The Probability of Teenage Parenthood: Parental Predictions and Their Accuracy

P. Wesley Routon[1]

Abstract

Teenage parenthood is an often-discussed topic in family economics since it has been shown to affect many outcomes for the teen, child, and household. Using a nationally representative longitudinal panel of American teenagers and their parents, two questions related to the probability of teenage parenthood are examined. First, how do predictions of this occurrence made by the teenager's parents vary across the population? Second, how does the accuracy of these predictions vary? The actual prevalence and variance of teenage parenthood are also examined, and the determinants of its occurrence are estimated. Among other results, expectations and their accuracy are found to differ substantially across socioeconomic status and some demographics such as race and religion. The average American parent underestimates the probability their child will become a teen parent by only a small amount, but within certain demographic groups this outcome is considerably underestimated, and in others it is overestimated. These differences help explain the variability in teen parenthood effects, and more broadly, the analysis serves as a test of parents' ability to judge their childrens' future outcomes.

Becoming a parent usually changes an individual's life in many important ways. Economists have become very cognizant of this fact. Economic models of fertility choice, and more broadly ones with an intergenerational component, are commonplace (e.g., Barro and Becker 1989; Piketty 2000; Pollak 2004). The individual and household effects of parenthood are an area of continued economic study, with much of the literature focusing on labor market effects (e.g., Lundberg and Rose 2000; Marshall and Flaig 2014; Nsiah et al. 2013). As an example of magnitude, Gibb et al. (2014) estimate perhaps as much as 90% of the gender wage gap in New Zealand can be explained by such effects. Parenthood has also been shown to influence health (e.g., Cross 2014), education (e.g., Kane et al. 2013; Pilat 2014), and other important outcomes.

The most overarching impact might be that on general well-being, or life satisfaction. Hansen (2012) noted that, while attitudes and folk theories suggest parenthood is central to a meaningful and fulfilling life, most empirical evidence suggests children interfere with well-being on average. Negative effects of parenthood on happiness are found to be more common and pronounced for females, singles, in pronatalist societies, and for those of lower socioeconomic status (Hansen 2012). Whether the effect of parenthood on happiness will be positive or negative for a particular individual is difficult to predict, but it can be said with near certainty that such an impact will take place.

The timing of parenthood is an important determinant of its benefits and costs. Teenage pregnancy and parenthood, which given national US statistics are most often thought "too early" (US Department of Health and Human Services [HHS] 2015), are well researched topics (e.g., Hoffman et al. 1993; Hoffman and Maynard 2008; Luker 1996; Ribar 1994). The US teen birth rate is higher than that of many other developed nations, including Canada and the UK, the two nations to which the US is most often compared for

✉ P. Wesley Routon
  prouton@ggc.edu
  https://sites.google.com/site/wesrouton/

1 School of Business, Georgia Gwinnett College,
  Lawrenceville, GA 30043, USA

social and demographic trends (HHS 2015). Young mothers are found to ultimately obtain less human and social capital, experience more mental health difficulties, and marry less reliable and supportive (both economically and emotionally) partners (Moffitt 2002). Longitudinal studies have shown children born to teen mothers are at higher risk of many adverse outcomes, both in child- and adulthood (e.g., Jaffee et al. 2001). There are also frequently cited medical consequences of teen pregnancy, for both mother and child, though the increased health risks are thought to be predominantly caused by the social, economic, and behavioral factors that predispose some young women to pregnancy (Cunnington 2001). Overall, the relationship between teen parenthood and socioeconomic status is generally believed to be significant and not completely understood.

In a more recent study, Casad et al. (2012) found that if a mother's age at first childbirth is too young, they will generally attain less education; a lower adult socioeconomic status; have lower self-esteem; be less satisfied with life, relationships, and work; and have smaller choice sets. Kearney and Levine (2012) discussed the importance of studying teen birth rates in the US and its correlates, and found that a sizable portion of the geographic variation in its prevalence can be explained by variation in economic inequality. Cherry and Wang (2015) showed evidence that such correlates also include employment conditions, alcohol use, illegal drug use, gonorrhea infection rates, and the local minimum wage.

Given all this, one could argue the *probability* of teen parenthood warrants study. What is this probability and how accurately is it assessed by teens and their families? Defining an unplanned pregnancy as one which is either unwanted or occurring "too soon" in the teen's eyes, the US Department of Health and Human Services estimates that 77% of teen pregnancies in the US are unplanned (HHS 2015). With this national statistic in mind, one might venture that at the individual and household levels the expectation of teen parenthood is being underestimated, perhaps significantly.

Perceptions and expectations can have strong impacts on economic outcomes (DeBacker and Routon 2017), warranting the study of expectations of important life events such as fertility. There is indeed substantial support in the economic and related literature for the importance of expectations and aspirations in determining outcomes, with Appadurai (2004) having called the capacity to aspire to better outcomes a "meta-capacity." For example, several studies have uncovered significant links between educational expectations and important economic outcomes (e.g., Attanasio and Kauffmann 2009; Eccles 1983; Genicot and Ray 2017; Jacob and Wilder 2011; Jensen 2010; Kaufmann 2014). Betts (1996) found that such expectations can vary significantly, both in general and specifically across socioeconomic status. The link between fertility expectations and socioeconomic status is a primary focus here.

Oyserman (2013) highlighted the importance of *parental* expectations as key factors in child outcomes. In a study similar to the one presented here, DeBacker and Routon (2017) demonstrated, both through a theoretical model and empirical analysis of expectation data, that parental expectations are indeed important determinants of teenagers' outcomes. Their model, which was based on models from the theoretical literature surrounding human capital, showed that parental expectations will affect the quantity of household resources devoted to the child, thereby affecting the actual probabilities of important child outcomes. The focus of their empirical study was educational expectations, while the focus here was fertility expectations.

The analysis that follows is an attempt to answer two questions. First, how do parental predictions of teen parenthood vary across the American population? To be clear, "parental predictions" here refers to predictions made by the teenager's parents, not the teenagers themselves, another worthy area of study. Based on the literature mentioned previously, knowledge of differences in parental expectations may provide important insight as to the outcome's occurrence. Second, how does the *accuracy* of these predictions vary across relevant sub-populations? It is not only the absolute and relative values of expectations that matter, but also their accuracy. For example, individuals who less accurately predict future outcomes will less efficiently allocate their limited resources. For teens with parents, it is more often the parents who are allocating household resources, further warranting the study of their expectations. More broadly, the analysis serves as a test of parents' ability to judge future child outcomes, and the variability in this skill. Knowing which subpopulations are relatively more apt at predicting child outcomes, and by how much, may aid in future research on parenting, particularly research related to child fertility. In seeking these answers, population differences in actual teen birth rates are also discussed and examined, and the marginal effects of a long list of teen birth determinants are estimated.

Parental Predictions

Data used in this analysis came from the National Longitudinal Survey of Youth 1997 cohort, the NLSY97. This survey is conducted by the United States Department of Labor Bureau of Labor Statistics (BLS), and was designed to gather information on the significant life events of United States citizens, especially their labor market activities (BLS 2016). The NLSY97 consists of approximately 9000 respondents who were born between and including 1980 and 1984 (BLS 2016). After the initial 1997 interview, follow-up interviews were conducted annually through 2011 and biannually thereafter. The sample was designed to

Table 1 Teen parenthood predictions of a teenager's parents, United States, 1997

Sample	Percent chance		Sample	Percent chance	
	Mean	SD		Mean	SD
Full	15.2	25.2	Household income quintile 1	23.7	24.4
White male	12.2	20.8	Household income quintile 2	18.6	31.3
White female	12.8	22.3	Household income quintile 3	14.6	28.2
African-American male	18.4	27.4	Household income quintile 4	14.0	23.8
African-American female	16.7	30.1	Household income quintile 5	9.1	17.5
Hispanic male	20.2	28.6	ASVAB percentile 0–20	20.1	29.2
Hispanic female	18.3	26.9	ASVAB percentile 21–40	17.4	26.0
Urban household	15.9	25.8	ASVAB percentile 41–60	12.3	21.7
Rural household	13.0	23.1	ASVAB percentile 61–80	9.5	18.4
Region: Northeast	12.9	23.1	ASVAB percentile 81–100	7.3	15.2
Region: North Central	15.6	24.5	Neither parent, HS diploma	22.2	29.5
Region: South	15.0	25.5	One parent, HS diploma	19.5	27.8
Region: West	17.4	26.8	Both parents, HS diploma	15.3	25.5
Two parent household	11.8	21.7	One parent, some college	14.4	25.6
Single female household head	19.9	29.3	Both parents, some college	14.3	22.8
Single male household head	16.7	25.2	One parent, college degree	12.3	25.5
Mother had child by 20	19.3	28.3	Both parents, college degree	9.2	19.2
Mother did not have child by 20	13.1	23.1	Catholic	15.9	25.2
Teen is already a parent	47.2	45.5	Protestant	15.5	25.5
Teen is not a parent	14.6	24.1	Other religion	3.4	10.9
			No religion	10.2	21.0

Parents were asked to rate the probability of parenthood and could answer with any whole number percent chance between and including 0–100. Data come from the NLSY97. In all sub-samples, mode = median = 0, except "teen is already a parent" (where median = 50) and "Neither parent, HS diploma" (where median = 3)

SD standard deviation

be nationally-representative, and includes sample weights towards this aim (which are used in this analysis).

As part of the initial survey wave, a sub-sample of respondents' parents were asked a few questions pertaining to their expectations for the primary respondent, their teen-age child. One of these questions regarded childbirth. Specifically, parents were asked: "What is the percent chance that [your child] will become the mother/father of a baby sometime between now and when he/she turns 20?" Parents could respond to this question with any whole number percent between and including 0 and 100%. Manski (2004) discussed the importance and benefits of capturing subjective probabilities through survey questions such as this, as opposed to inferring expectations through observed choices as is often done in applied economics.

Table 1 presents the mean responses to this survey question, and standard deviations, for the full parental expectations sample and across several demographic groups. The average American parent believed there was about a 15% chance their child would become a teen parent. Across gender and race, this mean expectation ranged between approximately 12% for White males to 20% for Hispanic

males. Differences across region and urban–rural status were relatively small, with the mean urban parent having reported an approximate 3 percentage point higher probability. Teens in two-parent households were less expected to become a teen parent, with those in single female-headed households having had a greater mean expectation than those in single male-headed households. Teens whose mother was a teen parent were more expected to become teen parents themselves, but only by about 6 percentage points, a magnitude that may be smaller than anticipated. Sixty-one of the primary respondents were already a teen parent at the time of the expectations survey. For these respondents, their parents were being asked for the probability of an additional teen childbirth. Within this sub-sample, the mean reported probability was much higher at over 47%. Though some religion-specific sample sizes are small, there is evidence Catholic and Protestant households were little different in this expectation, on average, but that they reported higher mean probabilities

Table 2 Percent of sample who became a teen parent, United States, 1997–2004

Sample	Entire NLSY97	Predictions sub-sample	Sample	Entire NLSY97	Predictions sub-sample
Full	17.3	17.6	Household income quintile 1	31.6	30.0
White male	6.4	7.2	Household income quintile 2	21.4	22.7
White female	15.7	15.6	Household income quintile 3	17.6	16.9
African-American male	18.1	18.0	Household income quintile 4	14.0	16.1
African-American female	34.1	35.9	Household income quintile 5	7.4	7.9
Hispanic male	13.5	14.7	ASVAB percentile 0–20	25.3	25.1
Hispanic female	31.1	28.2	ASVAB percentile 21–40	19.3	18.8
Urban household	17.9	18.52	ASVAB percentile 41–60	13.1	16.4
Rural household	15.3	14.6	ASVAB percentile 61–80	7.8	9.3
Region: Northeast	14.5	15.9	ASVAB percentile 81–100	3.7	3.8
Region: North Central	15.6	14.1	Neither parent, HS diploma	28.7	29.3
Region: South	21.3	22.3	One parent, HS diploma	25.9	27.9
Region: West	14.5	14.4	Both parents, HS diploma	18.3	17.0
Two parent household	10.5	11.1	One parent, some college	16.2	16.4
Single female household head	25.1	24.6	Both parents, some college	15.6	14.0
Single male household head	22.1	22.5	One parent, college degree	14.5	13.9
Mother had child by 20	25.7	25.4	Both parents, college degree	4.9	6.9
Mother did not have child by 20	12.8	13.5	Catholic	14.7	15.9
Teen is already a parent	19.1	21.6	Protestant	18.6	18.9
Teen is not a parent	16.4	15.9	Other religion	4.8	3.5
			No religion	19.6	15.6

Values are percents (decimal places have already been moved). Data come from the NLSY97

than non-religious households and significantly higher mean probabilities than households practicing a different religion.[1]

An interesting and useful aspect of the NLSY97 is that all of the teens took a computer-adapted form of the math and English portions of the Armed Services Vocational Aptitude Battery (ASVAB; the standardized entrance exam used by the US Armed Forces) as part of the initial survey wave, regardless of future aspirations of military or civilian service. Moving up the distribution of scores on this exam, the mean parental expectation the teen would become a teen parent monotonically decreases, from about a 20% chance for those who scored in the 0–20 percentile range to a 7% chance for those in the 81–100 percentile range.

Though other demographic differences have import of their own, of primary interest is how expectations relate to the socioeconomic status (SES) of the household. Using household income as the measure of SES, households in the lowest income quintile expected their teen to become a teen parent with about a 24% probability, on average, while this expectation was much lower at approximately 9% for those in the highest income quintile.[2] The mean expectation decreases monotonically moving up the income distribution. While household income (or wealth) may be the most commonly used measure of SES, the education level of the teen's parents is a worthy alternative. A similar pattern to household income emerges, with the mean expectation of teen parenthood decreasing monotonically as one moves up the parental education distribution. Teens who had parents with less than a high school education were given a mean expectation of teen parenthood of over 22%, while those who had two college graduates for parents were assigned a lower mean expectation of about 9%.

Now, enough time has passed since this expectations survey such that the outcome (becoming a teen parent) either occurred or did not. That is, all respondents are now well over 20 years of age. Using information collected as part of subsequent NLSY97 survey waves, a binary variable was created which takes on the value 1 if the primary respondent became a parent before 20 years or age, and 0 otherwise.

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[1] For those households practicing an "other religion," the specific religion is made known through the NLSY97 surveys. However, Table 1 shows the combined sample size of these groups is only 64 households; delineating further unfortunately leads to insufficient sample sizes.

[2] When household wealth quintiles are used in place of income quintiles, a highly similar pattern emerges. This is true for the remainder of the analysis that follows. Results from an analysis of teen parenthood and household wealth are available from the author upon request.

This variable is presented in Table 2 for the full sample and each demographic group previously analyzed in Table 1. For reference, displayed are the percent frequencies for both the parental predictions sub-sample and the NLSY97 sample in its entirety. The NLSY97, by design, is nationally-representative. The table shows that the parental predictions sub-sample contained within was not vastly dissimilar in terms of this teenage parenthood outcome.

Regarding the expectations sub-sample, about 17% of teenagers became a parent by age 20. According to the US Department of Health and Human Services, there were 51.3 births for every 1000 females aged 15–19 in the US in 1997, the year of the parental predictions survey (HHS 2015). By 2013, this national statistic had dropped to 26.5 births for every 1000 females aged 15–19, or 273,105 babies born to females in this age group in that year (HHS 2015). For the entire period 1997–2013, minority Americans birthed over twice as many relative children compared to Whites (HHS 2015). Thus, putting the sampled age cohort in socio-historical context, they were teenagers at a time when teen parenthood was about twice as prevalent as it is today, though demographic differences in this occurrence were largely similar. Most were leaving their teenage years soon before the September 11, 2001 terrorist attacks on the US (Routon 2014), which spurred an increased focus on home life and time spent with family in the nation (Carducci 2009).

As expected, within the NLSY97's sub-sample, there are many demographic differences in birth rates. Approximately 28 and 36% of the Hispanic and African-American females became a teen parent, respectively. This proportion is lowest for White males at 7.2%. Urban teens were more likely to become teen parents than rural teens, and the American South had the highest proportion of teen parents at over 22%. Just as their expectations were lower, teens who were in two-parent households were less likely to become parents. At about 25% versus 13, teens whose mother was a teen parent were roughly twice as likely to become one themselves. Stark differences are uncovered across the income, academic ability, and parental education distributions. Teens in houses that belonged to the lowest income quintile were estimated to have a 30% chance of becoming a teen parent, while at the other end of the income distribution this likelihood was much lower at around 8%. A very similar pattern is seen across parental education. Additionally, those who scored in the 0–20 percentile range on the ASVAB become teen parents at a rate of approximately 25%, with teens in the 81–100 percentile range having been much less likely at less than 4%.

When examining teen birth rates, one must be cognizant of several gender-specific possibilities. First, it is possible for a male to be a parent but not know so. It is also possible for a small number of males to impregnate a relatively larger number of females. Both of these possibilities lead to teen birth rates appearing or becoming relatively higher for females, which is demonstrated in Table 2. Lastly, similar to many other nations [e.g., Australia (Australian Bureau of Statistics 1997) or the United Kingdom (Office for National Statistics 2008)], sexual relationship age disparity statistics disclose that in the modal US heterosexual couple the male is older than the female (US Census Bureau 2013). Thus, female teen birth rates may be relatively higher due to their partners often not being teenagers, but older males.

It may also be of interest to investigate the subjective probabilities presented in Table 1 across these ultimate realizations in Table 2. As would be expected, and hoped for the sake of prediction accuracy, expected probabilities were higher on average for those teenagers who indeed became a parent. Specifically, the average parental prediction for those who became a parent was a 29.2% chance, while for those who did not it was 12.2%.[3]

In aggregate, the statistics presented in Table 2 demonstrate how teen birth rates vary across the population. More importantly, Table 1 provides evidence that parental expectations of this outcome also vary significantly across demographic groups. However, while this sample was designed to be nationally representative, the reader is advised to remain cognizant of the limitations of sample statistics when interpreting these findings. Notably, the sample here is not particularly large in size. In the following section, the relative accuracy of these predictions is examined.

Parental Prediction Accuracy

Methodology

The accuracy of a parent's prediction may be thought equal to the difference between said (subjective) prediction and the objective probability of the outcome for the child. For ease of discussion, name this difference the "prediction gap," as shown in

$$\text{Prediction gap}_p = \text{Subjective probability}_p - \text{Objective probability}_c$$
(1)

where subscripts p and c refer to parent and child (the teen), respectively. The smaller the absolute value of prediction gap_p, the more accurate the prediction. Also, a positive value of prediction gap_p implies the parent has overestimated the true probability of their child becoming a teen parent, while negative values represent underestimation. To examine prediction accuracy, one must first capture the

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[3] A Student's t hypothesis test of mean equality shows these two values are statistically different at the 99.9% confidence level (p-value < .001).

objective probabilities in Eq. (1). Thus, a teenage parenthood model of the form

$$\text{Teen parent}_{c,p,h} = \alpha + \beta \mathbf{X}_c + \gamma \mathbf{Y}_p + \delta \mathbf{Z}_h + \varepsilon_{c,p,h} \qquad (2)$$

was estimated, where teenparent$_{c,p,h}$ is the binary teenage parenthood outcome in question; α an intercept; $\mathbf{X}_c$ a vector of the teen's characteristics, with β its corresponding vector of parameters; $\mathbf{Y}_p$ a vector of relevant parental characteristics, with γ its corresponding vector of parameters; $\mathbf{Z}_h$ a vector of general household characteristics, with δ its corresponding vector of parameters; and $\varepsilon_{c,p,h}$ the usual (in this case, well-behaved) error term. Since the dependent variable is binary, the model in Eq. (2) was estimated with logistic regression.[4] Then, objective probabilities of teen parenthood were calculated using the formula

$$\text{Objective probability}_c = \frac{e^{\alpha + \beta \mathbf{X}_c + \gamma \mathbf{Y}_p + \delta \mathbf{Z}_h}}{1 + e^{\alpha + \beta \mathbf{X}_c + \gamma \mathbf{Y}_p + \delta \mathbf{Z}_h}} \qquad (3)$$

where e refers to the mathematical constant known as Euler's number (approximately equal to 2.71828) and all other symbols are as described previously.

The primary respondents' parents were asked for their subjective probabilities in the initial 1997 wave of the survey. Though many survey waves have been conducted since, using information from these surveys to estimate objective probabilities would be "cheating" as this information might have been unavailable to the parent at the time of their prediction. Thus, only independent variables captured in the initial 1997 survey round were incorporated into the model of Eq. (2). Even so, there were many such predictors available.[5] Table 3 presents summary statistics for all of the independent variables in $\mathbf{X}_c$, $\mathbf{Y}_p$, and $\mathbf{Z}_h$.

This vector of predictors contains a long list of variables. Several are general demographics known to be related to teenage pregnancy and parenthood: gender, race (four categories), number of siblings, and place of birth. Two important (e.g., Addo 2017) economic status variables are available: parental income and household net worth. Regarding geography, regional indicators (four categories), the total number of places ever lived in, and urban/rural status are available and included. Health measures include indicators for physical and emotional/learning handicaps, as well as general health status (five categories). Other parental variables are both parents' place of birth, both parents' years of schooling, the mother's age when the teen was born, and the mother's age when she birthed her first child. Household structure variables available are indicators for an intact

family, the gender of single household heads, and whether a stepparent is present.

Education, and a teen's attachment to it, has been shown highly related to teen pregnancy (e.g., Bennett and Assefi 2005; Vincent et al. 1987; Zelnik and Kim 1982). In the US, public education very often includes sex education, for example, which is hoped to have a direct effect on the prevalence of teenage parenthood. Several educational variables are available and used here: days suspended from school; days absent; number of school changes; number of times physically threatened at school; the teen's perception of their teachers' quality (four categories); and indicators for those not enrolled but who legally should be, accelerated summer courses, make-up summer courses, and summer courses for "other" reasons. Religion (six categories) was included, as it is related to teen abstinence and perceptions of intercourse, among other factors (Paul et al. 2000; Regnerus 2007; Uecker 2008).

Delinquent and related behavior is thought to be correlated with teenage pregnancy (Huizinga et al. 1993; Woodward et al. 2001), and several such measures were available: marijuana consumption, other illicit drug consumption, illegal marijuana sales, illegal sale of other illicit drugs, fighting, gang affiliation, gun behavior, arrest record, and the number of times ran away from home. Three level of parental involvement variables were included: an indicator if the youth ever spent significant time (20+ h/week) in childcare when very young, and two index variables (one for each parent) describing parental involvement and monitoring. These index variables range 0–16 where 0 represents the complete absence of that parent and 16 the highest possible level of parental monitoring. Other determinants include ASVAB scores (previously discussed), an indicator for those with a driver's license, annual weeks working (as a labor market attachment variable), and an indicator for teens who were already a parent at the time of survey.[6]

Since race and gender have been shown to be particularly important in related research, national statistics, and in this analysis thus far, I also included three race–gender interaction terms. Since ability has been shown to have a quadratic relationship to other outcomes (e.g., educational and labor outcomes), I included the square of the respondent's ASVAB score.[7] Variables that are particularly useful

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[4] Otherwise identical models estimated with probit regression or linear probability yield similar results to those presented here. These additional results are available from the author upon request.

[5] There are other variables in addition to those included here that may constitute teen parenthood determinants, but one must of course work within the confines of what is available in the NLSY97.

[6] As an alternative approach, instead of controlling for those teens who were already teen parents through an indicator variable, the entire analysis was re-performed after completely dropping these 61 individuals from the sample. Results from that analysis are highly similar to those presented here. For brevity, these estimates are not shown but are available from the author upon request.

[7] Models without the gender–race interactions and/or this quadratic term yield similar results. I retain these variables, however, as they slightly improve the predictive power of the model.

Table 3 Summary statistics of parenthood predictors, United States, 1997

Continuous determinant	Mean	SD	Min	Max
Parental income ($0000)	34.004	41.497	0	247
Household net worth ($0000)	66.450	124.360	0	600
Number of siblings	2.319	2.430	0	45
ASVAB math/English percentile	35.779	31.832	0	100
Days suspended from school	1.190	8.367	0	180
Days absent from school	4.731	7.518	0	200
Num. times changed schools	0.417	0.603	0	5
Age of mom when born	25.370	5.263	10	45
Age of mom, her first child	23.000	5.031	10	45
Mother's total years of schooling	12.530	2.995	1	20
Father's total years of schooling	12.990	3.309	1	20
Num. times ran away from home	0.252	1.474	0	30
Num. places ever lived in	3.357	3.192	1	50
Weeks worked last year	6.833	14.243	0	52
Parental monitoring by mother	5.886	5.497	0	16
Parental monitoring by father	3.546	4.531	0	16
Number of sexual partners	0.778	3.809	0	99

Binary determinant	Rel. freq.	Binary determinant	Rel. freq.
Male	0.512	Health: fair	0.048
Race: African-American	0.260	Physical handicap	0.063
Race: Hispanic	0.212	Has a driver's license	0.145
Race: Mixed race	0.009	Ever consumed marijuana	0.200
Male × African-American	0.130	Ever consumed hard drugs	0.058
Male × Hispanic	0.109	Raised by a stepparent	0.110
Male × Mixed race	0.004	Mother born in US	0.846
Rural residence	0.226	Father born in US	0.833
Experienced hardship	0.048	Religion: raised Jewish	0.008
Born in the US	0.765	Religion: raised Protestant	0.534
Emotional and/or learning handicap	0.092	Religion: raised Catholic	0.307
Ever been arrested	0.081	Religion: raised Muslim	0.004
Region: Northeast	0.176	Religion: raised in other religion	0.006
Region: North Central	0.228	Heavy (20+ h/week) childcare	0.290
Region: South	0.374	Has had menstrual period	0.416
Intact family	0.489	Has had intercourse	0.185
Single female household head	0.282	Has had intercourse more than once	0.156
Health: excellent	0.387	Already a parent	0.011
Health: very good	0.337	Uses birth control	0.139
Health: good	0.225		

Omitted categories for race, region, "My teachers are good," and health are White, west, strongly disagree, and poor, respectively. $N =8984$. Data come from the NLSY97

in the context of teen parenthood include indicators for teens who have had intercourse, who have had intercourse more than once, (females) who have had their menstrual period, and those who regularly use birth control. The number of sexual partners to date was also included. Lastly, an indicator for those whose parents reported their child (the teen) has ever lived through hardship was included.

Accuracy Estimates

For reference, in the interest of full disclosure, and because these estimates are relevant in their own right, Table 4

Table 4 Teen parenthood model estimates, United States, 1997–2004

Teen parenthood determinant	Marginal effect	Standard error	Teen parenthood determinant	Marginal effect	Standard error
Male	− .074***	0.016	Health: good	.047	0.062
African-American	.082***	0.014	Health: fair	.042	0.062
Hispanic	.106***	0.016	Physical handicap	− .029†	0.017
Mixed race	.044	0.054	Mother's total years of schooling	− .005**	0.002
Male × African-American	− .091***	0.018	Father's total years of schooling	− .003**	0.001
Male × Hispanic	− .094***	0.019	Has a driver's license	.045***	0.011
Male × Mixed race	.005	0.077	Ever consumed marijuana	.011	0.011
Parental income ($00,000)	− .082***	0.009	Ever consumed hard drugs	.062***	0.016
Household net worth ($00,000)	− .029***	0.003	Raised by a stepparent	− .005	0.020
Number of siblings	.013***	0.002	Num. times ran away from home	.023***	0.003
ASVAB math/English percentile	− .002***	0.001	Num. places ever lived in	.009***	0.001
ASVAB—squared	.001	0.001	Weeks worked last year	− .001	0.001
Rural residence	.009	0.010	Mother born in US	.100**	0.032
Days suspended from school	.004***	0.001	Father born in US	.091**	0.033
Days absent from school	.003***	0.001	Raised Jewish	.005	0.043
Num. times changed schools	.021***	0.006	Raised Protestant	− .005	0.015
Age of mom when born	− .005***	0.001	Raised Catholic	− .024†	0.015
Age of mom, her first child	− .008***	0.001	Raised Muslim	− .009	0.058
Experienced hardship	.073***	0.018	Raised in other religion	− .046	0.048
Born in the US	.025*	0.013	Heavy (20+ hrs/wk) childcare	− .030	0.044
Emotional&/or learning handicap	.050***	0.013	Parental monitoring by mother	− .011***	0.001
Ever been arrested	.054***	0.015	Parental monitoring by father	− .012***	0.001
Region: Northeast	.024*	0.012	Has had menstrual period	.037*	0.016
Region: North Central	.041***	0.012	Has had intercourse	.135***	0.026
Region: South	.048***	0.011	Has had intercourse more than once	.041†	0.024
Intact family	− .033**	0.013	Number of sexual partners	− .009†	0.001
Single female head of household	.072***	0.009	Already a parent	.546***	0.037
Health: excellent	.083	0.064	Uses birth control	− .060**	0.019
Health: very good	.050	0.062			

Sample weights designed for national representation were used in this logistic regression. $N = 8984$. $^{†}p < .10$; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$. Pseudo $R^2 = .312$. Data come from the NLSY97

presents the marginal effects of the teen parenthood predictors estimated in the model of Eq. (2). Estimates are generally as one would expect and similar to those discussed in previous research on teenage pregnancy and parenthood. As examples, large positive effects are estimated for sexual promiscuity and prior parenthood, while large negative effects are estimated for parental income and household net worth. It is not these estimated effects, however, but the predicted values calculated post-estimation of this model (Eq. 3) that are of primary interest here, as they represent objective probabilities. These estimated probabilities are presented as a density plot in Fig. 1. As expected, the predicted values constitute a right-tailed distribution. Most teens had a relatively small estimated probability

of becoming a teen parent, though some a much higher probability.

Table 5 displays the primary results of the analysis, the prediction gaps from Eq. (1), the average differences between subjective and objective teen parenthood probabilities across all samples investigated. The mean American parent was found to have underestimated the probability of their child becoming a teen parent by 3.4 percentage points. Figure 2 presents the distribution of the prediction gap, which appears normally distributed around this mean of − 3.4 with a standard deviation of 25.8. The gap varies significantly across the gender and race of the teen, with parents of African-American females underestimating this probability by over 19 percentage points and parents of White or Hispanic

Fig. 1 Density plot of the probability of teen parenthood. Predicted values come from logistic regression. Data come from the NLSY97. Observations = 8984
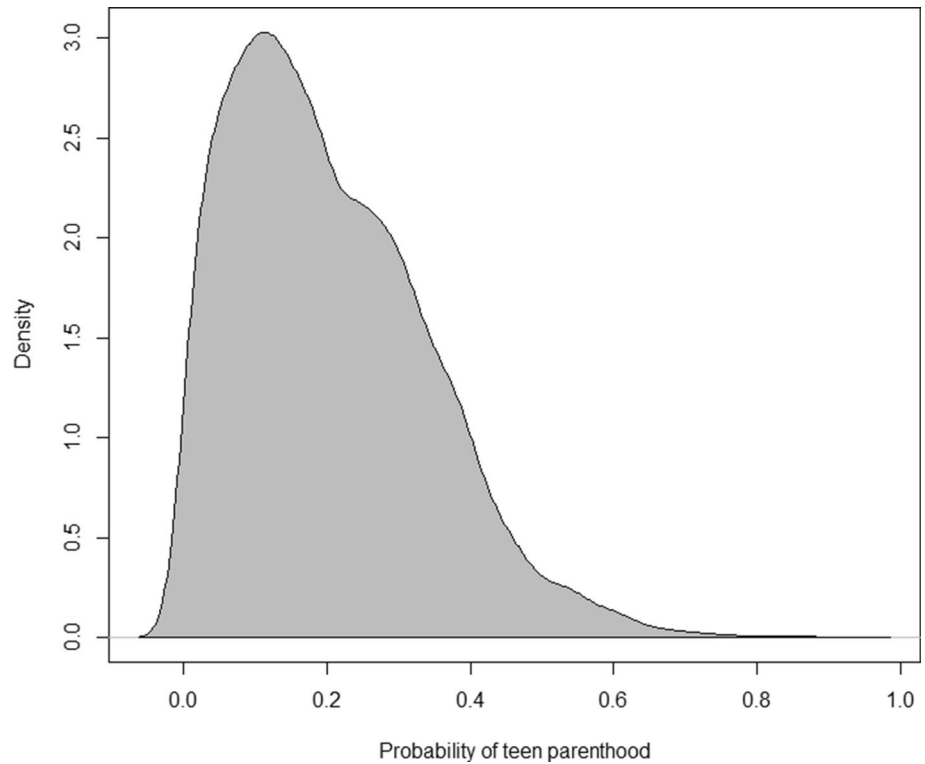

Table 5 Parental prediction accuracy (mean prediction gap across sub-samples), United States, 1997–2004

Sample	Prediction gap	Sample	Prediction gap
Full	− 3.43	Household income quintile 1	− 8.01
White male	4.98	Household income quintile 2	− 5.80
White female	− 4.09	Household income quintile 3	− 4.67
African-American male	− 2.61	Household income quintile 4	− 1.92
African-American female	− 19.44	Household income quintile 5	0.87
Hispanic male	4.97	ASVAB percentile 0–20	− 7.17
Hispanic female	− 14.23	ASVAB percentile 21–40	− 5.10
Urban household	− 3.50	ASVAB percentile 41–60	− 2.83
Rural household	− 3.21	ASVAB percentile 61–80	− 0.15
Region: Northeast	− 2.50	ASVAB percentile 81–100	4.97
Region: North Central	− 0.84	Neither parent, HS diploma	− 7.42
Region: South	− 8.22	One parent, HS diploma	− 5.59
Region: West	1.77	Both parents, HS diploma	− 4.87
Two parent household	0.87	One parent, some college	− 4.44
Single female household head	− 7.84	Both parents, some college	− 3.17
Single male household head	− 7.00	One parent, college degree	− 2.01
Mother had child by 20	− 6.92	Both parents, college degree	4.89
Mother did not have child by 20	− 1.58	Catholic	− 0.43
Teen is already a parent	2.46	Protestant	− 4.92
Teen is not a parent	− 3.56	Other religion	− 0.06
		No religion	− 7.82

Values are means of the parents' predictions minus the estimated objective probabilities. Data come from the NLSY97

Fig. 2 Density plot of the prediction gap. Prediction gap = parental reported expected value − predicted value from logistic regression. Mean = − 3.43. Standard deviation = 25.8. Minimum = − 92.4. Maximum = 99.1. Data come from the NLSY97. Observations = 2990
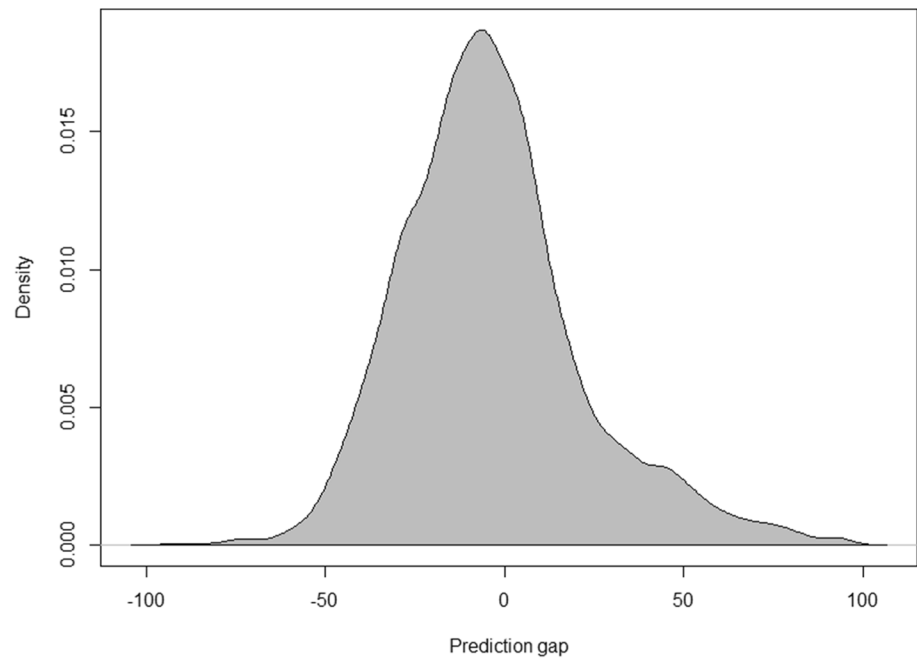
males overestimating the probability by about 5 percentage points. Still regarding gender and race, parents of African-American males, on average, are shown to have been the most accurate predictors of the outcome.

The difference in the mean prediction gap across urban/rural status was statistically and economically insignificant, but regional differences were not.[8] Southerners were the most likely to underestimate the probability of teen parenthood, households residing in the western US slightly overestimated this probability on average, while those residing in the North Central US were the most accurate overall. Two-parent households were much more accurate predictors than single-parent households, and the gender of the single-parent household head appears to have mattered little, on average. Interestingly, households with a mother who was herself a teen parent underestimated the probability of the teen becoming one more than other households, at about 7 versus 2 percentage points. Though the sample size is small, for teens who were already a parent, their parents overestimated the probability of an additional teen birth. On average, Catholic households and those of a non-Christian religion were very accurate predictors of teen parenthood, while Protestant and non-religious households underestimated this probability by about 5 and 8 percentage points, respectively.

Differences across the household income distribution are also uncovered. Those in the highest income quintile were within a single percentage point of estimating the probability of teen parenthood, on average. Those in the lowest income quintile were underestimating this probability by about 8 percentage points, on average. The prediction gap increases monotonically (shrinks) moving up the income quintiles. Figure 3 helps further disclose the relationship between household income and teen parenthood. The correlation coefficient for income and the probability of teen parenthood is − 0.44, which following rule of thumb classifications implies a "relatively weak negative relationship." Regressing the probability of teen parenthood solely on household income (in thousands of dollars) yields a coefficient of − 0.0012 (p-value $< 1e^{-15}$) and $R^2 = 0.11$. A similar pattern is seen across the parental education distribution as is that for household income. The gap is − 7.4 for households with no high school graduate parents and increases monotonically to households with two college graduate parents where the gap is + 4.9. The gap increases monotonically across the ASVAB score distribution as well, with those teens with the lowest scores having had their probability of parenthood being underestimated by about 7 percentage points and those with the highest scores having been overestimated by 5 percentage points.

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[8] A t-test of mean equality across urban/rural status results in $t = − 0.28$ with p-value = .7801. Similar hypothesis tests across Census region result in $t = 1.23$ (p-value = .2180) for Northeast versus North Central; $t = − 4.39$ (p-value = .0000) for Northeast versus South; $t = 2.87$ (p-value = .0042) for Northeast versus West; $t = − 6.22$ (p-value = .0000) for North Central versus South; $t = 1.88$ (p-value = .0604) for North Central versus West; and $t = 7.46$ (p-value = .0000) for South versus West.

Fig. 3 Household income and the probability of teen parenthood. Teen parenthood probability estimates are predicted values from logistic regression. Red line is line of best fit. Correlation coefficient = − 0.44. Data come from the NLSY97. Observations = 8984
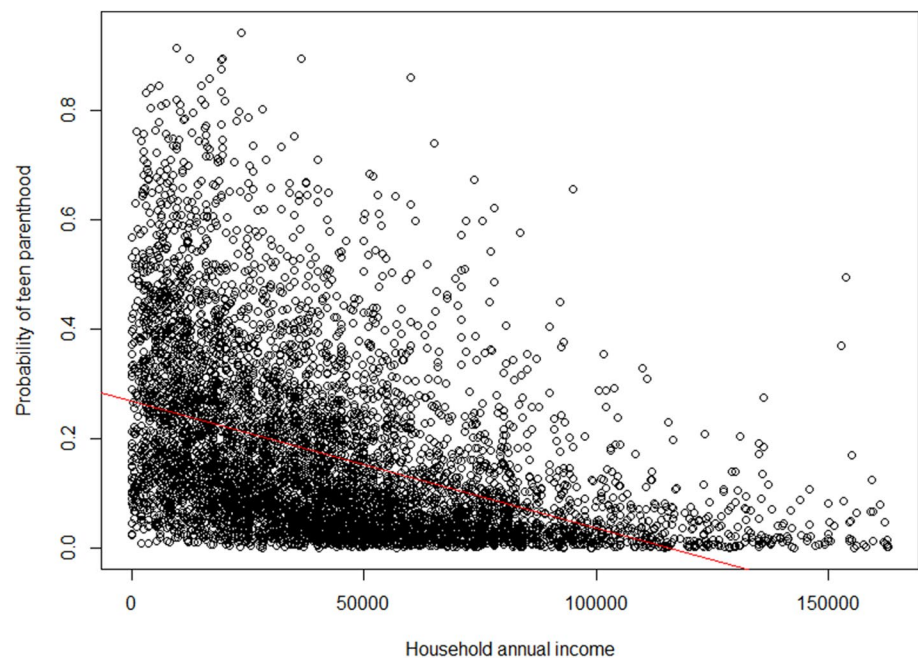
Table 6 Other select subsample statistics

Subsample	Mean subjective prediction	Percent who became teen parent	Mean prediction gap	N
Prediction given when teen was 15	14.96	17.48	− 3.93	1070
Prediction given when teen was 16	14.11	17.71	− 4.02	1417
Prediction given when teen was 17	18.55	17.26	− 1.08	503
Prediction was 0, 50, or 100%	13.63	17.52	− 6.09	725
Prediction was not 0, 50, or 100%	19.63	17.62	− 2.58	2265

Parents were asked to rate the probability of pregnancy and could answer with any whole number percent chance between and including 0–100. Prediction gap = parental prediction − the predicted value from logistic regression. Data come from the NLSY97

Expectation Data Concerns

In aggregate, the estimates in Table 5 help disclose how prediction accuracy varies across the American population. There are, however, at least two potential concerns with the subjective predictions data that may change how we interpret these accuracy estimates. The first is specific to the survey instrument. The primary respondents in the expectations sub-survey were not all the same age at the time of survey; they were between 15 and 17 years old. This is relevant as it is safe to assume that, on average, parents of 17 year olds have collected more information on their child over the additional 2 years of life. Additionally, 15 year olds have two additional years remaining to become a teen parent, relative to a 17 year old. However, national statistics show that

currently over 73% of teen births occur to 18 and 19 year olds (HHS 2015).

The second concern is general to predictive survey responses with percentage point answers. Respondents have a tendency to over-report a 0, 100, or 50% probability when they believe the outcome is very unlikely, very probable, or they are unsure, respectively. It is of course possible, however, that a parent truly believes one of these three values is the actual probability. Given these concerns, I re-estimate the mean subjective predictions, teen birth rates, and prediction gaps within the three age groups and across the samples who did or did not respond with a 0, 50, or 100% answer.

Table 6 presents the findings from these robustness checks. Across the three teen ages, mean subjective parental

predictions, teen birth rates, and mean prediction gaps vary by 4.4, 0.5, and 2.9 percentage points, respectively. Across the samples who did or did not report a 0/50/100% answer, mean subjective parental predictions, teen birth rates, and mean prediction gaps vary by 6.0, 0.1, and 3.5 percentage points, respectively. Given these mostly small differences, these two potential issues are perhaps cause for less concern than what might have been expected ex ante.

Conclusions

This analysis was an attempt to answer two questions pertaining to parental predictions of teenage parenthood. First, what are these predictions and how do they differ across relevant socioeconomic and demographic groups? Second, how accurate are these predictions generally, and how does the accuracy of these predictions vary across the same groups? A longitudinal survey instrument which captured parental predictions of children's possible future teenage parenthood was used, as well as actual teen birth outcomes and a long list of young parenthood determinants.

Subjective beliefs of teen parenthood are indeed found to vary across socioeconomic status and relevant population demographics. The average American parent in this sample believed there is a 15% chance their teen child will be a parent themselves before they are 20 years of age. Those in the lowest income quintile expect their children to become teen parents at over twice the rate as those in the highest quintile, at 24 versus 9%. Differences in this expectation were larger across the income distribution than they are across gender and race, geography, household structure, the fertility age of mothers, religion, parental education, and even the academic ability of the teen.

The primary goal of this analysis was to estimate average prediction accuracy across this sample of the US population. The difference between a parent's reported subjective probability and the objective probability (as measured by the unbiased econometrician) of a particular outcome constitutes an accuracy measure of the prediction. The accuracy of these predictions is found to vary significantly across several distributions as well as specific individual and household characteristics. The average parent in the sample underestimated the probability their child would become a teen parent by only 3.4 percentage points. By comparison, parents of American teenagers have been recently shown to overestimate the teen's probabilities of high school and college completion by 18.0 and 37.6 percentage points, respectively and on average (DeBacker and Routon 2017).

While this average inaccuracy is relatively small, certain segments of the population are much less accurate. The most inaccurate sub-population examined were parents of female African-American teens, who on average underestimated this probability by 19.4 percentage points, a prediction gap almost six times as large as the estimated national average. Such a prediction gap is more likely to cause inefficient planning and resource allocation within a household.

Parents of White males, Hispanic males, and students in the 81st academic percentile or above all *over* estimated this probability by about 5 percentage points on average. Households with two college graduate parents were also overestimating this probability by about 5 percentage points, on average. The higher household income, the more accurately parents were able to predict the occurrence of teen parenthood. Households in the highest income quintile were within 1 percentage point of estimating this probability, on average, while those in the lowest income quintile were underestimating it by about 8 percentage points. If demographic differences in prediction accuracy are not constrained to teen parenthood but persist in other areas such as labor and education, then the prediction skills of parents may be a major factor driving demographic differences in many economic outcomes.

Teen parenthood has been shown by others to reduce the probability of many favorable outcomes such as high school completion, college enrollment, general happiness, economic well-being, and the future economic success of the infant. Thus, the fact those already belonging to the lowest SES groups (as measured by income or wealth) are found to predict teen parenthood the least accurately is of relevance to the study of economic inequality. Indeed, while these households expect teen parenthood with the highest probability, they are still shown to be underestimating this probability the most, on average. One may venture that those households who least accurately expected teen parenthood will be the most affected by its occurrence, as it comes as more of a "shock." This may constitute something similar to a negative feedback loop, where low SES households are the most affected by teen parenthood, which results in a lower probability of more favorable future economic outcomes. However, differences in the prediction gap across the income distribution are not as large as many others uncovered here, particularly those across the race and gender of the teen. Parents of minority females are both the least accurate predictors of teen parenthood and the most likely to underestimate its probability. Large prediction gaps, for teen parenthood and perhaps other relevant possibilities as well, may in small part explain racial differences in several economic outcomes.

The purpose of parenting is to influence the outcomes of children. Theoretical and empirical research has discussed and uncovered many links between parental influence and various teen outcomes, ranging widely from future labor market outcomes (e.g., Schoon and Parsons 2002), to alcohol and tobacco consumption (Simons-Morton 2004; Abar and Turrisi 2008), to online privacy protection (Youn 2008),

as only a few examples. Among these outcomes are several related to fertility, including promiscuity, contraceptive use, and risky sexual behaviors (Whitaker and Miller 2000; Miller 2002; Meschke et al. 2002). Findings in the analysis at hand contribute to the current theoretical and empirical work on parental influence and teen outcomes by demonstrating, at least in terms of teen fertility, how both parental beliefs and the accuracy of those beliefs vary across the US population. Given the teen's parent finds a particular teen parenthood outcome more desirable than the other, the strength of attempted parental influence is likely to vary across the outcome's expectation. For example, a parent who does not want their teen becoming a teen parent but who thinks that occurrence has a high probability may devote more influence against the outcome than an otherwise identical parent who believes the occurrence has a small probability.

More research is needed to increase the understanding of the expectation of teen parenthood. First, parental prediction data are scarce, and the sample used here was small in observation size. As is always the case, a more robust sample would yield more trustworthy estimates. Perhaps most importantly, analysis of the teen's own expectations would provide further enlightenment. Do the patterns uncovered here for the predictions made by the teen's parents follow that of the teen? Are teens more or less accurate predictors than their parents? The

data limitations encountered in this study are also cause for additional research. First, some of the sub-sample sizes were quite small, leading to lower confidence in the statistics estimated. Second, all of the primary respondents investigated here were 15–17 years old at the time of the prediction, and it may be equally as important to investigate predictions made when they were younger. As a final thought, one may ask, what roles do these expectations play in the effects of teen parenthood? It is reasonable to believe teens who are very much expected to become young parents will be relatively less affected by that outcome. Estimation of effect differentials along these lines would likely further our understanding of the effects themselves.

Compliance with Ethical Standards

Conflict of interest The author declares that he has no conflicts of interest.

Research Involving Human and Animal Participants This article does not contain any studies with human participants or animals performed by any of the authors.

Appendix

See Table 7.

Table 7 Sub-sample sizes

Sample	n	Sample	n
Full	2990	Household income quintile 1	357
White male	804	Household income quintile 2	684
White female	806	Household income quintile 3	597
African-American male	383	Household income quintile 4	672
African-American female	401	Household income quintile 5	680
Hispanic male	307	ASVAB percentile 0–20	1179
Hispanic female	266	ASVAB percentile 21–40	518
Urban household	2273	ASVAB percentile 41–60	456
Rural household	717	ASVAB percentile 61–80	432
Region: Northeast	498	ASVAB percentile 81–100	405
Region: North Central	753	Neither parent, HS diploma	246
Region: South	1147	One parent, HS diploma	356
Region: West	592	Both parents, HS diploma	493
Two parent household	1450	One parent, some college	645
Single female household head	882	Both parents, some college	199
Single male household head	658	One parent, college degree	759
Mother had child by 20	1036	Both parents, college degree	292
Mother did not have child by 20	1954	Catholic	969
Teen is already a parent	61	Protestant	1880
Teen is not a parent	2929	Other religion	64
		No religion	77

Values are number of households. Data come from the NLSY97

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P. Wesley Routon Dr. Wesley Routon lives in Atlanta, Georgia and is Assistant Professor of Economics at Georgia Gwinnett College. He received his Ph.D. in economics from Middle Tennessee State University. In the field of family economics, he has published on the effects of military service on marital stability, as well as research on the relationships between parental predictions, own predictions, inequality, and economic outcomes.