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Outcomes for Teenage Mothers in the First Years after Birth

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Abstract

This study compares the educational, employment, health and partnership outcomes of teenage mothers with outcomes of women first giving birth in their twenties and those without children. The study finds that teenage motherhood has a range of negative effects, some of which worsen over time (e.g. educational outcomes) and others diminish over time (e.g. employment effects). Although some of the associations of teenage motherhood with poorer outcomes in the first years after birth are unlikely to be causal since they disappear after ensuring treatment and control group are comparable, other associations remain strong. Propensity score matching analysis suggests that relative to childless women: teenage mothers are less likely to complete Year 12, be employed, and be in good health; they are more likely to smoke; and have less personal income.

Keywords: Teenage mothers, Educational outcomes, Health outcomes, Labour market outcomes

JEL classification: J12, J13, J16

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1. Introduction

Teenage motherhood is a critical policy issue in many countries. The major concern is that early childbearing interferes with human capital investment, causing young mothers to be disadvantaged in the labour market and in relationship outcomes, and to be more likely to rely on welfare. This in turn has negative consequences for themselves, their children and society. Indeed, amongst single mothers, teenage mothers are over-represented in welfare participation. For example, in Australia around one-third of single Parenting Payment recipients whose youngest child is less than six years old had their first child before age 20, while only one per cent of single mothers were teenage mothers (Jeon, Kalb and Vu, 2011).

Although teenage motherhood is less common in Australia than in many other OECD countries, socio-economic outcomes for teenage mothers are comparatively poor (see Jeon, Kalb and Vu, 2008). Teenage mothers can therefore benefit from well-designed social policy interventions to help improve their outcomes.

Teenage mothers' outcomes have been widely studied. Earlier research tends to establish a link between teenage motherhood and a wide range of outcomes without investigating whether the link is causal. In recent studies, the focus has been on determining whether the poor outcomes experienced by teenage mothers are caused by teenage motherhood or by selection bias.

In Australia, Webbink, Martin and Visscher examine whether teenage motherhood has a causal impact on smoking, drinking and body size (2008) and on human capital investment (2011). The current study complements those two studies by considering the impact of teenage motherhood on additional outcomes, such as educational, labour market, partnership and health outcomes. Thus, this study broadens the evidence base for Australia.

Establishing whether or not there is a causal link between teenage motherhood and later outcomes has important policy implications. If causality is found to be likely, then policies that prevent early childbearing can help improve later outcomes for disadvantaged women. However, if poor outcomes are due to selection bias, a different type of policy may be more relevant: for example, addressing the underlying factors driving teenage motherhood and poor outcomes later in life. Although we cannot 'prove' causality with the available data, we can rule out causality in some cases, while in other cases, causality remains a possibility.

The rest of the paper proceeds as follows. Section 2 summarises the literature on outcomes of teenage mothers. Sections 3 and 4 respectively describe the methods and data. Section 5 presents the estimation results while section 6 summarises and concludes.

2. Literature Overview

Education is a major pathway through which teenage motherhood could affect a woman's later outcomes. The late teenage years is when young people prepare for high-school completion and make decisions regarding further education. Pregnancy and motherhood during this period may reduce the time available for and raise the opportunity cost of schooling to the young woman, reduce her investment in it, and thus worsen her educational outcomes (Levine and Painter, 2003). However, on the reverse,

leaving school early may also lead to teenage motherhood due to a low opportunity cost of time, or early school leaving and teenage pregnancy are both caused by another (unobserved) factor. In fact, Jeon, Kalb and Vu (2011) observe that most teenage mothers seemed to have left school before becoming pregnant, potentially supporting one of the latter two relationships.

Teenage motherhood can affect a woman's labour market outcomes through its impact on her education and/or work experience, as childbearing and caring are likely to keep her out of the labour market for some time (indirect effects). Fletcher and Wolfe (2008) find that teenage mothers have lower annual earnings in adulthood than other comparable women. This could be due to lower education and/or less work experience, but motherhood could also reduce the energy a woman has for other activities, thus lowering her productivity (direct effect). Poorer labour market outcomes will thus necessitate greater welfare reliance among teenage mothers.

A woman's standard of living also depends on the presence and 'quality' of a partner. Since men are often still the main breadwinners, partnership can be an important pathway for women to escape from poverty and disadvantage. Teenage mothers are likely to be more constrained than other women in their choice of a partner. This could be because childbearing and caring responsibilities reduce the amount of time that a young mother has to search for a partner, or because children from a previous relationship discourage potential partners. As a result teenage mothers may be less likely to be partnered (Bradbury, 2006) or they are more likely to have a poorly educated and unemployment-prone partner (Ermisch and Pevalin, 2005).

The effect of teenage motherhood on health outcomes is theoretically ambiguous. On the one hand, teenage motherhood could adversely affect health outcomes. This could be because childbearing and caring responsibilities at an early age, usually as a single parent[1] and with limited resources and experience, are stressful and detrimental to a woman's mental and physical health. An alternative pathway for the effect could be through reduced choices and opportunities. For example, poor educational, labour market and partnership outcomes may affect teenage mothers' mental health, and induce unhealthy behaviours or lifestyles. On the other hand, teenage motherhood could also have a positive effect on health outcomes. This is because early motherhood may change the priorities of young women, steering them away from risky behaviours for the sake of their children.

There is ample evidence that teenage motherhood has significant negative impacts on a range of outcomes, even after selection bias is accounted for. For example, using a matching method, Chevalier and Viitanen (2003) find that teenage motherhood decreases the probability of continued schooling after age 16 by 12-24 percentage points. Using biological fertility shocks to instrument for age at first birth, Miller (2011) finds an increase of nine per cent in earnings per year of delay in motherhood, with three per cent being due to an increase in wages and six per cent to an increase in work hours. Webbink, Martin and Visscher (2008), who use Australian twins data and an instrumental variable (IV) method to account for selection, find that teenage mothers smoke on average 2.6-4 years longer and are less likely to quit smoking than

[1] In the US, 83 per cent of births to teenagers are outside a marriage, and among Blacks this rate is 96 per cent (Hamilton *et al*. 2005).

their (twin) sisters. Teenage motherhood is also found to raise the probability of being overweight, especially at age 40 or older.

In contrast, several other studies find little causal impact of teenage motherhood. For example, using the difference-in-difference method, Brien, Loya and Pepper (2002) find that while teenage mothers have lower test scores than their counterparts without children, the effects of motherhood itself are negligible. In a more recent study using Australian twins data, Webbink, Martin and Visscher (2011) find no difference in educational attainment between teenage mothers and their identical twin sisters, suggesting little evidence of a negative causal effect of teenage childbearing on educational attainment. Geronimus and Korenman (1992) find no significant effect of teenage childbearing on the probabilities of employment and welfare participation once unobserved family characteristics are taken into account (using sibling data). Using similar methods to Webbink, Martin and Visscher (2008) on 25-year-old Americans, Fletcher (2012) finds that teenage motherhood has little effect on smoking and obesity, but may reduce drug use and binge drinking in the short term.

Some authors argue that teenage motherhood only brings forward motherhood in time, so over the life cycle, the effect of teenage motherhood is not different from the effect of later motherhood. Using miscarriages as an IV, Hotz, McElroy and Sanders (2005) show that while teenage mothers appear less likely to receive a high-school diploma, they appear to offset this by being more likely to obtain a General Educational Development certificate later in life and by working much more over their early adulthood than if they had delayed childbearing. Hotz, McElroy and Sanders (2005) also find teenage mothers to have higher levels of earnings during adulthood than if they had postponed motherhood. Moreover, while teenage childbearing seems to increase public aid expenditures immediately after a teen birth, this 'negative' consequence is short-lived, in that teenage mothers use less public aid in their late twenties as their earnings rise and their children age. On the one hand, these findings concur with Bronars and Grogger (1994) who, exploiting the natural experiment of 'twin births first', find that the short-term adverse effects of unplanned births on labour force participation, poverty and welfare recipiency dissipate over time for white unwed mothers. On the other hand, Hotz, McElroy and Sanders' (2005) findings disagree with Taniguchi (1999), who finds that women who experience early childbearing are more likely to experience a higher wage penalty.[2]

Most of the empirical studies on teenage motherhood focus on educational and labour market outcomes. Recently, there has been rising interest in the impact of teenage motherhood on partnership and health outcomes. Selection bias seems the strongest with respect to educational outcomes, with much evidence indicating that teenage mothers would have low educational outcomes even if they had not had a child as a teenager. This is consistent with Jeon, Kalb and Vu (2011) who, based on Australian data, find that the majority of teenage mothers had already left school before they were pregnant.

There is considerable evidence that results differ a great deal by method.

[2] Bronars and Grogger (1994) examine the effect of unplanned births while Taniguchi (1999) considers the timing of births on women's wages. Neither study focuses specifically on teenage mothers.

Studies that use the IV method tend to find much stronger negative estimates of the effects of teenage motherhood than those that use sibling difference to control for unobserved family characteristics.[3] This could be because the sibling method relies crucially on the assumption that the only unobserved characteristics that affect teenage motherhood are related to family background. The assumption that siblings do not differ with respect to unobserved individual characteristics, such as innate abilities and motivation, is especially strong when the siblings are not identical twins.

Overall, even though the evidence is mixed, the balance of the evidence suggests that teenage motherhood has an adverse causal impact on a wide range of outcomes, including school completion, educational attainment, employment, earnings, welfare recipiency, partnering status, quality of partner and health.

3. Methods

To examine the effects of teenage motherhood on outcomes, a reduced-form model is specified:

$$Y_i = \alpha + \beta_T T_i + \boldsymbol{\beta_X} X_i + \varepsilon_i \quad (1)$$

where i indexes individuals, T is a binary variable capturing whether a woman had a first birth at ages 15-19, and $\boldsymbol{X}$ is a vector of controls. α, β_T and $\boldsymbol{\beta_X}$ are parameters to be estimated, with β_T capturing the total direct effect of teenage motherhood on the outcome in question, holding constant other observable factors.

A methodological issue arises because teenage motherhood is potentially endogenous. Thus, while a significant negative relationship between teenage motherhood and an outcome may show that teenage motherhood is associated with a poorer outcome, it does not prove that teenage motherhood *per se* leads to the outcome. Ignoring the potential endogeneity of teenage motherhood may lead to biased and inconsistent estimates of its impact on later outcomes. Teenage mothers may be different from other young women in many regards, and it might be these other characteristics that drive a difference in outcomes. To address this heterogeneity of young women, we need to compare teenage mothers to women who are as much like them as is possible.

Our data do not support the use of IV approaches used by Bradbury (2006) or fixed effect approaches (based on sibling or twin data) used by Webbink, Martin and Visscher (2008, 2011). Therefore to address the potential selection into teenage motherhood based on observables, this study uses the propensity score matching (PSM) method. PSM estimates the treatment effect (of teenage motherhood) by comparing a treated case (teenage mother) with an untreated case (non-teenage mother) that is as similar to the treated case as possible. Specifically, the PSM process involves three steps. The first step obtains the propensity score, which is the predicted

[3] Ribar (1999) confirms this by applying the two methods to the same data. He argues that if the unobserved individual-specific factors influencing fertility and socio-economic status are at least as strongly related as the unobserved family-specific factors influencing fertility and socio-economic status, then the sibling difference estimates represent a lower bound on the estimated effects of teenage motherhood.

probability of being a teenage mother given a woman's characteristics. The second step matches a teenage mother with a non-teenage mother based on their propensity scores. Individuals that can be matched to a teenage mother form a control group. In the last step, the average treatment effect (impact of teenage motherhood on outcome) is estimated as the mean difference in the outcome between the treatment group and the control group.

Two methods will be used to match a teenage mother with a non-teenage mother. In the first method (kernel matching), a 'synthetic' counterfactual is created for each teenage mother, based on the kernel-weighted average of the characteristics of the nearest non-teenage mothers with closer neighbours receiving higher weights. The second method (calliper matching) matches a teenage mother with one or more non-teenage mothers if the difference in propensity scores between the teenage mother and the non-teenage mother is less than a specified limit. For both methods, the likelihood of a match can be raised by setting a larger bandwidth, but this would be at the expense of the match quality (resulting in higher standard errors).

The more explanatory variables are available for the estimation of the propensity score equation, the more plausible it is that selection on unobservables is minimised as well (since selection is mostly captured by the observed characteristics) and that the estimated effect using PSM can be interpreted as causal. Previous overseas studies which have used PSM to estimate the impact of motherhood include Levine and Painter (2003) for the US, Chevalier and Viitanen (2003), and Goodman, Kapman and Walker (2004) for the UK, and Simonsen and Skipper (2006) for Denmark. Unfortunately, only a limited number of explanatory variables are available for this study, so our results have to be interpreted with caution.

4. Data

Data sources

This study draws on data from two surveys: the Longitudinal Study of Australian Children (LSAC) and Household, Income and Labour Dynamics in Australia (HILDA).

HILDA is a longitudinal survey of Australian households collecting information on all individuals for a number of randomly selected households on a yearly basis. HILDA started in 2001 and has been run annually, with each year corresponding to a wave. It covers approximately 13,000 individual respondents living in more than 7,000 households. HILDA collects information on a large number of individual characteristics, such as education, health, labour force participation, income, and a broad range of characteristics for all adults living in the household; and household characteristics, such as the number and age of children, and the number of adults in the household.[4]

LSAC is a panel data survey that follows around 10,000 children and their families. At the time of the study, six years of information over four waves were available. There are two birth cohorts of around 5,000 children each. Children in the birth (B) cohort were three to 19 months old when the study began in 2004, while children in the kindergarten (K) cohort were four to five years old at the start. This study only uses the B-cohort. Data are collected from the children's parents, childcare

[4] Detailed information on HILDA is available on the website http://melbourneinstitute.com/hilda/. For discussion of the design of the HILDA Survey refer to Wooden and Watson (2007).

providers or teachers, and the child once they are old enough. Information is collected on many early childhood issues, such as health, parenting, family relationships, education, childcare, family support, and separated families, but also on the well-being and labour market participation of the parents.[5]

In LSAC, the focal children are followed over time, and information on the mothers of the children is collected when available. All women in LSAC are thus mothers, either teenage mothers (i.e. women who have become a mother during their teenage years) or older mothers (i.e. women who have become a mother in their twenties or later). HILDA, in contrast, tracks all adults living in selected households over time. HILDA data do not only contain teenage mothers and older mothers but also childless women.

To make HILDA mothers roughly comparable to LSAC B-cohort mothers (whose children are aged between three and 19 months in 2004) while still retaining a sufficiently large number of teenage mothers, we only include HILDA mothers whose children are up to three years old in the 2004 wave. Since the number of mothers aged 15-29, who had their first child as a teenager, is not very large (fewer than 200 in each survey) and since LSAC does not contain childless women, we pool both data sets. In particular, most of the analysis is based on LSAC B-cohort wave 1 and HILDA wave 4 (both carried out in 2004). Our pooled estimation sample has just over 300 observations on teenage mothers. The average age at which teenage mothers have their first child is 18.2. Figure B1 shows the age distribution of having the first child.

For robustness checks, using outcomes at slightly older ages, we also include LSAC waves 2 and 3, and HILDA waves 6 and 8 (carried out in 2006 and 2008 respectively). The estimation samples are restricted to women up to age 29 in 2004, 31 in 2006 and 33 in 2008.

Key variables

We consider 11 outcomes, which are classified into four groups:

- Educational outcomes: Year 12 completion and having a post-school qualification, where a post-school qualification can be a university degree or a non-degree qualification;
- Labour market outcomes: employment status (i.e. employed or not employed) and personal income (measured as total income from all sources in current dollars per week);
- Health outcomes: physical health status, psychological distress, feelings of depression,[6] and smoker status;
- Partnership outcomes: partnering status, partner's employment status and family income (family income is the same as personal income if the woman is single, and it equals her personal income plus her partner's income if the woman has a partner).

[5] More information is available from http://www.growingupinaustralia.gov.au/.

[6] Psychological distress is defined as the respondent 'being nervous', 'being so sad that...', or 'everything being an effort' in LSAC and being 'nervous', 'so down that...', and 'worn out' in HILDA in the last four weeks. Depression is defined as being 'so sad that...' in LSAC, and 'so down that...' in HILDA. Index values for these two indicators refer to the frequency with which these feelings are experienced, ranging from one (all of the time) to five (none of the time), so a higher value on the index indicates better mental health.

Furthermore, we apply a lower age limit for most of the analysis, as some ages are too young for certain outcomes to have been achieved. In particular:

- Year 12 completion, having post-school qualification, employment status, personal income and family income are analysed for women aged 20 or above;
- Having a university degree is analysed for women aged 23 or above;
- Physical health status and smoker status are analysed for all women;
- Psychological distress and feelings of depression are analysed for all women;
- Partnering status is analysed for women aged 20 or above with children only;[7]
- Partner's employment status is analysed for partnered women aged 20 or above with children only.

Descriptive statistics

Table 1, which contains the means of the regression variables for our 2004 estimation sample, shows that childless women are less likely to have a partner than teenage mothers, who are in turn less likely to have a partner than older mothers. For the other ten outcomes, teenage mothers have poorer outcomes than older mothers, who in turn have poorer outcomes than childless women, except on mental health variables. For most outcomes and characteristics, the means for older mothers and childless women are statistically significantly different from the means for teenage mothers.

Table 1 - Descriptive Statistics of LSAC and HILDA Estimation Samples

	LSAC		*HILDA*		
	Teenage mothers	*Older mothers*	*Teenage mothers*	*Older mothers*	*Childless women*
Outcomes					
Completed Year 12 [a]	0.321	0.647 ***	0.250	0.604 ***	0.807 ***
Post-school qualification [a]	0.396	0.611 ***	0.214	0.461 ***	0.572 **
Employed [a]	0.151	0.443 ***	0.250	0.412 ***	0.863 *
Personal income in $/week [a]	235	254 ***	84	171	495
Having good or better health	0.838	0.906 ***	0.800	0.898 **	0.910 ***
Being a smoker	0.618	0.286 ***	0.598	0.302 ***	0.237 ***
Psychological distress index (1=often distressed; 5=never distressed)	4.280	4.327 **	3.668	3.892	3.829 ***
Depression index (1=often feeling depressed; 5=never feeling depressed)	4.436	4.584 **	4.008	4.330 *	4.213 ***
Partnered [a,b]	0.704	0.864	0.464	0.781 ***	
Partner employed [a,b,c]	0.784	0.937	0.846	0.920 ***	
Family income in $/week [a]	529	881 ***	292	695 ***	785 ***
Control variables					
Own background characteristics					
Age	18.878	25.965 ***	18.538	26.614 ***	20.871 ***
School completion (ref: Year 9 or less)	0.252	0.057 ***	0.214	0.051 ***	0.061 ***
Year 10-11 only	0.564	0.296 ***	0.604	0.345 ***	0.305 ***
Year 12 [d]	0.184	0.647 ***	0.182	0.604 ***	0.635 ***

[7] Partnership outcomes are only considered for women with children, since for childless women, not having a partner when they are aged 20 to 29 cannot be interpreted as a good or a bad outcome. However, when children are present, having someone with whom to share the caring responsibilities is likely to make partnered women better off than single women.

Table 1 - Descriptive Statistics of LSAC and HILDA Estimation Samples (continued)

	LSAC		*HILDA*		
	Teenage mothers	*Older mothers*	*Teenage mothers*	*Older mothers*	*Childless women*
Post-school qual. (ref: No qual.)	0.736	0.389 ***	0.846	0.539 ***	0.645 ***
Non-degree qualification [e]	0.264	0.416	0.154	0.257 ***	0.171 ***
University degree		0.195 ***		0.204 ***	0.184 ***
Parents separated by age 14	0.207	0.184 ***	0.506	0.262	0.239 ***
No parent employed at age 14	0.098	0.045 ***	0.186	0.057 ***	0.045 ***
Religion (ref: No religion)	0.433	0.236 **	0.346	0.239 ***	0.266 ***
Catholic	0.201	0.276 ***	0.109	0.175 **	0.206 *
Other Christian	0.250	0.389 ***	0.128	0.373 ***	0.245 ***
Other religion	0.104	0.093	0.013	0.057	0.038 **
Religion not known	0.012	0.005 ***	0.404	0.156	0.244 ***
Indigenous Australian	0.159	0.038 ***	0.207	0.038 ***	0.031 ***
Migrant status (ref: Australian born)	0.915	0.817 ***	0.929	0.866 ***	0.854 **
Migrant from an ESB country	0.030	0.058	0.045	0.042	0.036
Migrant from an NESB country	0.055	0.125 ***	0.026	0.092 ***	0.110 ***
Residence (ref: Metropolitan)	0.390	0.502 ***	0.449	0.548 ***	0.691 **
Regional residence	0.530	0.443 ***	0.506	0.423 **	0.291 *
Remote residence	0.079	0.054 **	0.045	0.029	0.018
Parental characteristics					
Par. migrant status (ref: No migrant parent)	0.722	0.582 ***	0.735	0.634 ***	0.603 **
One parent is migrant	0.136	0.148	0.129	0.164	0.181
Both parents are migrants	0.142	0.270 **	0.135	0.202 ***	0.216 *
Family characteristics					
Living with parents	0.317	0.085 ***	0.276	0.050 ***	0.516 ***
Mixed family [f]	0.530	0.134	0.410	0.090 ***	0.390 ***
Number of children	1.195	1.709 ***	1.103	1.443 ***	
Age of youngest child (ref: 0 years)	0.884	0.859 ***	0.718	0.439	
1 year	0.116	0.141 ***	0.141	0.252	
2 years			0.096	0.164	
3+ years			0.045	0.145	
Partner's characteristics					
Partner's employment (ref: No partner)	0.393	0.136 ***	0.441	0.233 ***	0.755 ***
Partner employed	0.491	0.810 ***	0.355	0.706 ***	0.223 ***
Partner not employed	0.117	0.054 ***	0.204	0.061 ***	0.022 ***
Observations	164	1,700	156	456	2,653

Sources: LSAC (wave 1) and HILDA (wave 4), women aged up to 29 years only.
Notes: *, ** and *** denote sample means that are significantly different from the means for teenage mothers at the 10%, 5% and 1% level respectively. (a) Outcome measured for women aged 20 or over only; (b) Outcome measured for women with children only; (c) Outcome measured for partnered women only. Partnership outcomes for all women aged 15-29 are shown under 'partner's characteristics'; (d) Excludes non-school Year 12 equivalent qualifications; (e) Includes all certificate- and diploma-level qualifications; (f) A mixed family contains other people living with a couple or a nuclear family (which includes parent(s) and dependent child(ren) only), or at least two people who are not part of a couple.

5. Results

Basic regression results

Before presenting the PSM results, we first report the results from simple regressions of the relevant outcomes on teenage motherhood and older motherhood status while controlling for as many relevant characteristics as available in the data. Summary results are presented in Table 2, with full results available in A1-A3. These provide a reference point for the results in the following subsection.

These results show that, mostly, outcomes for teenage mothers are worse than for older mothers and childless women. Outcomes for older mothers are also generally worse than for childless women, at least with regard to labour market outcomes and income, which is as expected due to the presence of young children. These negative associations are often substantial and significant for several of the analysed outcomes. For example, comparing the negative association of teenage motherhood with employment to the average rate of employment in the sample, we observe that the employment rate is decreased by over two-third for teenage mothers. The only exceptions are for the mental health outcomes, where childless women appear to do the worst and older mothers fare best.[8] However, examining the summary statistics in table 1, this may be due to differences between HILDA and LSAC. Childless women are only observed in HILDA, while the other two types of women appear in both surveys. As a result, the reference group of childless women may capture the difference between HILDA and LSAC rather than the difference between childless women and mothers. The summary statistics indicate that childless women do slightly worse with regard to mental health outcomes but not to the extent estimated in table 2.

Table 2 - Effects of Motherhood Status on Outcomes in the First Three Years After Birth [a]

Outcome	*Mean outcome in estimation sample*	*Number of teenage mothers*	*Effect of motherhood status* [b]		*Number of observations*	*(Pseudo) R-squared*
			Teenage mother	*Older mother*		
Year 12 completed	0.682	77	-0.442 ***	-0.175 ***	3,230	0.072
Post-school qualification	0.576	77	-0.113	0.008	3,227	0.051
Employed	0.583	77	-0.434 ***	-0.404 ***	3,155	0.265
Personal income in $/week	332.0	77	-53.3	-231.5 ***	3,142	0.358
Having good health	0.898	223	-0.018	0.039 *	3,588	0.043
Being a smoker	0.299	196	0.183 ***	0.021	2,766	0.132
Psychological distress index	4.041	220	0.363 ***	0.493 ***	3,595	0.111
Depression index	4.380	220	0.267 ***	0.366 ***	3,587	0.067
Partnered	0.837	77	0.023		2,139	0.128
Partner employed	0.931	48	-0.027		1,763	0.138
Family income in $/week	848.64	77	-98.6	-224.4 ***	3,154	0.378

Source: Estimated from LSAC (wave 1) and HILDA (wave 4), women aged up to 29 years only
Notes: a) Full results are available in A1-A3. b) Reference category: childless women.
* significant at 10%, **significant at 5%, ***significant at 1%.

[8] Similar results are obtained when mental health outcomes are defined as binary indicators of experiencing psychological distress and feelings of depression respectively, at least 'some of the time'.

Given that a large proportion of teenage mothers already left school before becoming pregnant, most of the large marginal effect on Year 12 completion cannot be attributed to teenage motherhood. However, while other women may catch up with their schooling at a slightly later stage (i.e. in their early 20s), teenage mothers are less likely to do this, widening the gap in education.

One of the control variables included is whether the respondent lives with her parents. Although these have on average no or a negative impact on post-school qualifications or personal income, when interacted with being a teenage mother, living with parents seems to exert a small positive impact on outcomes, suggesting that these parents provide some support to their daughters. However, the effect of teenage motherhood remains largely unchanged, and given the small number of teenage mothers and the more complex interpretation of results, regressions with interaction terms are not reported.

The next section investigates how many of these associations remain after matching teenage mothers to similar women in the older mothers and the childless women categories.

PSM results

Propensity score equations

First we estimate propensity score equations. Table 3 presents the average marginal effects of a range of characteristics on the probability of being a teenage mother. The probability of being a teenage mother serves as the propensity score in the PSM estimation. The distribution of the propensity score presented in figure B2 shows that the propensity to become a teenage mother is less than 20 per cent for most women in the sample (even for those women who became a teenage mother). The difference in outcomes between a teenage mother and a non-teenage mother with similar propensity scores is attributed to teenage motherhood.

Several background characteristics are associated with the likelihood of being a teenage mother. For the pooled sample combining the HILDA and LSAC samples (column 1), Year 10 completion is associated with a reduction by 14 percentage points in the probability of being a teenage mother, while women with Christian beliefs are 4.7 to 5.4 percentage points less likely than non-religious women to become a mother in their teens.[9] Own migrant status and parental migrant status have almost zero, and insignificant, associations with the probability of being a teenage mother. Indigenous status is a strong predictor of teenage motherhood, with Indigenous women being 8.6 percentage points more likely to become a teenage mother than non-Indigenous women.

Parental employment status at age 14 is relevant as well, with women who had no parent employed at age 14 being 4.2 percentage points more likely to be a teenage mother.[10] The father's total unemployment duration during childhood is also important (see column 3), but is only collected for HILDA respondents. Residents of regional

[9] Given that we only consider teenage mothers who had their first childbirth at age 15 or over, completion of Year 10 should have occurred before childbirth.

[10] Parental employment at age 14 is defined differently in HILDA and LSAC. In HILDA, the survey includes a direct question on employment at age 14 for each parent, whereas in LSAC, parental employment at age 14 is only asked for the main breadwinner. We assume that if the main breadwinner is not employed that the other parent (if present) is also not employed.

areas are respectively 3.5 percentage points more likely to be a teenage mother than metropolitan residents. Similar results on the probability of being a teenage mother are obtained when using the HILDA sample only, except that parental separation by age 14 is only significant in the HILDA sample (table 3, columns 2 and 3).

Table 3 - Marginal Effects on the Pprobability of Being a Teenage Mother

	HILDA and LSAC pooled (1)	*HILDA only (2)*	*HILDA only (extra variable) (3)*
At least Year 10	-0.140 ***	-0.093 ***	-0.086 ***
Religion (ref: No religion)			
Catholic	-0.047 ***	-0.039 **	-0.038 *
Other Christian	-0.054 ***	-0.043 **	-0.043 **
Other religion	-0.007	-0.063	-0.060
Religion not known	-0.001	0.017	0.018
Indigenous Australian	0.086 ***	0.080 ***	0.076 ***
Migrant status (ref: Australian born)			
Migrant from an ESB country	0.001	0.000	0.000
Migrant from an NESB country	-0.011	0.000	0.000
Father unemployed for at least 6 months when growing up			0.027 *
Parental status at age 14			
Parents separated by age 14	0.012	0.033 ***	0.033 ***
No employed parents at age 14	0.042 **	0.038 **	0.033 *
Parental migrant status (ref: No migrant parent)			
One parent is migrant	-0.016	-0.019	-0.017
Both parents are migrants	-0.012	-0.002	-0.003
Residence (ref: Metropolitan)			
Regional residence	0.035 ***	0.035 ***	0.035 ***
Remote residence	0.032	0.029	0.030
Observations	4,169	2,331	2,327
Pseudo R-squared	0.11	0.151	0.156
Number of teenage mothers	304	142	142

Source: Estimated from LSAC (wave 1) and HILDA (wave 4), women aged up to 29 years only.
Notes: *significant at 10%, **significant at 5%, ***significant at 1%.

Applying the PSM approach appears to work well in making the treatment group (teenage mothers) and control group (non-teenage mothers) more comparable. When comparing the treatment and control groups in terms of their mean characteristics before and after applying the weights, obtained through one of the PSM approaches, the means in the two groups have become much more similar after applying the weights.[11]

Computing the average treatment effect on the treated

Applying the PSM method allows us to attribute differences in outcomes between a teenage mother and a non-teenage mother to the effect of teenage motherhood, conditional on the treatment and control group being sufficiently similar on observed

[11] A4 compares the means of the treatment and control groups before and after the matching. Most explanatory variables are statistically different between the two groups before the matching, but no significant differences remain after the matching.

and unobserved characteristics after the PSM weighting. Computing the average difference in outcome across all teenage mothers for each outcome, we obtain the Average Treatment effect on the Treated (ATT). The ATT estimates for 2004 (including women with children up to the first three years after birth) are presented in table 4. For each outcome, there are six estimates.

Table 4 - Effects of Teenage Motherhood on Outcomes (ATT) in the First Three Years After Birth, Based on Various Propensity Score Matching Methods

	Kernel, bandwidth 0.001 (1)	*Kernel, bandwidth 0.01 (2)*	*Calliper, bandwidth 0.001 (3)*	*Calliper, bandwidth 0.01 (4)*	*Same as (1) compared with older mothers only (5)*	*Same as (1) compared with childless women only (6)*
Completed Year 12						
Estimate	-0.257 ***	-0.241 ***	-0.252 **	-0.249 ***	-0.183 **	-0.395 ***
Number in control group	2,020	2,450	208	221	1,592	281
Post-school qualification						
Estimate	-0.161 **	-0.149 **	-0.166 **	-0.156 **	-0.168 **	-0.081 **
Number in control group	2,001	2,447	206	220	1,597	281
Employed						
Estimate	-0.271 ***	-0.272 ***	-0.222 **	-0.209 **	-0.153 **	-0.567 ***
Number in control group	2,060	2,449	212	222	1,595	281
Personal income						
Estimate	-49 **	-49 **	-48 *	-50 **	-28 **	-123 **
Number in control group	2,018	2,437	211	220	1,635	281
Having good or better health						
Estimate	-0.063 *	-0.042 *	-0.088 **	-0.064 *	-0.078 *	-0.072 **
Number in control group	2,395	2,718	358	416	1,446	883
Being a smoker						
Estimate	0.296 ***	0.262 ***	0.313 ***	0.289 ***	0.233 ***	0.349 ***
Number in control group	2,011	2,233	297	342	1,290	595
Psychological distress index						
Estimate	0.001 **	0.035 **	-0.125 **	-0.087 **	-0.197 **	0.117 **
Number in control group	2,447	2,725	380	414	1,429	882
Depression index						
Estimate	-0.063 **	-0.022 **	-0.133 **	-0.078 **	-0.197 **	0.035 **
Number in control group	2,454	2,718	366	403	1,419	928
Partnered						
Estimate	-0.127 *	-0.148 **	-0.157 **	-0.163 **	-0.127 *	
Number in control group	1,592	2,055	198	215	1,592	
Partner employed						
Estimate	-0.071 *	-0.051 *	-0.103 *	-0.106 *	-0.071 *	
Number in control group	1,278	1,611	119	130	1,278	
Family income						
Estimate	-209 ***	-219 ***	-249 ***	-257 ***	-212 ***	-18 ***
Number in control group	2,019	2,449	208	221	1,591	281

Source: Estimated from LSAC (wave 1) and HILDA (wave 4), women aged up to 29 years only.
Notes: Standard errors (not shown) are bootstrapped with 50 replications. *significant at 10%, **significant at 5%, ***significant at 1%. For each outcome, the number of treated observations is the same as the number of teenage mothers in table 2. Also see notes of table 1.

The first two estimates are based on the kernel method (see columns 1 and 2), where for each teenage mother, a 'synthetic' counterfactual is created based on the kernel-weighted average of the characteristics of the nearest non-teenage mothers. This method has the advantage of using most non-teenage mothers in establishing the 'counterfactual' case for a teenage mother. The kernel weight depends on the propensity score of each non-teenage mother compared to the propensity score of the nearest teenage mother. The closer a non-teenage mother is to a teenage mother in terms of propensity score, the higher is the weight applied to that non-teenage mother in creating the 'counterfactual' case for a teenage mother.

Two alternative bandwidths are used for the kernel method: 0.001 and 0.01.[12] When the chosen bandwidth is smaller, the kernel weight placed on closer neighbours is relatively larger. A bandwidth can be thought of as a 'tolerable difference'. The higher the chosen bandwidth is, the more likely it is to find a non-teenage mother that can be matched to a teenage mother, yet the less likely it is that they are a good match. The distribution of the kernel matching weights (with bandwidth 0.001) is presented in figure B3.[13]

The next two estimates are based on the calliper method (see columns 3 and 4 in table 4). This method matches a teenage mother with one or more non-teenage mothers if the difference in propensity scores between the teenage mother and the non-teenage mother is less than a specified limit (the bandwidth). The calliper method gives equal weight to all matched observations and ignores all unmatched observations. As such, only a limited number of non-teenage mothers are used in calculating the counterfactual outcomes. Again, two bandwidths (0.001 and 0.01) are used for this matching method.

We also compute two other estimates, both using the kernel method with a bandwidth of 0.001. The first estimate is based on a comparison between teenage mothers and older mothers only (see column 5) and the second estimate is based on a comparison with childless women only (see column 6). For all PSM estimations, we only use treated observations whose propensity scores lie in the 'common support' region. A teenage mother is said to satisfy this condition if her predicted propensity score is smaller than the maximum propensity score amongst older mothers and/or childless women, and larger than the minimum propensity score amongst this group.

Examining the results in table 4, we can make a number of observations. First, a comparison with the regression results in table 2 shows that although several estimated effects have become somewhat smaller, more of the estimated effects are now significant with some effects even remaining of equal size or slightly bigger. However, reassuringly, most of the counterintuitive differences in mental health outcomes between teenage mothers and childless women are now much less significant, and much smaller in size.

Second, the kernel method (columns 1 and 2) produces larger estimates (in absolute value) for employment status, while the calliper method (columns 3 and 4) produces larger estimates for most other outcomes. However, the two sets of estimates are of the same order of magnitude. For example, the kernel method with a bandwidth

[12] Chevalier and Viitanen (2003) also use these two bandwidths.
[13] Treated observations all have weight one.

of 0.001 suggests that teenage motherhood reduces the probability of employment by 27.1 percentage points, whereas the calliper method with the same bandwidth suggests a smaller (but still similarly sized) reduction of 22.2 percentage points. While the kernel method with a bandwidth of 0.001 attributes 6.3 percentage points of a decrease in the probability of having good or better health to teenage motherhood, the corresponding reduction predicted by the calliper method is larger in magnitude, at 8.8 percentage points.

Third, while increasing the bandwidth always increases the number of matches, its impact on the magnitude of the estimated effect can be either positive or negative. In general, estimates based on the two bandwidths are broadly similar. For example, the kernel method with a bandwidth of 0.001 (column 1) suggests that teenage motherhood reduces the probability of completing Year 12 by 25.7 percentage points, while the same method with a bandwidth of 0.01 (column 2) suggests the reduction is 24.1 percentage points. Similarly, the calliper method with a bandwidth of 0.001 (column 3) and 0.01 (column 4) suggests that teenage motherhood reduces weekly personal income by $48 and $50 respectively.

Fourth, the impact of teenage motherhood is larger when comparing teenage mothers with childless women (column 6) than when comparing with older mothers (column 5). For example, while teenage mothers have only $28 less in average weekly personal income compared with older mothers, they have $123 less compared with childless women. This pattern is consistent with the raw patterns observed in table 1 in section 4 and the regression results in table 2, which suggest that the mean outcomes of older mothers lie somewhere between those for teenage mothers and those for childless women.

To assess potential longer-term effects, we also estimate the impact of teenage motherhood in later years. The results, presented in A5, do not show a clear pattern, with the association of teenage motherhood with some outcomes increasing over time yet decreasing for others. This could be at least partly because of the small number of teenage mothers that remain in the survey in later years.[14]

The impact of teenage motherhood on educational outcomes worsens over time. For example, while teenage motherhood is associated with a reduced probability of Year 12 completion by 26 percentage points in the first three years after birth, the corresponding reduction increases to 32 percentage points in the fifth year and remains at 32 percentage points two years later. This could be because childless women are more likely than teenage mothers to accumulate further education as they age, which widens the gaps in educational outcomes between the two groups. In addition, the youngest group of teenage mothers (i.e. the group that had a child before turning 17 years of age) was more likely to be excluded from the analysis of educational outcomes in table 4 since they would not have reached the age of 20 within three years of their last childbirth. This youngest group is likely to be most affected with regard to their school completion outcome. No such effect is found for post-school qualifications.

[14] The attrition rates for teenage mothers are significantly higher than for other women. In LSAC, 37 per cent of teenage mothers who were in our estimation sample in wave 1 had left the survey four years later, compared with 19 per cent for other women. In HILDA, the corresponding attrition rates were 97 per cent and 75 per cent respectively. The attrition rate for HILDA adult respondents over the same period was 20 per cent.

In contrast, the impact of teenage motherhood on employment diminishes over time. In particular, teenage motherhood is associated with a reduction in the probability of working by 27 percentage points in the first three years after birth, but this drops to 26 and 18 percentage points respectively in the fifth and seventh years after birth. This is likely to reflect the increasing tendency for mothers to increase labour supply as their child grows up. In addition, it may be the case that teenage mothers who do better in this regard are also more likely to remain in the survey.

Overall, the PSM analysis shows that although not all of the observed associations between teenage motherhood and outcomes can be attributed to the causal impact of teenage motherhood, several strong associations remain after applying the matching approach. Some of these may be causal.

6. Summary and Conclusion

This study has used data from the LSAC (waves 1-3) and HILDA (waves 4, 6, 8) surveys to examine educational, labour market, health and partnership outcomes of young women who became a mother during their teenage years and compared them with outcomes of women who became a mother in their twenties and those who do not have children yet. Descriptive statistics indicate that on average, teenage mothers have considerably poorer outcomes than older mothers, who in turn have considerably poorer outcomes than childless women.

The PSM approach, which allows comparison of outcomes for women who have similar propensities to become a teenage mother, shows that a large part of these associations are due to selection bias. However, although several of the observed associations are not due to the causal impact of teenage motherhood, the indication is that some associations remain strong even after controlling for differences between teenage mothers and other women. In particular, PSM analysis suggests that relative to similarly characterised childless women, teenage mothers are 40 percentage points less likely to complete Year 12 (however, part of the educational disadvantage pre-dates teenage motherhood with school-leaving occurring before pregnancy), 57 percentage points less likely to be employed and 35 percentage points more likely to be a smoker. Relative to childless women, teenage mothers have $123 less in weekly personal income and are seven percentage points less likely to have good health or better than good health.

Examining outcomes after two and four additional years respectively, the disadvantage with regard to the outcomes listed above has remained to a large extent. The disadvantage with regard to education appears to deepen in the years after birth, while the disadvantage with regard to employment reduces, presumably because mothers can increase their labour supply as their children grow up. However, the difference in income (both in personal and family income) appears to become larger over time, possibly due to the different career opportunities available to teenage mothers (and their partners, if present) compared to other women.

The results are subject to the limitations in the PSM method. This method rests crucially on the assumption that assignment to treatment (i.e., becoming a teenage mother) is purely random, given the probability of treatment (our predicted propensity score). Thus, it is difficult to precisely pin down the effect of teenage

motherhood on outcomes. On the one hand, the observed effect is overstated because several factors, such as unobserved personal characteristics that are important in shaping a woman's outcomes, cannot be controlled for, and unfortunately we have a limited number of explanatory variables to use in the model to predict the probability of teenage motherhood. On the other hand, the observed effect of teenage motherhood on outcomes could be understated if we do not account for the indirect effects because teenage motherhood is strongly associated with educational outcomes and education has a strong effect on outcomes, especially labour market outcomes.

It appears that young teenage mothers are disadvantaged because they have children, which is compounded by the fact that they have children at such a young age. Child bearing and caring responsibilities associated with having children are impediments to a woman's labour market activity while having children at a young age is also an obstacle to human capital accumulation.

Accordingly, policies aimed at reducing early motherhood should help improve outcomes for young women. In addition, there is evidence that labour market outcomes improve as children get older. This indicates that childcare assistance remains an important policy direction to focus on; not only to support employment but also to ensure young mothers can complete Year 12 and/or obtain some post-school qualification. Teenage mothers have on average substantially lower education levels compared to other women, which negatively impacts on their employment outcomes over their lifetime (as shown by Jeon, Kalb and Vu, 2011). Successful early assistance is likely to have long-term effects for these women's outcomes over their lifetimes. This may be particularly relevant to Indigenous women who are disproportionally more likely to become a teenage mother and who have much higher fertility rates compared to other women, negatively affecting their labour force participation (Hunter and Daly, 2013).

Appendix A

Table A1 - Effects of Teenage Motherhood and Other Factors on Educational and Labour Market Outcomes in the First Three Years After Birth

	Completed Year 12 (1)	*Post-school qualification (2)*	*Employed (3)*	*Personal income (4)*
Mean outcome of estimation sample	0.682	0.576	0.583	332.016
# teenage mothers	77	77	77	77
Motherhood status (ref: Childless woman)				
Teenage mother	-0.442 ***	-0.113	-0.434 ***	-53.254
Older mother	-0.175 ***	0.008	-0.404 ***	-231.458 ***
Living with parents	-0.045	-0.095 ***	0.024	-52.310 *
Parental status at age 14				
Parents separated by age 14	-0.101 ***	-0.088 ***	-0.034	-18.073
No employed parents at age 14	-0.122 **	-0.034	-0.015	-51.175 *
Religion (ref: No religion)				
Catholic	0.075 ***	0.036	0.034	4.139
Other Christian	-0.003	0.041	-0.01	-28.644 *
Other religion	-0.004	0.057	-0.078 *	-29.094
Religion not known	-0.098 **	-0.067	-0.028	-34.635
Indigenous Australian	-0.167 ***	-0.052	-0.105 *	55.396 *
Migrant status (ref: Australian born)				
Migrant from an ESB country	0.012	0.029	-0.007	39.843
Migrant from an NESB country	0.085 *	-0.151 ***	-0.090 *	-7.564
Residence (ref: Metropolitan)				
Regional residence	-0.089 ***	-0.056 **	0.047 **	-46.357 ***
Remote residence	-0.096 *	-0.013	0.065	2.339
Par. migrant status (ref: No migrant parent)				
One parent is migrant	-0.021	0.022	-0.018	-18.813
Both parents are migrants	-0.034	0.078 **	-0.021	-11.86
Mixed family			-0.026	-2.253
Number of children			-0.075 ***	43.429 ***
Age of youngest child (ref: 0 years)				
1 year			0.094 ***	
2 years			0.074	
3+ years			0.119 *	
Partner's employment (ref: No partner)				
Partner employed			0.113 ***	-69.357 ***
Partner not employed			-0.097 *	1.149
Age			0.015 ***	233.363 ***
Age squared				-4.456 ***
School completion (ref: Year 9 or less)				
Year 10-11 only		0.124 **	0.131 **	-10.908
Year 12		0.292 ***	0.217 ***	-23.284
Post-school qual. (ref: No qual.)				
Non-degree qualification			0.089 ***	15.369
University degree			0.113 ***	99.135 ***
Employed				258.955 ***
Observations	3,230	3,227	3,155	3,142
(Pseudo) R-squared	0.072	0.050	0.265	0.352

Source: Estimated from LSAC (wave 1) and HILDA (wave 4), women aged up to 29 years only.
Notes: *significant at 10%, **significant at 5%, ***significant at 1%. Also see notes of table 1.

A2 - Effects of Teenage Motherhood and Other Factors on Health Outcomes in the First Three Years After Birth

	Having good health (1)	*Distress index (2)*	*Depression index (3)*	*Being a smoker (4)*
Mean outcome of estimation sample	0.898	4.041	4.380	0.299
# teenage mothers	223	220	220	196
Motherhood status				
Teenage mother	-0.018	0.363 ***	0.267 ***	0.183 ***
Older mother	0.039 *	0.493 ***	0.366 ***	0.021
Living with parents	0.003	0.100 *	0.058	-0.083 **
Parental status at age 14				
Parents separated by age 14	0.004	-0.087 **	-0.100 **	0.065 **
No employed parents at age 14	-0.084 **	-0.05	-0.098	0.027
Religion (ref: No religion)				
Catholic	0.012	-0.024	-0.014	-0.027
Other Christian	0.008	0.012	0.022	-0.131 ***
Other religion	-0.052	-0.06	-0.054	-0.156 ***
Religion not known	0.045 **	-0.076	-0.161 **	-0.032
Indigenous Australian	-0.025	-0.097	-0.084	0.119 *
Migrant status (ref: Australian born)				
Migrant from an ESB country	-0.009	0.058	0.058	0.061
Migrant from an NESB country	0.01	-0.003	-0.114	-0.159 ***
Residence (ref: Metropolitan)				
Regional residence	0.009	0.037	0.030	-0.021
Remote residence	0.041	0.138 *	0.088	-0.01
Par. migrant status (ref: No migrant parent)				
One parent is migrant	-0.021	-0.008	-0.005	0.027
Both parents are migrants	-0.007	-0.067	-0.088	-0.002
Mixed family	0.001	-0.048	-0.053	0.086 **
Number of children	-0.015	-0.046 *	-0.054 *	0
Age of youngest child (ref: 0 years)				
1 year	-0.001	-0.085 *	-0.072	-0.036
2 years	-0.042	-0.445 ***	-0.277 **	0.183 *
3+ years	-0.078	-0.468 ***	-0.472 ***	-0.047
Age	-0.001	-0.057	-0.104 *	0.004
Age squared		0.001	0.002 **	
School completion (ref: Year 9 or less)				
Year 10-11 only	0.051	0.110 *	0.099	-0.070
Year 12	0.076 **	0.196 ***	0.209 **	-0.214 ***
Post-school qual. (ref: No qual.)				
Non-degree qualification	0.021	0.010	0.026	-0.051 *
University degree	0.060 ***	0.061	0.120 **	-0.166 ***
Observations	3,588	3,595	3,587	2,766
(Pseudo) R-squared	0.043	0.111	0.067	0.131

Source: Estimated from LSAC (wave 1) and HILDA (wave 4), women aged up to 29 years only.
Notes: *significant at 10%, **significant at 5%, ***significant at 1%. Also see notes of table 1.

A3 - Effects of Teenage Motherhood and Other Factors on Partnership Outcomes in the First Three Years After Birth

	Partnered *(1)*	*Partner employed* *(2)*	*Family income* *(3)*
Mean outcome of estimation sample	0.837	0.931	848.64
# teenage mothers	77	48	77
Motherhood status			
Teenage mother	0.023	-0.027	-98.596
Older mother			-224.446 ***
Living with parents			-60.136
Parental status at age 14			
Parents separated by age 14	-0.017	-0.01	31.599
No employed parents at age 14	-0.017	-0.012	-62.588
Religion (ref: No religion)			
Catholic	0.042	-0.011	28.311
Other Christian	0.056 **	-0.01	12.301
Other religion	0.087 **	-0.072 *	-85.249 *
Religion not known	-0.007	-0.07	-28.367
Indigenous Australian	-0.173 ***	-0.180 **	53.781
Migrant status (ref: Australian born)			
Migrant from an ESB country	0.027	-0.002	116.664 *
Migrant from an NESB country	0.02	-0.021	-58.458
Residence (ref: Metropolitan)			
Regional residence	0.049 **	-0.027 *	-71.959 ***
Remote residence	0.092 **	0.009	66.377
Par. migrant status (ref: No migrant parent)			
One parent is migrant	-0.035	0.008	-21.719
Both parents are migrants	0.007	0.005	-0.293
Mixed family			-10.141
Number of children			32.583 *
Partner's employment (ref: No partner)			
Partner employed			671.180 ***
Partner not employed			144.242 **
Age	0.017 ***	0.005 *	222.088 ***
Age squared			-3.989 ***
School completion (ref: Year 9 or less)			
Year 10-11 only	0.154 ***	0.153 **	31.832
Year 12	0.215 ***	0.188 ***	44.926
Post-school qual. (ref: No qual.)			
Non-degree qualification	0.012	0.011	18.158
University degree	0.112 ***	0.038 *	192.837 ***
Employed			245.967 ***
Observations	2,139	1,763	3,154
(Pseudo) R-squared	0.128	0.138	0.377

Source: Estimated from LSAC (wave 1) and HILDA (wave 4), women aged up to 29 years only.
Notes: *significant at 10%, **significant at 5%, ***significant at 1%. Also see notes of table 1.

A4 - Comparison of Treatment and Control Groups Before and After Matching

	Unmatched		*Matched*	
	Mean of treatment group	*Mean of control group*	*Mean of treatment group*	*Mean of control group*
At least Year 10	0.831 ***	0.948	0.829	0.862
Both parents are migrants	0.195	0.208	0.184	0.189
Catholic	0.156 *	0.254	0.158	0.135
Indigenous Australian	0.117 ***	0.037	0.118	0.108
Migrant from an ESB country	0.039	0.038	0.026	0.016
Migrant from an NESB country	0.078	0.086	0.079	0.078
No parent employed at age 14	0.078	0.051	0.066	0.069
One parent is migrant	0.091 *	0.168	0.092	0.091
Other Christian	0.208 ***	0.372	0.211	0.217
Other religion	0.130 *	0.073	0.132	0.142
Parents separated by age 14	0.325 **	0.214	0.316	0.322
Regional residence	0.584 **	0.438	0.579	0.603
Religion not known	0.156 ***	0.051	0.145	0.161
Remote residence	0.026	0.044	0.026	0.014

Source: Estimated from LSAC (waves 1-3) and HILDA (wave 4, 6, 8).
Notes: *, ** and *** denote sample means that are significantly different between the treatment and control groups at the 10%, 5% and 1% level respectively. Estimates are based on the kernel matching method with a bandwidth of 0.001.

A5 - Effects of Teenage Motherhood on Outcomes (ATT) in the First Seven Years After Birth, Based on the Propensity Score Matching Method

	Years 0-3 (1)	*Years 4-5 (2)*	*Years 6-7 (3)*
Completed Year 12 [a]			
Estimate	-0.257 ***	-0.324 ***	-0.315 ***
Number in control group	2,020	1,716	1,613
Number treated	76	69	46
Post-school qualification [b]			
Estimate	-0.161 **	-0.187 **	-0.121 **
Number in control group	2,001	1,703	1,606
Number treated	76	69	46
Employed			
Estimate	-0.271 ***	-0.260 ***	-0.178 **
Number in control group	2,060	1,747	1,633
Number treated	77	70	47
Personal income			
Estimate	-49.027 *	-136.387 ***	-102.387 **
Number in control group	2,018	1,709	1,605
Number treated	77	70	47
Having good or better health			
Estimate	-0.063 **	-0.051 **	-0.047 **
Number in control group	2,395	1,694	1,744
Number treated	207	144	93

A5 - Effects of Teenage Motherhood on Outcomes (ATT) in the First Seven Years After Birth, Based on the Propensity Score Matching Method (continued)

	Years 0-3 *(1)*	*Years 4-5* *(2)*	*Years 6-7* *(3)*
Being a smoker			
Estimate	0.296 ***	0.162 **	0.254 **
Number in control group	2,011	1,835	2,019
Number treated	179	117	91
Psychological distress index			
Estimate	0.001 *	-0.070 **	0.010 **
Number in control group	2,447	2,043	1,720
Number treated	208	190	92
Depression index			
Estimate	-0.063 *	-0.060 **	-0.003 **
Number in control group	2,454	2,048	1,736
Number treated	207	187	92
Partnered			
Estimate	-0.127 **	-0.072 **	-0.041 **
Number in control group	1,592	1,303	1,204
Number treated	75	69	46
Partner employed			
Estimate	-0.071 ***	0.024 **	0.017 **
Number in control group	1,278	802	747
Number treated	48	39	27
Family income			
Estimate	-209.195 ***	-317.784 ***	-251.860 **
Number in control group	2,019	1,716	1,612
Number treated	76	69	46

Source: Estimated from LSAC (waves 1-3) and HILDA (wave 4, 6, 8), women aged up to 29 years only for first year, up to 31 for second year and up to 33 for third year.
Notes: Estimates are based on the kernel matching method with a bandwidth of 0.001. Standard errors (not shown) are bootstrapped with 50 replications. *significant at 10%, **significant at 5%, ***significant at 1%. Also see notes of table 1.

Appendix B

Figure B1 - Age Distribution of Having the First Child Amongst Teenage Mothers

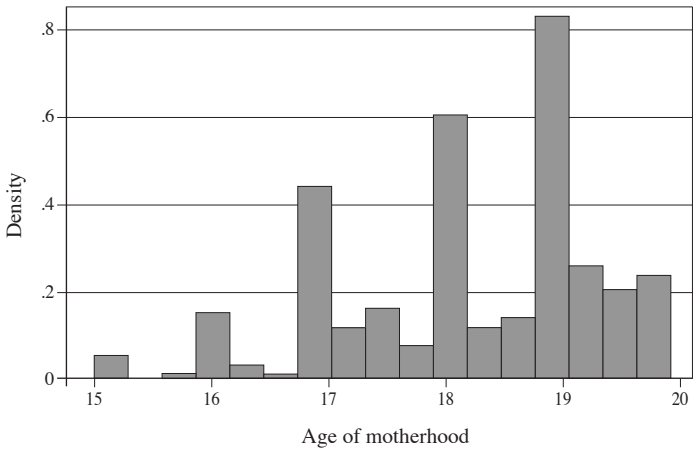
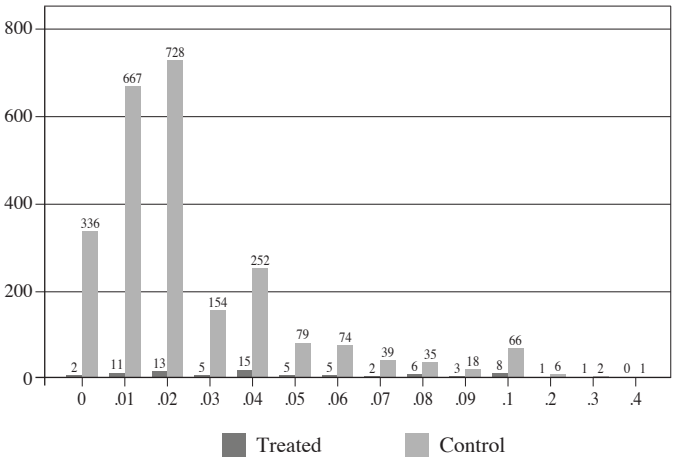
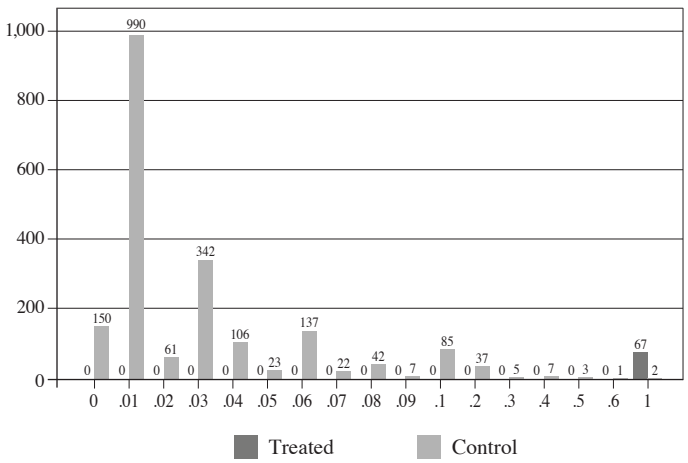


Figure B2 - Frequency Distribution of Propensity Score



Source: Estimated from LSAC (wave 1) and HILDA (wave 4), women aged up to 29 years only.
Notes: Treated: teenage mothers; Control: older mothers and childless women.

Figure B3 - Frequency Distribution of Kernel Matching Weight



Source: Estimated from LSAC (wave 1) and HILDA (wave 4), women aged up to 29 years only.
Notes: Treated: teenage mothers; Control: older mothers and childless women; bandwidth = 0.001.

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