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Does adolescent motherhood affect education and labor market outcomes of mothers? A study on young adult women in Chile during 1990–2013

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Abstract

Objectives We analyze the impact of adolescent motherhood on several education and labor market outcomes in Chile over the 1990–2013 period. We explore whether effects are different across income levels, timing of adolescent births, and three sub-periods.

Methods Using the CASEN national household survey, we applied propensity score-matching methods on two samples of women aged 24: one for women in the 2009–2013 period and another sample of 24-year-old women living with their mother between 1990–2013.

Results In both samples, adolescent motherhood has negative effects on educational outcomes (high school completion, enrollment in technical institutes and universities, and years of education) and on labor outcomes of non-poor women. Childbearing in early adolescence is associated with worse outcomes, and the adverse effects of adolescent motherhood on education and labor outcomes have diminished over the period.

Conclusions Similar to results in developed countries, adolescent motherhood has negative consequences on women's education and labor outcomes, particularly on women that become mothers early in adolescence. Public policies aimed at reducing teen motherhood will have important effects on young women's education and employment.

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Introduction

Latin American countries have among the highest teenage fertility rates in the world, and early childbearing is an important public policy concern due to its impact on women's education and future socio-economic outcomes (Azevedo et al. 2012; Guzman et al. 2001). In contrast to other regions, the decline in adolescent pregnancy in Latin America during the last 25 years has been small, with some countries experiencing increases in teenage childbearing (Singh 1998). Meanwhile, high school enrollment and graduation in the region remain a challenge: the high school enrollment rate was 69% in 2005, and only one in two adolescent girls completed high school (Bassi et al. 2013). Domestic and motherhood responsibilities, along with economic problems, are the main reasons girls drop out of high school in Latin America (Rico and Trucco 2014).

Most of the teen pregnancy literature has analyzed women in developed countries, and in particular in the United States and Great Britain, because these countries have the highest teenage motherhood rates among OECD countries and because data are widely available. The literature has shown a negative relationship between teen motherhood and mothers' future outcomes, such as high school completion, years of schooling, labor market participation, income, and participation in poverty assistance programs (Ribar 1994; Klepinger et al. 1999; Chevalier and Viitanen 2003; Fletcher and Wolfe 2009; Gibb et al. 2014). However, the literature for developing countries—where

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adolescent motherhood remains high—is much smaller: Azevedo et al. (2012) review factors associated with teenage pregnancy and early childbearing in Latin America; Urdinola and Ospino (2015) find that in Colombia, adolescent mothers hold lower quality jobs, suffer higher rates of domestic violence, and have higher shares of deceased children; Arceo-Gomez and Campos-Vasquez (2014) find that in Mexico, women who are adolescent mothers have lower educational attainment and attendance, work fewer hours, and have higher marriage rates; and Buvinic (1998) finds a negative association with economic and social outcomes in Chile during the early 1990s. The literature is also limited for other developing regions, with the exception of South Africa, where studies reveal that adolescent mothers have worse education outcomes (Marteleto et al. 2008; Timæus and Moultrie 2015). In addition, all studies for developed and developing countries have measured the contemporary impact of adolescent motherhood on mothers' outcomes using single cross-sectional data.

In this paper, we estimate the average effects of adolescent motherhood—defined as motherhood before the age of 20—on mothers' education and labor outcomes in Chile between 1990 and 2013. We assess differentiated effects by poverty status, timing of maternity, and how the effects evolved over the period. Chile is an interesting case study, because it has transitioned from a low-to-high–middle-income country, experiencing major social changes during the period of study. The country moved from a dictatorship to a democracy, underwent a period of high economic growth, and implemented policies that led to significant reductions in poverty and increases in access to education. However, these benefits were not distributed equally, as the country has among the highest income inequality indices in the world, as well as unequal access to education (Cornia 2014).

This study is a contribution in at least two dimensions. First, it contributes to the growing evidence on the effects of adolescent motherhood on mothers' educational and labor market outcomes in developing countries with a methodology that addresses the problem of selection into motherhood. Second, it is the first to analyze how the effect of adolescent motherhood changed over a period of more than 20 years. Our findings provide evidence to guide policy decisions in the Latin American region, as well as in other developing regions.

We analyze several outcomes, including high school completion, enrollment in post-secondary education, years of education, labor force participation, employment, and monthly income. We select these outcomes guided by data availability and economic theory that relates adolescent motherhood to educational and labor market outcomes. Specifically, human capital theory predicts that having a

child in adolescence raises mothers' opportunity costs of staying in school due to the time constraint faced in her human capital investment decision: child-rearing activities are time intensive, and they reduce time available for education activities (Becker 1981); consequently, having a child as a teen reduces the mother's human capital accumulation, her likelihood of working, and her ability to access higher paying jobs (Urdinola and Ospino 2015).

Human capital theory also predicts that income constraints reduce educational investments (Becker 1981). Young women from more affluent families have higher wealth levels that can (partially) compensate the time demands of motherhood by accessing paid child care. Thus, giving birth is likely to have a larger negative impact on poor adolescent mothers. Finally, theory indicates that the timing of pregnancies affects human capital accumulation (Blackburn et al. 1993), and heterogeneity in the timing of first births should affect the distribution of human capital accumulation. Empirical evidence shows that early adolescent pregnancies have negative consequences on mothers' educational attainment (Upchurch and McCarthy 1990).

Our hypotheses are that among teenage women that are similar in observable characteristics, those that experience a birth in their adolescent years will face more difficulties completing a formal education (secondary and post-secondary), and that their truncated school attainment will lead to fewer opportunities in the labor market and to lower incomes. Our specific contributions include exploring: (1) whether having a child in adolescence impacts mother's education and labor market outcomes; (2) whether the consequences of an adolescent birth vary according to the socio-economic characteristics of the mother; (3) whether the magnitude of the impact of adolescence birth is related to its timing—earlier or latter adolescence; and (4) whether the effects have changed over the 24-year period.

Methods

To estimate the causal effect of adolescent motherhood, it is important to account for confounding factors. This is difficult, because early motherhood and socio-economic outcomes are often the result of the same risk factors: growing up in poverty, low school quality, or being born to an adolescent mother, among others. In addition, adolescent mothers may be different from those who delay childbirth in terms of their academic abilities, goals, psychological well-being, and fertility preferences, so that differences in their adult socio-economic outcomes are not necessarily due to the young age of their first birth but to unobservable individual characteristics (Hoffman 1998; Levine and Painter 2003). If confounding risk factors are

not considered, results may over-state the effects of adolescent childbearing, because they capture, in part, the correlation between unobserved risk factors and outcomes.

Several methodologies have been used to address this issue: regression frameworks (Geronimus and Korenman 1992; Hofferth et al. 2001; Hoffman et al. 1993); comparisons of random events, such as a miscarriage or a multiple birth (Ashcraft et al. 2013; Fletcher and Wolfe 2009; Hotz et al. 2005); and propensity score matching (PSM) methods (Levine and Painter 2003; Assini-Meytin and Kerry 2015; Lee 2010).

In this paper, we implemented a PSM methodology comparing outcomes of individuals who are similar along a gradient of observable characteristics, except on their adolescent mother status (Rubin 1973; Rosenbaum and Rubin 1983; Imbens and Angrist 1994; Heckman et al. 1998; Abadie and Imbens 2006). Our PSM estimations involved three steps: (1) constructing the propensity score (PS)— probability of being an adolescent mother—by estimating each individual's probability of adolescent motherhood with a Logistic regression that controlled for individual and family characteristics. (2) Matching each adolescent mother to the woman with the closest PS but who was not an adolescent mom, to construct a control group of non-adolescent mothers who were similar in terms of their predicted likelihood of adolescent motherhood (our PSM procedure allowed for replacement, included a caliper of 0.005, and imposed a common support restriction). (3) Finally, with the samples of adolescent mothers and their matched control group, we estimated a regression of each outcome (linear regression for continuous outcomes and logistic for binary ones) on adolescent motherhood and all covariates used in the matching process. We used this regression-adjusted methodology instead of differences in means, because this method is regarded as the most appropriate in the literature (Rubin 1973; Rubin and Thomas 2000; Abadie and Imbens 2006). PSM is used to reduce large covariate bias between treatment and control groups, and regression adjustment in the outcome model corrects for small residual biases and increases efficiency in the estimates (Stuart and Rubin 2007). With the PSM procedure, if the two groups are similar in their observed background characteristics, their adult differences in education and labor market outcomes can be attributed to adolescent motherhood (Rosenbaum and Rubin 1983 and 1985; Imbens and Angrist 1994; Heckman et al. 1998). Our results remain unchanged if we measured the effects with differences in means.

Data, sample, and variables

We used CASEN surveys (Encuesta de Caracterización Socioeconómica Nacional, CASEN) fielded between 1990 and 2013. CASEN is a nationally representative multi-topic household survey carried out by the Ministry of Social Development of Chile, which gathers information on all household members at the time of the survey (households may have more than one nuclear family). Motherhood status is not directly reported; however, it is possible to construct it from household relationships. Specifically, as in other household surveys in Latin America, the family relationships in CASEN surveys refer to the head of the household and to heads of each nuclear family, so that it is not possible to account for all mother–child relationships within a household. To identify motherhood status, we followed a two-step procedure. First, we eliminated indirect and non-family members from the data, keeping heads of nuclear families, his/her spouse or partner, and his/her children or stepchildren (they account for 92% of all individuals surveyed). Next, we estimated a mother's age at first birth by subtracting the age of the oldest child in the nuclear family unit from the age of the mother. If a mother's age at first birth was 19 or less, we classified her as an adolescent mother. In addition, we created two binary variables to indicate the timing of an adolescent birth: one for early adolescent motherhood if the mother was aged 13–15 when she first gave birth and one for latter adolescent motherhood if the woman was aged 16–19 when she became a mother. Given that in our data, date of birth is not available, and we underestimate the extent of adolescent motherhood, because we have age in years without months. In our sample, we expect the underestimation of adolescent motherhood to happen in 17% of all possible cases; however, our results were robust to an alternative definition of adolescent motherhood, whereby all mothers aged 20 were considered as adolescent mothers (results are available upon request).

We are interested in studying medium-term effects of adolescent motherhood, including its impact on post-secondary education. Thus, we analyzed 24-year-old women, because women in this age group are close to post-secondary completion (results are robust to studying women aged 20–23 and 24–26 years; available upon request). The PSM methodology requires covariates that are not affected by the treatment. For instance, being the daughter of an adolescent mother has been found to affect the probability of becoming a teen mother (Kahn and Anderson 1992). In our context, we matched women based on characteristics prior to her adolescent birth, including family of origin's socio-economic characteristics. Since availability of information on family of origin varies over time in CASEN surveys, we constructed two different samples: one for the years 1990–2013 and another for 2009–2013.

The 1990–2013 rounds of the survey contain information on a large set of family of origin's characteristics for women still living with their parents, because they all live

in the household at the time of the survey. We cannot observe these variables if women do not live with their parents, so we restrict this sample to women living with at least their mother. One possible concern with this sample is a potential bias given that it only includes the sub-group of women still living with their family of origin: 60% of women aged 24 continued to live with their mother at age 24, yet 33% of adolescent mothers continue to live with their mother at that age (this fraction has steadily increased over time, reaching 42% in 2013). The advantages of this sample include its larger size (11 rounds of the survey), availability of a large, and rich set of covariates that improve the PSM implementation and the ability to analyze the evolution of the impact of teenage motherhood over the 20+ year period. Although results from this sample could be biased, it is likely that the adverse effects of adolescent motherhood are ameliorated by the support; these women

receive from their families, so that our estimates are likely lower bounds of the potentially negative impacts.

As previously mentioned, CASEN does not include information on family members not living in the household; thus, for women that live away from their parental family, we cannot observe family of origin characteristics. However, the 2009–2013 rounds of the survey asked a small set of retrospective questions on parental characteristics to heads of nuclear units and their spouses, which allowed us to obtain parents' education for women not living with their parents who were heads/spouses in their nuclear unit. The remaining 24-year-old women—who were not heads/spouses of nuclear units—continued living with their parents, so we obtained their parents' education directly from the education section of the survey (as in the 1990–2013 sample).

Our 2009–2013 sample, therefore, includes 24-year-old women who live with their parents, as well as 24-year-old

Table 1 Descriptive statistics of women at age 24: adolescent motherhood and outcomes, Chile (2009–2013)

	Adolescent motherhood	Finished high school	Ever attended technical or vocational institute	Ever attended college or university	Years of schooling	Participates in labor force	Is employed	Income
A. All women								
Mean	0.191	0.835	0.148	0.322	13.036	0.521	0.420	279.938
St. Dev.	(0.39)	(0.37)	(0.36)	(0.47)	(3.02)	(0.50)	(0.49)	(462.89)
Obs.	3170	3170	3170	3170	3168	3170	3170	1040
B. Women by motherhood status								
Adolescent mothers								
Mean		0.628	0.104	0.094	11.294	0.516	0.412	219.637
St. Dev.		(0.48)	(0.31)	(0.29)	(2.76)	(0.50)	(0.49)	(241.38)
Obs.		607	607	607	606	607	607	215
Non-adolescent mothers								
Mean		0.885	0.159	0.377	13.448	0.522	0.421	295.653
St. Dev.		(0.32)	(0.37)	(0.48)	(2.93)	(0.50)	(0.49)	(503.83)
Obs.		2563	2563	2563	2562	2563	2563	825
C. Women by household poverty status								
Poor households								
Mean	0.280	0.684	0.084	0.160	11.5	0.324	0.158	102.3
St. Dev.	(0.45)	(0.47)	(0.28)	(0.37)	(3.08)	(0.47)	(0.36)	(71.5)
Obs.	450	450	450	450	448	450	450	72
Non-poor households								
Mean	0.177	0.860	0.159	0.349	13.3	0.554	0.463	293.2
St. Dev.	(0.38)	(0.35)	(0.37)	(0.48)	(2.94)	(0.50)	(0.50)	(476.8)
Obs.	2720	2720	2720	2720	2720	2720	2720	968

Authors' estimations from CASEN surveys (2009, 2011, and 2013). Includes women aged 24 years for whom there is information on parental education. Adolescent motherhood: being a mother by age 19. Income reported in thousands of Chilean pesos (CLP) per month (average exchange rate in 2009: CLP560/US$1)

women that do not live with their parental families. This sample is more representative of all teenage mothers (87% of all 24-year-old women), ameliorating the problem of potentially biased estimates. However, it is smaller (three rounds of CASEN surveys) and includes only parents' education as family of origin covariates in the PSM estimation, which may reduce the quality of the PSM procedure. The 1990–2013 sample includes 8345 women

Table 2 Descriptive statistics of women at age 24 living with their mother: adolescent motherhood and outcomes, Chile (1990–2013)

	Adolescent motherhood	Finished high school	Ever attended technical or vocational institute	Ever attended college or university	Years of schooling	Participates in labor force	Is employed	Income
A. All women								
Mean	0.128	0.749	0.150	0.248	12.3	0.570	0.462	166.7
St. Dev.	(0.33)	(0.43)	(0.36)	(0.43)	(3.49)	(0.50)	(0.50)	(262.9)
Obs.	8345	8345	8345	8345	8336	8345	8345	3967
B. Women by motherhood status								
Adolescent mothers								
Mean		0.507	0.073	0.076	10.6	0.554	0.447	132.2
St. Dev.		(0.50)	(0.26)	(0.27)	(2.96)	(0.50)	(0.50)	(108.1)
Obs.		1072	1072	1072	1072	1072	1072	513
Non-adolescent mothers								
Mean		0.785	0.161	0.273	12.6	0.573	0.464	171.8
St. Dev.		(0.41)	(0.37)	(0.45)	(3.49)	(0.49)	(0.50)	(278.3)
Obs.		7273	7273	7273	7264	7273	7273	3454
C. Women by household poverty status								
Poor households								
Mean	0.207	0.536	0.086	0.089	10.4	0.432	0.259	58.4
St. Dev.	(0.40)	(0.50)	(0.28)	(0.28)	(3.52)	(0.50)	(0.44)	(61.0)
Obs.	1578	1578	1578	1578	1575	1578	1578	540
Non-poor households								
Mean	0.110	0.799	0.165	0.285	12.7	0.603	0.509	183.8
St. Dev.	(0.31)	(0.40)	(0.37)	(0.45)	(3.34)	(0.49)	(0.50)	(278.0)
Obs.	6767	6767	6767	6767	6761	6767	6767	3427
D. Women by survey periods								
1990–1996 period								
Mean	0.117	0.605	0.154	0.114	11.2	0.571	0.480	89.1
St. Dev.	(0.32)	(0.49)	(0.36)	(0.32)	(3.65)	(0.50)	(0.50)	(122.1)
Obs.	2181	2181	2181	2181	2174	2181	2181	1416
1998–2006 period								
Mean	0.146	0.719	0.136	0.202	11.9	0.573	0.457	176.3
St. Dev.	(0.35)	(0.45)	(0.34)	(0.40)	(3.47)	(0.49)	(0.50)	(171.0)
Obs.	3614	3614	3614	3614	3601	3614	3614	1717
2009–2013 period								
Mean	0.121	0.879	0.161	0.396	13.5	0.559	0.446	255.3
St. Dev.	(0.33)	(0.33)	(0.37)	(0.49)	(3.00)	(0.50)	(0.50)	(437.7)
Obs.	2894	2894	2894	2894	2892	2894	2894	987

Authors' estimations from CASEN surveys (1990, 1992, 1994, 1996, 1998, 2000, 2003, 2006, 2009, 2011, and 2013). Includes women aged 24 years living with their mother for whom there is information on parental education. Adolescent motherhood: being a mother by age 19. Income reported in thousands of Chilean pesos (CLP) per month (average exchange rate in 2009: CLP560/US$1)

aged 24, with 1072 adolescent mothers, while the 2009–2013 sample includes 3170 women aged 24, with 607 adolescent mothers.

Outcomes: education variables included binary variables equaling one if the woman finished high school; if she was ever enrolled in post-secondary vocational/technical institutes; if she was ever enrolled in a college or university; and a continuous variable for years of education completed. The labor outcomes were binary variables equaling one if: she participated in the labor force (worked or sought employment); whether she was employed; and a continuous variable of the young woman's monthly income measured in Chilean pesos (adjusted for 2009 inflation).

Individual variables: woman's year of birth. Family variables: in the 2009–2013 sample, we include years of education of both parents. In the 1990–2013 sample, we use the household's demographic composition, which includes: number of teenagers, number of young adults aged 20–24, number of adults aged 25–64, and number of elderly aged 65+. We also include years of education of the household head; years of education of the grandmother (i.e., the woman's mother); grandmother's age at her first birth (calculated as the difference between grandmother's age and age of her oldest child still living

at home), and her age when she gave birth to the woman in our sample; whether the head of the household was female; total adult household income per person; and whether the household was poor (following the definition of the Chilean government, which uses an absolute poverty line: a household is poor if their income per capita is below the cost of a per-person basket of essential goods). We included a variable that measured household density (number of persons per number of bedrooms) as a proxy for wealth. Other variables: dummy variables for region of residence and a dummy variable for rural location of the household, to control for local conditions, may affect women's outcomes.

Results

Summary statistics for adolescent motherhood and all outcomes are reported in Tables 1 and 2. Summary statistics on covariates used in the PSM are reported in Online Resource Table OR1. In both samples, adolescent mothers had significantly lower levels of educational outcomes and income, and they come from families with worse socio-economic characteristics.

Table 3 Effects of adolescent motherhood on education and labor outcomes at age 24, Chile

Outcomes	High school diploma[a]	Technical or vocational institute[a]	Ever attended college or university[a]	Years of schooling completed[b]	Participates in labor force[a]	Is employed[a]	Income[b]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
A. All women (2009–2013)							
Adolescent motherhood	0.2293*** (0.036)	0.4966*** (0.086)	0.1836*** (0.035)	−1.7435*** (0.148)	0.9056 (0.107)	0.9700 (0.117)	−70.8067*** (22.301)
Observations	1214	1214	1214	1216	1214	1214	414
B. Women living with mother (1990–2013)							
Adolescent motherhood	0.3206*** (0.036)	0.5398*** (0.084)	0.3667*** (0.059)	−1.0351*** (0.111)	0.9805 (0.089)	0.9166 (0.084)	−7.3387 (6.332)
Observations	2144	2144	2144	2142	2144	2144	1012

Authors' estimations from CASEN surveys. Sample 2009–2013 uses 2009, 2011, and 2013 surveys and includes women aged 24 years living with their mother and women that are head or spouses in their own nuclear family. Sample 1990–2013 uses 1990, 1992, 1994, 1996, 1998, 2000, 2003, 2006, 2009, 2011, and 2013 surveys, and includes women aged 24 years living in their mothers' household

***, **, and * Statistical significance at the 1, 5, and 10% levels, respectively

[a] Reports odd ratios estimated from a logistic regression of the outcomes on adolescent motherhood and other covariates

[b] Reports estimates for a linear regression of the outcome on adolescent motherhood and other covariates. Adolescent motherhood is a binary variable equals one if the woman had a child before, she was 20 years of age and zero otherwise. Other covariates included in the estimations of Panel A: years of education of the mother's mother, years of education of the mother's father, and rural location of the household (binary); fixed effect for woman's year of birth and region fixed effects. Other covariates included in the estimations of Panel B: years of education of the household head; years of education of the grandmother; grandmother's age at her first birth; grandmother's age when she gave birth to the woman in simple; whether the head of the household is female (binary); binary variable for whether the household is poor (following the poverty line definition of the Chilean government in each year); total adult household income per person (income is measured in thousands of Chilean pesos (CLP) per month with an average exchange rate in 2009: CLP560/US$1); number of teenagers, young adults aged 20–24, adults aged 25–64, and elderly aged 65 + in the household; number of persons per number of bedrooms; rural location of the household (binary); and fixed effect for woman's year of birth and region fixed effects. Standard errors in parenthesis

Since part of the differences in outcomes can be attributed to differences in observable characteristics, we applied a PSM methodology (Online Resource Table OR2 reports PSM estimations for both samples, Table OR3 reports the socio-economic characteristics of the matched samples, and Figures OR1 and OR2 show the distribution of the PS). As the bias reduction and the test of difference-in-means reveal, our PSM process resulted in successful control groups: women in the matched samples had the same average background characteristics, with the only (statistically) significant difference being their adolescent motherhood status (see Table OR3).

Results for the effect of adolescent motherhood on outcomes are reported in Table 3. Panel A displays results for the 2009–2013 sample (tables with all covariates are available in Online Resources, Tables OR4–OR14) revealing that becoming a mother in adolescence had a negative impact on all educational outcomes and income: adolescent mothers were less likely to complete high school (OR = 0.23, $p < 0.01$); to enroll in a technical/vocational institute (OR = 0.50, $p < 0.01$), college/university (OR = 0.18, $p < 0.01$), they had 1.7 fewer years of education ($p < 0.01$) and lower income ($70.000 CLP, $p < 0.01$). Similar results

Table 4 Effects of adolescent motherhood on education and labor outcomes at age 24 by poverty status, Chile (1990–2013)

Outcomes	High school diploma[a]	Technical or vocational institute[a]	Ever attended college or university[a]	Years of schooling completed[b]	Participates in labor force[a]	Is employed[a]	Income[b]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
A. Sample 2009–2013							
Poor households							
Adolescent motherhood	0.2144*** (0.065)	0.6068 (0.377)	0.0105*** (0.016)	−1.3831*** (0.389)	1.3559 (0.393)	1.2965 (0.487)	9.7439 (23.176)
Observations	248	180	189	246	240	240	36
Non-poor households							
Adolescent motherhood	0.2569*** (0.048)	0.7294 (0.142)	0.1887*** (0.035)	−1.6669*** (0.168)	0.9752 (0.129)	1.0149 (0.133)	−80.1569*** (25.718)
Observations	968	968	968	968	968	968	364
B. Sample 1990–2013							
Poor households							
Adolescent motherhood	0.2818*** (0.056)	0.4794* (0.185)	0.0672** (0.075)	−1.0653*** (0.220)	0.6689** (0.114)	0.9788 (0.185)	5.0606 (6.411)
Observations	650	611	389	650	647	647	230
Non-poor households							
Adolescent motherhood	0.2414*** (0.036)	0.4477*** (0.077)	0.3557*** (0.060)	−0.9643*** (0.137)	0.7911** (0.088)	0.7696** (0.084)	−23.3418*** (7.860)
Observations	1486	1486	1486	1488	1486	1486	774

Authors' estimations from CASEN surveys. Sample 2009–2013 uses 2009, 2011, and 2013 surveys and includes women aged 24 years living with their mother and women that are head or spouses in their own nuclear family. Sample 1990–2013 uses 1990, 1992, 1994, 1996, 1998, 2000, 2003, 2006, 2009, 2011, and 2013 surveys, and includes women aged 24 years living in their mothers' household

***, **, and * Statistical significance at the 1, 5, and 10% levels, respectively

[a] Reports odd ratios estimated from a logistic regression of the outcomes on adolescent motherhood and other covariates

[b] Reports estimates for a linear regression of the outcome on adolescent motherhood and other covariates. Adolescent motherhood is a binary variable equals one if the woman had a child before she was 20 years of age and zero otherwise. Other covariates included in the estimations of Panels A: years of education of the mother's mother, years of education of the mother's father, and rural location of the household (binary); fixed effect for woman's year of birth and region fixed effects. Other covariates included in the estimations of Panel B: years of education of the household head; years of education of the grandmother; grandmother's age at her first birth; grandmother's age when she gave birth to the woman in simple; whether the head of the household is female (binary); binary variable for whether the household is poor (following the poverty line definition of the Chilean government in each year); total adult household income per person (income is measured in thousands of Chilean pesos (CLP) per month with an average exchange rate in 2009: CLP560/US$1); number of teenagers, young adults aged 20–24, adults aged 25–64, and elderly aged 65+ in the household; number of persons per number of bedrooms; rural location of the household (binary); and fixed effect for woman's year of birth and region fixed effects. Standard errors in parenthesis

Table 5 Effects of adolescent motherhood on education and labor outcomes at age 24 by mother's age of first birth, Chile (1990–2013)

Outcomes	High school diploma[a]	Technical or vocational institute[a]	Ever attended college or university[a]	Years of schooling completed[b]	Participates in labor force[a]	Is employed[a]	Income[b]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
A. Sample 2009–2013							
Aged 13–15 at first birth	0.0471*** (0.018)		0.1255*** (0.097)	−3.6448*** (0.427)	1.0900 (0.417)	0.9521 (0.377)	−76.8980 (66.593)
Aged 16–19 at first birth	0.2325*** (0.054)	0.8370 (0.172)	0.1494*** (0.034)	−1.6237*** (0.174)	0.9922 (0.152)	1.0541 (0.164)	−80.7445** (31.418)
Observations	1218	1185	1218	1216	1218	1218	418
B. Sample 1990–2013							
Aged 13–15 at first birth	0.2249*** (0.060)	0.3960* (0.208)	0.1230** (0.105)	−1.4817*** (0.251)	0.7095 (0.154)	0.7433 (0.164)	11.5303 (12.774)
Aged 16–19 at first birth	0.3326*** (0.038)	0.5514*** (0.086)	0.3873*** (0.063)	−0.9923*** (0.113)	1.0130 (0.094)	0.9356 (0.088)	−9.0274 (6.509)
Observations	2144	2144	2144	2142	2144	2144	1012

Authors' estimations from CASEN surveys. Sample 2009–2013 uses 2009, 2011, and 2013 surveys and includes women aged 24 years living with their mother and women that are head or spouses in their own nuclear family. Sample 1990–2013 uses 1990, 1992, 1994, 1996, 1998, 2000, 2003, 2006, 2009, 2011, and 2013 surveys, and includes women aged 24 years living in their mothers' household

***, **, and * Statistical significance at the 1, 5, and 10% levels, respectively

[a] Reports odd ratios estimated from a logistic regression of the outcomes on adolescent motherhood and other covariates

[b] Reports estimates for a linear regression of the outcome on adolescent motherhood and other covariates. Aged 13–15 at first birth equal to one if the mother was aged 13–15 when she gave birth, and aged 16–19 at first birth if the teenage mother was aged 16–19 when she became a mother. Other covariates included in the estimations: years of education of the household head; years of education of the grandmother; grandmother's age at her first birth; grandmother's age when she gave birth to the woman in simple; whether the head of the household is female (binary); binary variable for whether the household is poor (following the poverty line definition of the Chilean government in each year); total adult household income per person (income is measured in thousands of Chilean pesos (CLP) per month with an average exchange rate in 2009: CLP560/US$1); number of teenagers, young adults aged 20–24, adults aged 25–64, and elderly aged 65 + in the household; number of persons per number of bedrooms; rural location of the household (binary); fixed effect for woman's year of birth; and region fixed effects. Standard errors in parenthesis

for educational outcomes are obtained for the 1990–2013 sample. Our results are robust to different PSM methods, such as three and five nearest neighbors and kernel matching.

Next, we conducted an analysis separating households according to their poverty status (Table 4). For the 2009–2013 sample, we found similar negative effects on educational outcomes across both groups, but the effect on enrollment in college/university was larger for women living in poor families (OR = 0.01, p < 0.05). We also found that the negative effect on mothers' income comes from its effect on non-poor households. Interestingly, for the 1990–2013 sample, we found a negative effect on labor force participation among both groups, and that non-poor adolescent mothers were also less likely to work and have lower incomes.

We also investigated whether the effects were different according to the timing of an adolescent birth—having a child between the ages 13–15 vs. 16–19 years of age, relative to women who were not adolescent mothers. Instead of a single binary adolescent mother variable, each regression includes an adolescent motherhood variable for each age

group (Table 5). In both samples, we found that early adolescent motherhood has larger negative effects on finishing high school, college/university attendance, and years of schooling. Because of sample size, we could not estimate the effect on technical/vocational schools for early adolescent motherhood in the 2009–2013 sample. However, in the 1990–2013 sample, we found that earlier adolescent motherhood is more detrimental to these outcomes.

One of the reasons we used the 1990–2013 sample on a sub-group of women was that we can analyze whether adolescent motherhood effects changed over time. We divided the period of analysis into three sub-periods: 1990–1996, 1998–2006, and 2009–2013. We selected those sub-periods to balance the number of years, the number of surveys, and sample size. Results are reported in Table 6. We observe that the negative effects on educational outcomes decreased over time, particularly for access to college/university and technical/vocational institutes. In terms of labor market outcomes, we also found that negative effects disappear after 1996. However, in terms of income, we find an increasing negative effect over the period.

Table 6 Effects of adolescent motherhood on education and labor outcomes at age 24 by periods, Chile (1990–2013)

Outcomes	High school diploma[a]	Technical or vocational institute[a]	Ever attended college or university[a]	Years of schooling completed[b]	Participates in labor force[a]	Is employed[a]	Income[b]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Women living with mother, 1990–1996							
Adolescent motherhood	0.1967***	0.0894***	0.0286***	−1.1577***	0.5084***	0.6665*	3.4049
	(0.048)	(0.045)	(0.025)	(0.271)	(0.106)	(0.140)	(6.969)
Observations	472	453	345	472	472	472	260
Women living with mother, 1998–2006							
Adolescent motherhood	0.3211***	0.5511**	0.2964***	−0.8613***	0.8682	0.9397	−7.6126
	(0.053)	(0.157)	(0.082)	(0.177)	(0.116)	(0.127)	(7.984)
Observations	1,004	953	1,004	1,002	993	993	486
Women living with mother, 2009–2013							
Adolescent motherhood	0.3677***	0.9101	0.3451***	−1.0353***	1.0657	1.0360	−57.4588***
	(0.080)	(0.211)	(0.084)	(0.214)	(0.180)	(0.174)	(16.787)
Observations	664	664	664	672	664	664	262

Authors' estimations from CASEN surveys. Sample 2009–2013 uses 2009, 2011, and 2013 surveys and includes women aged 24 years living with their mother and women that are head or spouses in their own nuclear family. Sample 1990–2013 uses 1990, 1992, 1994, 1996, 1998, 2000, 2003, 2006, 2009, 2011, and 2013 surveys, and includes women aged 24 years living in their mothers' household

***, **, and * Statistical significance at the 1, 5, and 10% levels, respectively

[a] Reports odd ratios estimated from a logistic regression of the outcomes on adolescent motherhood and other covariates

[b] Reports estimates for a linear regression of the outcome on adolescent motherhood and other covariates. Adolescent motherhood is a binary variable equals one if woman had a child before she was 20 years of age and zero otherwise. Aged 13–15 at first birth equal to one if the mother was aged 13–15 when she gave birth, and aged 16–19 at first birth if the teenage mother was aged 16–19 when she became a mother. Other covariates included in the estimations: years of education of the household head; years of education of the grandmother; grandmother's age at her first birth; grandmother's age when she gave birth to the woman in simple; whether the head of the household is female (binary); binary variable for whether the household is poor (following the poverty line definition of the Chilean government in each year); total adult household income per person (income is measured in thousands of Chilean pesos (CLP) per month with an average exchange rate in 2009: CLP560/US$1); number of teenagers, young adults aged 20–24, adults aged 25–64, and elderly aged 65+ in the household; number of persons per number of bedrooms; rural location of the household (binary); fixed effect for woman's year of birth; and region fixed effects. Standard errors in parenthesis

Discussion

We analyzed whether education and labor market outcomes among 24-year-old women in Chile were affected by adolescent motherhood applying a PSM methodology. In addition to possible concerns regarding our data discussed previously, our PSM estimation has some limitations. Although we account for selection into motherhood due to observable individual or family characteristics, we cannot account for unobservables that simultaneously affect adolescent motherhood and outcomes. However, our estimates are consistent with the literature on the causal effects of adolescent motherhood.

We find that in Chile, having a child in adolescence has negative impacts on all mothers' educational outcomes by age 24, which is consistent with the literature in both developed and other developing countries. In terms of labor market outcomes, we find that adolescent motherhood can lead to lower income jobs among young women (although there is no effect on income among the sub-group of women living with their mothers). In terms of poverty status, the negative effects on educational outcomes are similar across groups (and for both samples) except college enrollment, where it is larger among poor women. In addition, contrary to what we expected, non-poor women are negatively affected in their labor market outcomes (particularly in the 1990–2013 sample). The mostly non-significant effects on poor mothers might be explained by their initially low levels of employment and income, which might not suffer further declines with motherhood, as they were already low.

A novel contribution of our study is that we estimated the effect of the timing of an adolescent birth on future outcomes, comparing births in early adolescence (ages 13–15) relative to late adolescence (ages 16–19). If a birth occurs in early adolescence, it is more difficult for the mother to continue or complete her formal schooling relative to adolescent mothers who give birth closer to the age of high school completion. It is more feasible that a young

mother completes her degree—either by returning to classes or obtaining a graduation certificate—if she is closer to finishing high school. Our study finds evidence that relative to non-adolescent mothers, there are larger detrimental effects of becoming a mother in early adolescence.

We also took advantage of our data set spanning a period of almost 25 years to study if the effects of adolescent motherhood changed during this period, for the subgroup of young women who still lived with their mothers. We found that the negative effects on educational outcomes diminish over time—especially for enrollment in technical/vocational institutes—but they remain large. These results are consistent with a large expansion of higher education institutions during the period (technical schools, colleges, and universities) along with the implementation of large nation-wide post-secondary scholarship and student loan programs implemented after the second half of the 1990s and that were targeted to low- and middle-income students, who tend to enroll in technical/vocational institutes.

In terms of labor market outcomes, we observe negative effects from adolescent motherhood between 1990 and 1996, and these disappear in later sub-periods. These changes could be attributed to several factors. For instance, the share of adolescent mothers that remain living with their parental families has increased in recent years, which means that they have more resources and support to enter the labor market. Another factor could have been the increasing access to various publicly provided child care services that were expanded during the 1990s and 2000s, such as a full-day school reform that extended school schedules (began in 1997) and the public day care expansion policy (began in 2006), both of which make motherhood and employment more compatible (Berthelon and Kruger (2011) shows that the full-day schooling program reduced adolescent motherhood). We also found that even though there are no effects on employment, adolescent mothers have lower income in the last sub-period (2009–2013), which could be explained by changes in returns to education in Chile (Manacorda et al. 2010): as adolescent mothers have lower educational attainment, even if they work, they may end up with lower salaries.

Reducing the prevalence of adolescent motherhood should be a public health priority Chile. Nonetheless, serious challenges exist, as the country does not have a global, comprehensive policy to address the issue, or comprehensive sex education programs in schools, and although the national public health policy provides birth control options, adolescents are often discriminated and denied access (Casas and Ahumada 2009). Overall, our results indicate that public policies aimed at reducing early childbearing will have important effects on young women's educational and labor market outcomes. Findings for Chile, a middle-income country, also provide evidence that can assist public policies in Latin America and other regions with similar income levels.

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