity and affirmative action programs, in combination with equal wages, may provide greater incentive for women to maintain their labour force attachment.

Third, the introduction of public policies has increased the necessity for a second breadwinner to maintain living standards. For example, government policy has shifted away from income support for remaining at home towards income supplements for working parents; and income testing has severely restricted the availability of child benefits, access to child-related housing and health care assistance.

In the period since the first NLCS, there have been a number of policy shifts that have seen the withdrawal of government funding and/or legislative support for these labour market retention strategies. The impact of these changes will be captured by the NLCS conducted in 2000 and this should provide some evidence on the relative importance of policies such as child care funding for maintaining women's labour force attachment.

The NLCS 2000 will also provide an opportunity for testing the robustness of the findings presented here since a substantial proportion of the women surveyed in 1997 remained in the panel and the simulations reported in Section 4 can be compared with actual outcomes. A study of this nature may provide us with a clearer indication of the conceptual validity of the kind of approach to forgone earnings used here and in other international studies.

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Appendix 1: Variable Definitions

EXP: Years of actual labour market experience since leaving full-time education. Constructed using retrospective questions on labour market experience adjusted for estimated annual working hours in order to take account of the fact that women with children who are employed work, on average, shorter hours.

EXP^2: Square of experience.

TEN: Years of tenure with current employer.

TEN^2: Square of tenure.

AGE24 and AGE34: Dummy variables that take the value of one if the respondent is aged 24 years or less and aged 25 to 34 years respectively.

MAR: A dummy variable that takes the value of one if the respondent is married (includes de facto relationships) and zero otherwise.

NESB: A dummy variable that takes the value of one if the respondent is born in a non-English speaking country.

YR12: A dummy variable that takes the value of one if the respondent's highest level of educational attainment is the completion of secondary school and zero otherwise.

TRADE: A dummy variable that takes the value of one if the respondent's highest level of educational attainment is the completion of a trade qualification and zero otherwise.

DEGREE/DIPLOMA: A dummy variable that takes the value of one if the respondent's highest level of educational attainment is the completion of a degree or diploma and zero otherwise.

P-INC: The annual income of the respondent's partner. For single women this variable takes the value of zero.

Couple should contribute to the household income: A dummy variable that takes the value of one if the respondent agreed or strongly agreed with the statement that 'Both the husband and wife should contribute to the household income'.

Husband should be the main breadwinner: A dummy variable that takes the value of one if the respondent agreed or strongly agreed with the statement 'It is better for the family if the husband is the principal breadwinner and the wife has primary responsibility for the home and the children'.

Ever had a child: A dummy variable taking the value of one if the respondent has ever had a child and zero otherwise.

1 child aged under 3 years: A dummy variable which takes the value of one if the respondent has one child less than 3 years and zero otherwise.

2 children aged under 3 years: A dummy variable which takes the value of one if the respondent has two or more children less than 3 years and zero otherwise.

1 child aged 3 to 15 years: A dummy variable which takes the value of one if the respondent has one child aged 3 to 15 years and zero otherwise.

Table A1 Variable Means and Standard Deviations

	Not employed		*Employed*		*All women*	
	Mean	*Standard deviation*	*Mean*	*Standard deviation*	*Mean*	*Standard deviation*
EXP	10.29	7.42	13.82	8.06	12.61	8.02
EXP^2	160.76	215.92	255.73	260.72	223.17	250.28
TEN	0.29	1.96	5.88	6.06	3.88	5.67
TEN^2	3.91	33.29	71.22	144.32	47.16	121.71
AGE24 (per cent)	0.12	0.33	0.15	0.35	0.14	0.35
AGE34 (per cent)	0.35	0.48	0.30	0.46	0.32	0.47
MAR (per cent)	0.68	0.47	0.62	0.49	0.64	0.48
DEGREE/DIPLOMA (per cent)	0.05	0.22	0.13	0.34	0.10	0.31
TRADE (per cent)	0.01	0.11	0.04	0.20	0.03	0.18
YR12 (per cent)	0.42	0.49	0.48	0.50	0.46	0.50
NESB	0.11	0.31	0.07	0.25	0.08	0.27
Ever had a child	0.83	0.38	0.62	0.49	0.69	0.46
1 child aged under 3 years	0.28	0.45	0.12	0.33	0.18	0.38
2 children aged under 3 years	0.13	0.34	0.02	0.15	0.06	0.24
1 child aged 3 to 15 years	0.24	0.43	0.16	0.37	0.19	0.39
2 children aged 3 to 15 years	0.16	0.36	0.14	0.34	0.14	0.35
3 children aged 3 to 15 years	0.08	0.28	0.05	0.22	0.06	0.24
P-INC ($)	22245	23040	23231	24970	22893	24320
Couple should contribute to the household income (per cent)	0.51	0.50	0.74	0.44	0.66	0.47
Husband should be the main breadwinner (per cent)	0.56	0.50	0.75	0.43	0.69	0.46
Observations	385		738		1123	

2 children aged 3 to 15 years: A dummy variable which takes the value of one if the respondent has two or more children aged 3 to 15 years and zero otherwise.

3 children aged 3 to 15 years: A dummy variable which takes the value of one if the respondent has three or more children aged 3 to 15 years and zero otherwise.

Appendix 2: Variable Means and Standard Deviations

Table A1 presents the descriptive statistics of the estimation sample.

Appendix 3: Determinants of Net Annual Earnings, Heckman Estimation

Table A2 presents the determinants of net annual earnings.

Table A2 Determinants of Net Annual Earnings, Heckman Estimation

	Selection equation		*Earnings equation*	
	Coefficient	*t-value*	*Coefficient*	*t-value*
EXP	0.072	2.59	0.070	5.34
EXP^2	–0.001	–1.51	–0.001	–3.68
TEN	0.660	5.50	0.030	2.94
TEN^2	–0.020	–5.76	–0.001	–2.29
AGE24	0.724	3.12	0.411	3.60
AGE34	0.415	2.90	0.309	4.21
MAR	–0.302	–1.77	–0.035	–0.47
DEGREE/DIPLOMA	0.587	2.92	0.551	9.10
TRADE	1.190	3.91	0.359	3.47
YR12	0.097	0.75	0.255	5.04
NESB	–0.133	–0.65	0.164	1.96
Ever had a child	–0.457	–2.63	–0.268	–4.44
1 child aged under 3 years	–0.434	–2.99	–0.142	–1.30
2 children aged under 3 years	–0.815	–2.00	–0.625	–3.57
1 child aged 3 to 15 years	0.323	2.18	–0.083	–1.14
2 children aged 3 to 15 years	0.278	1.72	–0.070	–0.89
3 children aged 3 to 15 years	0.318	1.74	–0.120	–1.10
P-INC/1000	0.010	2.48	–0.001	–0.78
Couple should contribute to the household income (per cent)	0.308	2.43		56.61
Husband should be the main breadwinner (per cent)	0.448	3.87		–0.61
Constant	–1.773	–5.87	8.904	
Lambda			–0.025	–0.61
Number of censored observations			385	
Number of uncensored observations			679	
R-squared				
Wald $chi^2(18)$			334.33	
Log likelihood			–873.60	

Notes: The earnings equation is estimated using the Huber/White sandwich estimator of variance. This results in standard errors that are robust to the presence of heteroscedasticity.

Endnotes

1. See, for example, Jones (1992) and Saunders (1994).

2. These issues are discussed at length in McDonald (2000).

3. Earlier work by Beggs and Chapman (1988) has been cited in both these contexts.

4. Ideally, research in this area would explore the impact of children in each dimension, and this is the approach adopted in Beggs and Chapman (1988).

5. The approaches in the literature rely on having appropriate instruments to identify the model. Information concerning respondents' attitudes at younger ages are often used (for example, Joshi, Paci and Waldfogel 1999). A larger sample size than is available from the NLCS is needed to implement this approach.

6. See Apps (1981) and Apps and Rees (1998) for a discussion of this issue.

7. The NLCS data set has several strengths for the exercise. First, the survey has extensive individual information with respect to the demographic, economic and social circumstances of Australian individuals, which is rare. Second, given the breadth of the information available, the NLCS is arguably the most up-to-date available cross-section for questions of our type. Third, attitudinal questions of an unusual nature are available in the survey which have allowed identification of the Heckman-selection correction in the earnings estimation. Finally, the similarity of the available variables with respect to those used in Beggs and Chapman (1988) allow very useful comparisons with the estimates made of the forgone earnings associated with child rearing over a decade ago.

8. Separating business and private income for this group is not possible. There are 93 self-employed women in the NCLS.

9. The questionnaire used for the NLCS asks about the amount of annual wage and salary income. Around 55 per cent of respondents reported annual wage and salary income and the remaining 45 per cent reported weekly, fortnightly or monthly income. In order to calculate hourly wages it is necessary to assume that the 55 per cent of respondents who reported income on an annual basis worked every week of the year the same as they worked the last week.

10. See Ehrenberg and Smith (1997) for a discussion of these issues.

11. If there have been structural changes, as seems likely given the large changes in female participation over the last decades, ignoring them would impose the incorrect assumption that the circumstances of an average 50 year old woman in 1997 will be replicated by the average 25 year old woman when she is 50, in the year 2022.

12. Respondents were asked about their opinion, ranging from strongly disagree to strongly agree, to the following statements: 'it is better for the family if the husband is the principal breadwinner and the wife has the primary responsibility for the home and the children'; 'a working mother can establish just as warm relationship with her children as a mother who does not work'; 'both the husband and the wife should contribute to the household income'; and 'a wife should give up her job whenever it is inconvenient to her husband and children'. Dummy variables were created for each of these responses where a value of one corresponds to a positive attitude towards employed women with children. Identification on the selection equation is achieved by including these attitudinal variables in the probability of employment equation.

13. For a summary of Australian research in this area, see Preston (1997).

14. The instruments are all statistically significant in the selection equation. We conclude that they are likely to be valid.

15. There were too few women in the 'Trade' category to allow meaningful simulations for this group.

16. However, the simulations involving this group use the regression coefficients applying to the category of 'three or more' children.

17. In December 1997, the minimum payment for one child under 13 was $23.40 per fortnight (or $608 per annum) and the maximum payment was $96 per fortnight (or $2496 per annum). Even if a family were to receive the maximum rate until a child turned 13, the maximum impact on lifetime earnings is around 10 to 15 per cent for the very lowest income earners.

18. The 1986 figure is from Beggs and Chapman (1988). The 1997 figure is derived from the NLCS.

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