The effects of family instability on children's outcomes

Rebecca Lessem and Carl Sanders

February 15, 2019

1 Introduction

The share of children born to unmarried women in the US rose from 30% to 44% between 2000 and 2014.[1] Policymakers on both the left and the right have pushed for programs that promote two-parent households, believing that this is best for child outcomes. However, the causal impact of family stability on child outcomes is still unknown. There are plausible reasons to believe that family instability has a negative effect on children: for one, it reduces the resources available to the child, both in terms of time and money, to only have one parent for extended periods of time. Additionally, children may have a difficult time adjusting psychologically to the uncertainty associated with having an unstable family. However, there are also reasons to think this instability may be a relatively minor problem relative to other issues such as income inequality: worse outcomes for children of unstable families are strongly confounded by the large socioeconomic difference between these families, and family instability may simply be another symptom of poverty rather than a cause of it.

In this paper, we study how family instability causally affects child outcomes, focusing on cognitive, physical, and emotional development. To do this, we develop and estimate a dynamic model of marriage and child development. The mother chooses both marital status and how much to invest in the child each period, and the child's outcomes evolve as a function of these decisions. One key component of the model is that marriage may create a more binding commitment to stay together, since both the monetary and psychological costs of divorce are likely higher than breakups of non-married couples. We use the model to evaluate the impact on families of policies that encourage families to stay together. These types of policies have a direct effect on the child if marital stability affects outcomes, and also potentially an indirect effect if the probability of divorce affects the mother's incentive to invest in the child.

[1]Statistics calculated by the Pew Research Center. See http://www.pewsocialtrends.org/2015/12/17/1-the-american-family-today/

In each period, the mother chooses her relationship status with her child's father,[2] as well as how much to invest in the child. The mother may invest differently in her child depending on her relationship status, given that she may have less time when she is single. Child outcomes evolve over time, as a function of marital status and parental investment. The mother considers the impact on future child outcomes when deciding her relationship status. We estimate this model using data from Fragile Families, a survey that starts from a sample of mothers and children at birth. The survey follows the mother and child up to age 15, allowing us to track parental investments and marriage decisions at each age, as well as the child's academic and health outcomes. After estimating the model, we can use our results to quantify how much their outcomes would improve if there were policies put in place to encourage parents to stay together; for example, transfers that were tied to the couple remaining as joint parents, or changes to the legal treatment of cohabiting couples making it more costly to separate.

The existing literature has indeed documented that family instability is negatively correlated with children's academic test scores and psychological well-being.[3] [Craigie et al., 2012] find that many differences in children's outcomes across parents' current relationship status (married, cohabiting without marriage, or separated) are reduced when controlling for socioeconomic characteristics such as parents' education and financial resources. However, the actual causal impact of instability remains an open question. One exception is [Lang and Zagorsky, 2001], who use parental death as an arguably exogenous shock that causes a child to have one parent, and find that this does not affect economic well-being in adulthood. [Tartari, 2015] quantifies the negative effects of parents' divorce on the cognitive test scores of children using as structural model. We also look at a wider variety of outcomes than just academic test scores, including measures of psychological and physical health. Furthermore, the research has not been able to identify the mechanisms that cause family instability to affect child outcomes, which we aim to identify. Lastly, the previous papers use current relationship status, which is a noisy proxy at best for the overall stability of the parents' relationship. Given the current rates of cohabitation, as well as parents that never marry, our broader focus on relationship stability rather than simply divorce aims to give our results more policy relevance. There is some work that studies cohabitation and marriage, but does not examine how it affects child outcomes.[4]

[2] The current version of the model is preliminary. In a future version of the paper, we will allow for the relationship status to be determined as the outcome of a bargaining problem between the mother and father.

[3] There is also some evidence that this persists to adulthood. For example, see [Ross and Mirowsky, 1999], [Amato and Sobolewski, 2001], [Maier and Lachman, 2000], [Tucker et al., 1997], and [Hayward and Gorman, 2004].

[4] For example, see [Brien et al., 2006].

2 Data

Data for our research question requires information over time on families that includes measures of relationship status and child outcomes, both academic and health-based. We use the Fragile Family and Child Wellbeing Study (hereafter Fragile Families), administered jointly by research groups at Princeton and Columbia Universities. Fragile Families is a longitudinal survey of parents and children. The parents were surveyed at birth, responding to a range of questions on relationship status, household structure, investments in children, and labor market status, and were re-surveyed at repeated intervals up to when the child turned 15. Importantly, at each wave the child was given tests to assess cognitive development and psychological evaluations, and there is information on the child's physical health. We will use the panel data structure to link together relationship status and investments in children with changes in children's outcomes over time, exploiting the longitudinal aspect of the survey instead of the more standard comparison of average outcomes between children with married versus unmarried parents. The surveys were done at birth (year 0), as well as at years 1, 3, 5, 9, and 15.

3 Reduced form evidence

3.1 Relationship transitions

First, we look at the transitions over marital status in the data. In Tables 1-5, we show the distributions of current period relationship status, conditioning on the prior period relationship status. We classify people as married, cohabiting, or other (which includes being single or being in a relationship but not living together). These tables show that there is a lot of variation in relationship status in our data. We see transitions between states each period, meaning that the children in these households experience transitions in their household structure over the first 15 years of their life. This demonstrates that our approach of using the whole history of marital status to understand evolution of child outcomes is important, because just the static relationship status is missing a huge part of the story. Marriage and cohabitation seem fairly evenly persistent; however we see that parents who are married are less likely to transition into the "other" state. For example, 5% of the couples who are married in period 0 are in the "other" state by period 1, as compared to 30% of couples who are cohabiting in period 0. [5]

[5] We are only considering marriage between the child's birth parents. If a parent is married to someone else, this is part of the "other" category.

Next, Table 6 shows the results of a probit regression where the dependent variable equals 1 if a person is single in a period and is 0 otherwise. We control for the previous period relationship status, and see that people who are married or cohabiting are less likely to be single. Comparing the coefficients for married and cohabiting, we also see that people who were previously married are less likely to be single than those who were previously cohabiting. Education of the mother and father both decrease the likelihood of being single.

3.2 Investments in children

Next we look at how marital status affects parental investments in children. The Fragile Families dataset gives us information on how much time parents spend with their children, which we use as a measurement of investment. We run regressions for various measures of parental investments; the results are shown in Tables 7-12. We do not see much of an effect of marital status on child investments. The strongest trend seems to be that mother's with higher education levels spend more time with their children. We also see some evidence that mothers who work spend more time with their children.

3.3 Health outcomes

We next look at the determinants of health outcomes. In Table 13, the dependent variable is a measure of self-reported health, on a 1-5 scale. We see some evidence that children in married households have higher health measures, and parental education also seems to increase the health outcomes. We next look at more concrete measures of health: BMI (reported as a percentile), height, and weight in Tables 14, 15, and 16 respectively. We see some evidence that father's education reduces the child's BMI, but otherwise do not see much evidence that any of these factors affect the child's BMI or height.

3.4 Academic outcomes

We now look at the determinants of academic outcomes. We report one table for each year; this is shown in 17-20. In each year, the child was given different standardized tests, where we use percentile scores as the dependent variable. For year 15, there were no tests, but instead we have their grades (reported on a 1-4 scale). We see that marital status, as well as parent's education, increase test scores and grades. At age 15, where we see grades, we also see some evidence that childreen of cohabiting parents do better than those who are not living together.

4 Model

In each period, a mother decides on her relationship status, which we denote as r_t. Her options are to be married ($r_t = 1$), cohabit with her partner ($r_t = 2$), or be single ($r_t = 3$). The mother also decides how much to invest in her child each period. Child outcomes evolve over time as a function of marital status and investment.

In any given period $t \in \{1...T\}$, the state variables for the mother are previous period relationship status r_{t-1} and the child's quality at the start of the period q_{t-1}. The mother has observable characteristics denoted by X. The mother chooses both her relationship status and how much to invest in the child by solving the following optimization problem:

$$\begin{aligned} V_t\left(r_{t-1}, q_{t-1}, X, \{\varepsilon_{rt}\}\right) &= \max_{r_t \in \{1,2,3\}, I_t} U\left(r_{t-1}, r_t, q_{t-1}, X\right) - c\left(I_t\right) + \varepsilon_{rt} \\ &+ \beta E\left[V_{t+1}\left(r_t, q_t, X, \left\{\varepsilon_{r(t+1)}\right\}\right)\right] \end{aligned} \tag{1}$$

$$q_t = H\left(X, q_{t-1}, r_t, I_t\right) \tag{2}$$

The first component in equation (1) is today's utility, which is a function of relationship status, child quality, and the mother's characteristics. There is a cost of child investment, denoted as $c(I_t)$. There are extreme value shocks to the relationship choice, denoted as ε_{rt}. Investment has a cost today, but a benefit from increased child quality tomorrow, where we assume that child quality evolves deterministically as a function of current child quality, relationship status, and investment, given by the function $H(\cdot)$ in equation (2). Mother's also consider the expected continuation value with discount rate β.

For each relationship status choice at each time, we can calculate the optimal investment. Investment decisions only depend on current child quality and the relationship decision, since the other components will drop out. Therefore for each possible relationship status choice, we can write

$$I^*\left(r_t, q_{t-1}\right) = \text{argmax}_{I_t} - c\left(I_t\right) + \beta E\left[V_{t+1}\left(r_t, H(X, q_{t-1}, r_t, I_t), \left\{\varepsilon_{r(t+1)}\right\}\right)\right] \tag{3}$$

In equation (3), we write next period child quality as $H(\cdot)$, to make clear how child investment impacts future valuations. The optimal investment decision for each relationship choice just comes from the first order condition of equation (3). We can rewrite the value function, denoting the optimal investment as $I^*(\cdot)$.

$$\begin{aligned} V_t\left(r_{t-1}, q_{t-1}, X, \{\varepsilon_{rt}\}\right) &= \max_{r_t \in \{1,2,3\}} U\left(r_{t-1}, r_t, q_{t-1}, X\right) - c\left(I^*\left(r_t, q_{t-1}\right)\right) + \varepsilon_{rt} + \\ &+ 0.95 \cdot E\left[V_{t+1}\left(r_t, q_t, X, \left\{\varepsilon_{r(t+1)}\right\}\right)\right], \end{aligned} \quad (4)$$

$$q_t = H\left(X, q_{t-1}, r_t, I^*\left(r_t, q_{t-1}\right)\right) \quad (5)$$

This now turns into a standard discrete choice problem. Since we assumed that the shocks to relationship status ε_{rt} follow the extreme value distribution, we can solve for the closed form solution to the continuation values.

$$E\left[V_t\left(r_{t-1}, q_t, X, \{\varepsilon_{rt}\}\right)\right] = \log\left(\sum_{r_t \in \{1,2,3\}} \exp\Bigg(U\left(r_{t-1}, r_t, q_{t-1}, X\right) - c\left(I^*\left(r_t, q_{t-1}\right)\right) \right. \quad (6)$$
$$\left. + 0.95 \cdot E\left[V_{t+1}\left(r_t, q_t, X, \left\{\varepsilon_{r(t+1)}\right\}\right)\right]\Bigg)\right) + \gamma$$

In equation (6), γ is Euler's constant. We can also use the properties of the extreme value distribution to compute the probability that a person chooses a given relationship status in a period. This takes a logit form as follows.

$$P(r_t | r_{t-1}, q_{t-1}, X) = $$
$$\frac{\exp\left(U\left(r_{t-1}, r_t, q_{t-1}, X\right) - c\left(I^*\left(r_t, q_{t-1}\right)\right) + 0.95 \cdot E\left[V_{t+1}\left(r_t, q_t, X, \left\{\varepsilon_{r(t+1)}\right\}\right)\right]\right)}{\sum_{r_{t \in 1,2,3}} \exp\left(U\left(r_{t-1}, r_t, q_{t-1}, X\right) - c\left(I^*\left(r_t, q_{t-1}\right)\right) + \varepsilon_{rt} + 0.95 \cdot E\left[V_{t+1}\left(r_t, q_t, X, \left\{\varepsilon_{r(t+1)}\right\}\right)\right]\right)}$$

At time 0, the mother has exogenous marital status $r_0 \in \{1, 2, 3\}$, which we take from the data as the marital status at the child's birth, and child quality $q_0 \sim \mathrm{N}(0, 1)$. In time 0, r_0 is exogenous but I_0 is chosen optimally given the assigned relationship status. We observe decisions starting at time $t = 1, ..., T$.

5 Estimation

5.1 Parameterization

Utility: the utility function is written as $U\left(r_{t-1}, r_t, q_{t-1}\right)$. We assume that utility is linear in relationship status and child quality at the start of the period, so

$$U\left(r_{t-1}, r_t, q_{t-1}\right) = k_{r_{t-1}, r_t} + X\beta_{r_{t-1}, r_t} + q_{t-1}$$

The k_{r_{t-1},r_t} are R^2 constants giving the base level of utility from one's current relationship status, as a function of your previous relationship status, while β_{r_{t-1},r_t} is $k \times R^2$ coefficients on the differences in preferences by observables. We set the total utility to being single with as 0, so $u(r_{t-1}, 3) = 0$ for all r_{t-1}.

Evolution of child quality: We assume that child quality evolves as follows

$$q_{t+1} = H\left(q_t, r_t, I_t\right) = q_t + \left(\delta_{r_t}\left(1 + X\beta_\delta\right) + \left(1 + X\beta_\gamma\right)\gamma_{r_t} I_t\right) \tag{7}$$

Child quality evolves depending on relationship status and investment in the child. There is a constant shifter δ, which depends on relationship status. The effect of investment on child quality also depends on relationship status. Assuming the X's are demeaned, δ_{r_t} and γ_{r_t} give the rates for the average level of observables and the β_δ and β_γ reflect differences in investment returns by observables.

Cost of investment: We parameterize the cost of investment as follows

$$c\left(I_t\right) = I_t^2 \tag{8}$$

5.2 Measurement and likelihood

We observe relationship states without error in the data. However, we do not have direct observations of child quality q and investment I. Instead, we observe them with error. For both quality and investment, we see a series of indicators each period that can inform us about the true measure with error. For investment, our data give a series of measures for time spent with the child. For child outcomes, we have measures of the children's health and academic outcomes.

Assume we have M_t^q measures of quality at time t. For each measure j, we write

$$m_{jt}^q = \alpha_{jt}^1 + \alpha_{jt}^2 q_t + \alpha_{jt}^3 \varepsilon,\ \ j = 1...M_t^q, t = 1...T,\ \varepsilon \sim \mathrm{N}\left(0, 1\right). \tag{9}$$

The parameters α differ by both test j and time t. There may be different numbers of tests per time period, and we do not assume that even same-name tests (e.g. Woodcock-Johnson academic tests) in different periods measure the same skills or measure skills with the same parameters. To interpret equation (9), recall that m_{jt}^q is an outcome of one of our quality measures (for example, a test score). This is a function of a person's unobserved quality q_t. We can do this for every outcome measure in the data.

We can do the same for investment

$$m_{jt}^{I}=\beta_{jt}^{1}+\beta_{jt}^{2}I_t+\beta_{jt}^{3}\varepsilon,\ j=1...M_t^I,t=1...T,\,\varepsilon\sim\mathrm{N}\left(0,1\right).$$

Our data consist of M_t^q measures of quality and M_t^I measures of investment for each period t. Given the parameters, relationship decisions, and known initial q_0, which we assume is distributed normally with mean 0 and variance 1, we can predict quality and investment for each individual. In particular, child investment is a deterministic function of one's relationship state and previous child quality, and quality also evolves deterministically as a function of investment, relationship status, and previous quality. This also allows us to predict each quality and investment measure, which we denote as $\hat{m}_{jt}^q$ and $\hat{m}_{jt}^I$. In particular,

$$\begin{aligned}\hat{m}_{jt}^{q} &= \alpha_{jt}^{1}+\alpha_{jt}^{2}q_t\\ \hat{m}_{jt}^{I} &= \beta_{jt}^{1}+\beta_{jt}^{2}I_t\end{aligned}$$

We also know that the standard deviation of each quality measure is α_{jt}^3 and the standard deviation of each investment measure is β_{jt}^3.

For each person, we write the time t likelihood as

$$\begin{aligned}&L_t\left(r_t,\left\{m_{jt}^q\right\}_{j=1}^{M_t^q},\left\{m_{jt}^I\right\}_{j=1}^{M_t^I}|r_{t-1},q_{t-1}\right)= \\ &\Pr\left(r_t|r_{t-1},q_{t-1},X\right)\cdot\prod_{j=1}^{M_t^q}\frac{1}{\alpha_{jt}^3}\phi\left(\frac{m_{jt}^q-\hat{m}_{jt}^q}{\alpha_{jt}^3}\right)\cdot\prod_{j=1}^{M_t^I}\frac{1}{\beta_{jt}^3}\phi\left(\frac{m_{jt}^I-\hat{m}_{jt}^I}{\beta_{jt}^3}\right)\end{aligned}\tag{10}$$

To derive equation (10), we use the fact that with known quality q, the measurements are independent of everything else. We can then derive the likelihood over all periods for each person, initial on q_0, which we write as $\tilde{L}\left(r,m^q,m^I|q_0\right)$. We are using r to denote the series of relationship statuses, m^q to denote the series of quality measures, and m^I to denote the series of investment measures. We can then integrate out initial quality q_0 to find the log likelihood for each person.

$$\begin{aligned}\mathcal{LL}\left(r,m^q,m^I\right) &= \log\left[\int_{q_0=-\infty}^{\infty}\tilde{L}\left(r,m^q,m^I|q_0\right)f\left(q_0\right)dq_0\right]\\ &= \log\left[\int_{q_0=-\infty}^{\infty}\exp\left(\log\left(\tilde{L}\left(r,q^m,I^m|q_0\right)\right)\right)f\left(q_0\right)dq_0\right].\end{aligned}\tag{11}$$

We assume that initial quality follows the standard normal distribution, which gives us

$$\begin{aligned}\mathcal{LL}\left(r, m^{q}, m^{I}\right) &= C + \log \int_{q_0=-\infty}^{\infty} \exp\left(\sum_{t=1}^{T} \log \Pr\left(r_t | r_{t-1}\right) + \sum_{t=1}^{T} \sum_{j=1}^{M_t^q} \left[\log \frac{1}{\alpha_{jt}^3} - \frac{1}{2}\left(\frac{m_{jt}^q - \hat{m}_{jt}^q}{\alpha_{jt}^3}\right)^2\right]\right. \\ &+ \left.\sum_{t=1}^{T} \sum_{j=1}^{M_t^I} \left[\log \frac{1}{\beta_{jt}^3} - \frac{1}{2}\left(\frac{m_{jt}^I - \hat{m}_{jt}^I}{\beta_{jt}^3}\right)^2\right] - \frac{1}{2} q_0^2\right) dq_o\end{aligned}$$

This is useful for calculations because it reduced the number of normal pdfs to explicitly evaluate. To actually integrate this, we use Gassian quadrature with a Hermite weight function, so we approximate the integral by

$$\begin{aligned}\mathcal{LL}\left(r, q^{m}, I^{m}\right) &= C + \sum_{i=1}^{N} \log\left[\sum_{k=1}^{K} \omega_k \cdot \exp\left(\sum_{t=1}^{T} \log \Pr\left(r_t^{\star} | r_{t-1}^{\star}\right)\right.\right. \\ &+ \sum_{t=1}^{T} \sum_{m_q=1}^{M_q} \left[\log \frac{1}{\sigma_{m_q}} - \frac{1}{2}\left(\frac{q_t^{m_q} - \hat{q}|_{q_0=\tilde{x}_k}}{\sigma_{m_q}}\right)^2\right] \\ &+ \left.\left.\left(\sum_{t=1}^{T} \sum_{m_I=1}^{M_I} \left[\log \frac{1}{\sigma_{m_I}} - \frac{1}{2}\left(\frac{I_t^{m_I} - \hat{I}|_{q_0=\tilde{x}_k}}{\sigma_{m_I}}\right)^2\right]\right)\right)\right]\end{aligned}$$

for weights ω_k and points $\tilde{x}_k$.[6]

6 Results

We are currently working to estimate the model.

[6] Use of the Hermite weights removes the $-\frac{1}{2}q_0^2$ term (since it gets lumped in to the weight function) as well as allows for accurate evaluation very cheaply: in the simulations, 11 evaluation points gets 3 digits of accuracy, 15 gets 4, and 21 gets 5.

References

[Amato and Sobolewski, 2001] Amato, P. R. and Sobolewski, J. M. (2001). The effects of divorce and marital discord on adult children's psychological well-being. *American Sociological Review*, 66 (6):900–921.

[Brien et al., 2006] Brien, M. J., Lillard, L. A., and Stern, S. (2006). Cohabitation, marriage, and divorce in a model of match quality. *International Economic Review*, 47(2):451–494.

[Craigie et al., 2012] Craigie, T.-A., Brooks-Gun, J., and Waldfogel, J. (2012). Family structure, family stability and outcomes of five-year-old children. *Families, Relationships, and Societies*, 1 (1):43–61.

[Hayward and Gorman, 2004] Hayward, M. D. and Gorman, B. K. (2004). The long arm of childhood: the influence of early-life social conditions on men's mortality. *Demography*, 41(1):87–107.

[Lang and Zagorsky, 2001] Lang, K. and Zagorsky, J. L. (2001). Does growing up with a parent absent really hurt? *The Journal of Human Resources*, 36 (2):253–273.

[Maier and Lachman, 2000] Maier, E. H. and Lachman, M. E. (2000). Consequences of early parental loss and separation for health and well-being in midlife. *International Journal of Behavioral Development*, 24 (2):183–189.

[Ross and Mirowsky, 1999] Ross, C. E. and Mirowsky, J. (1999). Parental divorce, life-course disruption, and adult depression. *Journal of Marriage and the Family*, 61 (4):1034–1045.

[Tartari, 2015] Tartari, M. (2015). Divorce and the cognitive achievement of children. *International Economic Review*, 56 (2):597–645.

[Tucker et al., 1997] Tucker, J. S., Friedman, H. S., Schwartz, J. E., Criqui, M. H., Tomlinson-Keasey, C., and Wingard, D. L. (1997). Parental divorce: Effects on individual behavior and longevity. *Journal of Personality and Social Psychology*, 73(3):381–391.

Tables and figures

Table 1: Relationship transitions, period 0 to period 1

	Period 1 relationship status			
Period 0 relationship status	Married	Cohabiting	Other	Number of observations
Married	94.30%	1.03%	4.67%	1071
Cohabiting	14.60%	55.37%	30.03%	1582
Other	4.00%	17.86%	78.14	1702

Table 2: Relationship transitions, period 1 to period 3

	Period 3 relationship status			
Period 1 relationship status	Married	Cohabiting	Other	Number of observations
Married	90.32%	1.65%	8.02%	1209
Cohabiting	13.92%	54.12%	31.96%	1092
Other	3.18%	10.19%	86.62%	1697

Table 3: Relationship transitions, period 3 to period 5

	Period 5 relationship status			
Period 3 relationship status	Married	Cohabiting	Other	Number of observations
Married	86.28%	1.94%	11.78%	1188
Cohabiting	15.91%	49.79%	34.30%	723
Other	2.00%	5.03%	92.97%	1750

Table 4: Relationship transitions, period 5 to period 9

	Period 9 relationship status			
Period 5 relationship status	Married	Cohabiting	Other	Number of observations
Married	81.99%	1.68%	16.34	955
Cohabiting	21.33%	45.33%	33.33%	375
Other	2.14%	4.85	93.01%	1589

Table 5: Relationship transitions, period 9 to period 15

	Period 15 relationship status			
Period 9 relationship status	Married	Cohabiting	Other	Number of observations
Married	78.36%	1.15%	20.49%	781
Cohabiting	12.16%	45.50%	42.34%	222
Other	1.37%	1.23%	97.40%	1462

Table 6: Probit regression on relationship status

	(1)
	Dependent variable = 1 if single in current period
Married in prior period	-2.413***
	(0.0323)
Cohabiting in prior period	-1.605***
	(0.0287)
Mother's education	-0.0507***
	(0.0148)
Father's education	-0.0681***
	(0.0152)
Period	0.0566***
	(0.00286)
Constant	1.144***
	(0.0384)
Observations	16832

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Child investments: songs

Dependent variable = Number of days per week that mother sings songs to child			
	(1)	(2)	(3)
	Period 1	Period 3	Period 5
Married	0.155*	-0.0380	0.0921
	(0.0809)	(0.0838)	(0.0907)
Cohabiting	0.0707	-0.0827	0.00910
	(0.0767)	(0.0910)	(0.117)
Mother's education	0.232***	0.253***	0.132***
	(0.0393)	(0.0424)	(0.0467)
Father's education	0.0912**	0.103**	-0.0403
	(0.0388)	(0.0425)	(0.0475)
Employment status	0.172***	0.0106	0.185**
	(0.0646)	(0.0690)	(0.0777)
Constant	4.562***	4.514***	4.113***
	(0.143)	(0.148)	(0.161)
Observations	4162	3817	3479
Adjusted R^2	0.023	0.022	0.003

Notes: Standard errors in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Child investments: reading stories

Dependent variable = Number of days per week that mother reads stories to child				
	(1)	(2)	(3)	(4)
	Period 1	Period 3	Period 5	Period 9
Married	0.0196	0.00680	0.112	-0.253**
	(0.0937)	(0.0827)	(0.0834)	(0.113)
Cohabiting	-0.0850	-0.125	-0.0716	-0.271
	(0.0889)	(0.0898)	(0.108)	(0.170)
Mother's education	0.271***	0.262***	0.182***	0.0752
	(0.0455)	(0.0418)	(0.0429)	(0.0588)
Father's education	0.216***	0.145***	0.138***	0.147**
	(0.0450)	(0.0419)	(0.0437)	(0.0596)
Employment status	0.225***	0.182***	0.277***	0.0801
	(0.0749)	(0.0680)	(0.0715)	(0.0994)
Constant	2.819***	4.137***	3.662***	3.123***
	(0.166)	(0.146)	(0.148)	(0.201)
Observations	4162	3817	3480	2807

Standard errors in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Child investments: Playing outside

Dependent variable=Number of days per week mother plays outside with child		
	(1)	(2)
	Period 5	Period 9
Married	0.277***	-0.0856
	(0.0866)	(0.0852)
Cohabiting	0.166	-0.0337
	(0.112)	(0.128)
Mother's education	0.00917	0.0474
	(0.0446)	(0.0443)
Father's education	-0.0464	0.0757*
	(0.0454)	(0.0449)
Employment status	0.369***	0.190**
	(0.0742)	(0.0748)
Constant	3.253***	1.318***
	(0.154)	(0.151)
Observations	3477	2807

Standard errors in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10: Child investments: playing inside

Dependent variable = number of days per week (?) that mother plays inside with child				
	(1)	(2)	(3)	(4)
	Period 1	Period 3	Period 5	Period 9
Married	-0.0617	-0.0940	0.00257	-0.0505
	(0.0807)	(0.0835)	(0.0932)	(0.0776)
Cohabiting	0.115	0.0324	0.0172	-0.324***
	(0.0756)	(0.0907)	(0.121)	(0.117)
Mother's education	0.134***	0.104**	0.0506	-0.0557
	(0.0388)	(0.0422)	(0.0480)	(0.0403)
Father's education	0.0936**	0.0150	-0.125**	-0.0202
	(0.0384)	(0.0424)	(0.0489)	(0.0409)
Employment status	0.235***	0.274***	0.220***	0.114*
	(0.0637)	(0.0688)	(0.0799)	(0.0682)
Constant	5.060***	4.892***	4.591***	1.621***
	(0.142)	(0.147)	(0.166)	(0.138)
Observations	3616	3811	3478	2807

Standard errors in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 11: Child investments: other

Dependent variable = Days per week with a given activity		
	(1)	(2)
	Period 1, peekaboo	Period 3, imaginary games
Married	-0.0998	0.0341
	(0.0678)	(0.0949)
Cohabiting	-0.0376	0.257**
	(0.0643)	(0.103)
Mother's education	0.181***	0.229***
	(0.0329)	(0.0480)
Father's education	0.122***	0.0874*
	(0.0326)	(0.0482)
Employment status	0.178***	0.195**
	(0.0542)	(0.0782)
Constant	5.163***	3.634***
	(0.120)	(0.168)
Observations	4158	3806

Notes: Standard errors in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 12: Child investments: Other, year 9

	Number of days per week doing a given activity			
	(1)	(2)	(3)	(4)
	TV	Video games	Current events	Homework
Married	-0.380***	-0.171**	-0.350***	-0.257**
	(0.111)	(0.0870)	(0.122)	(0.110)
Cohabiting	0.00196	-0.122	-0.262	0.0848
	(0.167)	(0.131)	(0.185)	(0.166)
Mother's education	-0.227***	-0.154***	0.0884	0.0735
	(0.0575)	(0.0452)	(0.0636)	(0.0573)
Father's education	-0.232***	-0.150***	0.0318	-0.0598
	(0.0583)	(0.0459)	(0.0646)	(0.0581)
Employment status	0.187*	0.0419	0.103	0.254***
	(0.0971)	(0.0764)	(0.108)	(0.0968)
Constant	4.910***	2.020***	3.222***	5.036***
	(0.197)	(0.155)	(0.218)	(0.196)
Observations	2807	2807	2807	2807

Notes: Standard errors in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 13: Child health: overall health status

	Dependent variable = child health (1-5 scale)				
	(1)	(2)	(3)	(4)	(5)
	Period 1	Period 3	Period 5	Period 9	Period 15
Married	0.0109	0.00889	0.0794***	0.127***	0.150***
	(0.0319)	(0.0299)	(0.0295)	(0.0358)	(0.0405)
Cohabiting	0.0145	0.0829**	-0.0513	-0.00253	-0.0759
	(0.0302)	(0.0325)	(0.0381)	(0.0539)	(0.0760)
Mother's education	0.0810***	0.0643***	0.0567***	0.00852	0.0444**
	(0.0155)	(0.0151)	(0.0152)	(0.0186)	(0.0205)
Father's education	0.0649***	0.0680***	0.0353**	0.0608***	0.0555***
	(0.0153)	(0.0152)	(0.0155)	(0.0189)	(0.0208)
Employment status	-0.0197	-0.0313	-0.0561**	-0.0262	-0.0998***
	(0.0254)	(0.0246)	(0.0253)	(0.0314)	(0.0370)
Constant	4.205***	4.223***	4.358***	4.241***	4.208***
	(0.0562)	(0.0528)	(0.0525)	(0.0636)	(0.0716)
Observations	4164	3817	3480	2807	2391

Standard errors in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 14: Deterrminants of BMI

Dependent variable = BMI (percentile)			
	(1)	(2)	(3)
	Period 3	Period 5	Period 9
Married	2.710*	0.115	0.174
	(1.598)	(1.597)	(1.302)
Cohabiting	0.0294	0.0116	2.238
	(1.680)	(1.940)	(1.934)
Mother's education	0.221	0.486	-0.751
	(0.812)	(0.818)	(0.677)
Father's education	-3.138***	-2.838***	-3.384***
	(0.819)	(0.836)	(0.688)
Employment status	-2.423*	-1.052	-1.825
	(1.318)	(1.354)	(1.145)
Constant	72.53***	72.05***	80.11***
	(2.870)	(2.782)	(2.318)
Observations	2229	1941	2632

Notes: Standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 15: Child height

Dependent variable= child height (cm)			
	(1)	(2)	(3)
	Period 3	Period 5	Period 9
Married	-1.778	-0.358	-0.443
	(1.441)	(0.383)	(0.329)
Cohabiting	-1.659	-0.733	0.247
	(1.524)	(0.470)	(0.488)
Mother's education	0.394	0.206	0.188
	(0.731)	(0.197)	(0.171)
Father's education	-0.0860	0.272	0.105
	(0.738)	(0.202)	(0.174)
Employment status	-1.130	-0.681**	-0.195
	(1.191)	(0.326)	(0.289)
Constant	98.85***	112.4***	136.7***
	(2.586)	(0.671)	(0.586)
Observations	2330	2082	2635

Notes: Standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 16: Child weight

Dependent variable = child weight (lb)				
	(1)	(2)	(3)	(4)
	Period 1	Period 3	Period 5	Period 9
Married	-0.503***	0.799	-0.455	-1.306
	(0.190)	(0.785)	(0.524)	(1.107)
Cohabiting	-0.454**	0.869	-0.470	3.213*
	(0.180)	(0.828)	(0.640)	(1.645)
Mother's education	-0.0550	-0.598	0.184	-0.492
	(0.0916)	(0.398)	(0.268)	(0.575)
Father's education	-0.232**	0.157	-0.591**	-1.762***
	(0.0904)	(0.402)	(0.276)	(0.584)
Employment status	-0.322**	-1.163*	-0.690	-0.844
	(0.152)	(0.645)	(0.445)	(0.973)
Constant	24.48***	37.28***	48.50***	87.61***
	(0.336)	(1.397)	(0.916)	(1.970)
Observations	3938	2344	2078	2642

Notes: Standard errors in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 17: Academic outcomes, Year 3

	Dependent variable = test scores (percentiles)	
	(1)	(2)
	TVIP	PPVT
Married	0.135	3.525***
	(2.961)	(0.858)
Cohabiting	-3.032	-0.746
	(3.206)	(0.880)
Mother's education	-0.331	3.007***
	(1.596)	(0.424)
Father's education	2.038	2.374***
	(1.766)	(0.423)
Employment status	1.199	-2.251***
	(2.269)	(0.688)
Constant	93.82***	76.90***
	(4.880)	(1.511)
Observations	153	2203

Notes: Standard errors in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 18: Academic outcomes, year 5

	Dependent variable = test scores (percentiles)	
	(1)	(2)
	PPVT	WJ22
Married	3.305***	1.560
	(0.781)	(1.437)
Cohabiting	0.0143	1.069
	(0.957)	(1.758)
Mother's education	3.998***	6.221***
	(0.401)	(0.736)
Father's education	2.168***	3.147***
	(0.412)	(0.757)
Employment status	-2.411***	-6.126***
	(0.665)	(1.222)
Constant	83.01***	37.84***
	(1.371)	(2.517)
Observations	2086	2097

Notes: Standard errors in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 19: Academic oiutcomes, year 9

Dependent variable = test scores (percentiles)			
	(1)	(2)	(3)
	PPVT	WJ9	WJ10
Married	3.766***	4.729***	8.054***
	(0.613)	(1.056)	(1.228)
Cohabiting	-0.568	0.686	-0.458
	(0.914)	(1.575)	(1.822)
Mother's education	3.928***	5.875***	5.517***
	(0.319)	(0.550)	(0.638)
Father's education	3.154***	3.364***	3.894***
	(0.324)	(0.560)	(0.648)
Employment status	-0.996*	-0.783	-2.550**
	(0.539)	(0.929)	(1.079)
Constant	78.34***	16.84***	29.36***
	(1.092)	(1.881)	(2.180)
Observations	2630	2589	2599

Notes: Standard errors in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 20: Academic outcomes, year 15

	Dependent variable = grades (1-4 scale)			
	(1)	(2)	(3)	(4)
	English	Math	History	Science
Married	0.231***	0.242***	0.249***	0.191***
	(0.0427)	(0.0474)	(0.0468)	(0.0468)
Cohabiting	0.261***	0.157*	0.196**	0.260***
	(0.0812)	(0.0909)	(0.0892)	(0.0885)
Mother's education	0.0798***	0.0899***	0.136***	0.140***
	(0.0217)	(0.0243)	(0.0240)	(0.0238)
Father's education	0.0922***	0.0786***	0.0822***	0.0404*
	(0.0219)	(0.0245)	(0.0243)	(0.0241)
Employment status	0.000554	-0.0230	-0.0364	-0.0359
	(0.0399)	(0.0445)	(0.0442)	(0.0436)
Constant	2.501***	2.363***	2.433***	2.454***
	(0.0766)	(0.0852)	(0.0846)	(0.0837)
Observations	2202	2206	2049	2170

Standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$