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Abstract

We hypothesize that the choices and behaviors of youths that may result in a teen nonmarital birth event are influenced by expectations of the consequences of each choice open to them. Two categories of such choice-conditioned long-term effects are explored: 1) a teen's expected personal income stream, and 2) the probability that she will establish a long-term and stable family-type relationship. We also measure the effects of an extensive list of other factors, including the characteristics of the girl's family and its choices, the social and economic environment in which she lives (including policy-related factors, such as public expenditures by states on family planning programs), her neighborhood's characteristics and her own prior choices. The empirical work uses the Michigan Panel Study of Income Dynamics. The results provide evidence that both expected relationship stability and personal income differences play a role in influencing these choices with a suggestion that relationship stability may have greater weight. The results also suggest an important role for public family planning expenditures.

Key words: teen births; nonmarital fertility, relationship stability, family planning.

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I. INTRODUCTION

The high numbers of teen births in the United States has been a topic of considerable public concern for the last two decades. The rate of teen births in the United States declined dramatically in the last dozen years yet this rate remains highest among western industrialized countries. The teen birth rate stood at 61.8 births per thousand in 1991, experienced a drop of approximately 31 percent over the subsequent dozen years, and stood at 43.0 births per thousand in 2002.[2] Even with this large drop, there are nearly four hundred and fifty thousand births to U.S. teenagers each year; these births account for nearly eleven percent of all births and eighteen percent of all African-American births. Even more staggering is the very high rate of births among unmarried teens; today, eighty percent of births to teenagers are out-of-wedlock; among Blacks nearly all (96 percent) teen births are out-of-wedlock. (National Vital Statistics, 52:10, December 17, 2003, table 17.)

This teen nonmarital childbearing phenomenon is viewed as a social and economic problem because of the presumed adverse effects on the human capital and the future productivity of both the mothers and their children. While the question of longer-term impacts of early, nonmarital childbearing

[1]While the authors are listed in reverse alphabetical order, all contributed equally to this paper. The authors gratefully acknowledge the contributions of Scott Niemann, Kathryn Wilson, Yuichi Kitamura, Susan Lee and Dawn Duren.

[2]Then-President Bill Clinton, in his 1995 State of the Union Message referred to this problem as the nation's "most serious social problem." Today the comment is most appropriately applied to the Latino and black populations. In 1998 the Latino teen birth rate was 93.6 and the black teen birth rate was 85.4, compared to the overall rate of 51.1 per 1,000 females 15–19 (Ventura et al., 2000).

on young mothers is unsettled among researchers,[3] the adverse effects of being born to a teen mother seem clear.[4]

In this paper, we hypothesize that the choices and behaviors of youths that may result in a teen nonmarital birth event are influenced by their expectations of the consequences of their choices among the alternative options that are open to them. We distinguish two categories of such choice-conditioned long-term effects for the potential mother—the effects on 1) her expected personal income stream and 2) the probability that she will establish a long-term and stable family-type relationship. We posit that the occurrence of a teen nonmarital birth has negative effects on both expected future personal income and 'relationship stability.' In turn, the income and relational stability consequences associated with the occurrence of a nonmarital birth are likely to influence the incidence of sex-related risky behaviors, and hence the probability of a nonmarital birth event. It is the behavioral response to the incentives created by these consequences that is the focus of this paper. We also measure the effects of an extensive list of other factors, including the characteristics of the girl's family and its choices, the social and economic environment in which she lives (including policy-related factors, such as public expenditures by states on family planning programs), her neighborhood's characteristics and her own prior choices.

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[3]While teen women who have a nonmarital birth tend to have less income, more marital instability, and lower educational attainment than those who do not, some portion of these outcomes may be attributable to unmeasured adverse family background or personal characteristics. A number of the studies in Maynard (1997) attempt to account for this selection problem in studying the consequences of adolescent childbearing. Hotz, McElroy, and Sanders (1997) and Hotz, Mullin, and Sanders (1997) use a natural experiment—a comparison of teen mothers with women who became pregnant as teens but who experienced a miscarriage—to account for adverse unmeasured effects, and suggest that virtually all of the costs associated with early childbearing are a manifestation of this selection effect. Their conclusion, however, depends on the extent to which miscarriages are purely random events, and there are important reasons for believing that this is not the case. See also Geronimous and Korenman (1992,1993), Hoffman, Foster, and Furstenberg (1993), Brooks-Gunn, Duncan, Klebanov, and Sealand (1993), and Bronars and Grogger (1994) who also analyze teen fertility.

[4]There is substantial evidence that the children born to teenage mothers (especially those who are not married) are more likely to grow up in a poor and mother-only family, live in a poor or underclass neighborhood, and experience high risks to both their health status and school achievements. See Haveman, Wolfe, and Peterson (1996), Haveman, Wolfe, and Pence (1999), and Wolfe and Perozek (1996). Rosenzweig and Wolpin (1995) also explore this issue.

II. A BRIEF LITERATURE REVIEW

Numerous early studies of the teen nonmarital birth outcome used cross-sectional and longitudinal data and reduced form estimation to relate the background, family and residence characteristics of young women to the non-marital birth outcome. None of them attempt to measure the response of teen unmarried women to the potential impacts of alternative nonmarital fertility-related choices (e.g., contraception, abortion) that they make, or study these choices in a dynamic framework, or as they interact with labor supply, schooling, and post-birth marital choices.

Recent research has taken a more economic approach to understanding the determinants of unmarried teen women's fertility decisions, and has sought to relate these choices to the conditional opportunities and constraints with which these women are confronted. For example, because access to welfare benefits is available to single mothers, the generosity of public income support in the state that women live has been viewed as influencing the choice to give birth out of wedlock, which is one of the avenues into single motherhood.

Duncan and Hoffman (1990) were among the first to explore this approach. They estimate a two-stage logit model over African-American teenagers in which a teenage nonmarital birth event (joint with the receipt of welfare benefits) depends upon the woman's perceptions of the family income associated with alternative choices. Maximum state AFDC benefits are taken to be the income available in case of a birth, and predicted taxable family earnings at age 26 proxy for the income available without a birth. While both of these expected economic opportunity variables have the expected sign, only the variable indexing economic opportunities without a birth is statistically significant.

Lundberg and Plotnick (1995) have also studied the economic determinants of the teen nonmaritial birth outcome, recognizing that women's decisions reflect a sequence of premarital outcomes: premarital pregnancy, pregnancy resolution, and the occurrence of marriage prior to birth. They jointly estimate these stages of the decision process using a three-stage nested logit model. While they focus on state welfare benefits, recognizing that higher benefits reduce the costs of a nonmaritial birth, differences in the availability of family planning services and state abortion policies are also hypothesized to affect choices in this sequence. For whites, they find that the level of welfare benefits are positively and significantly related to the birth outcome, and that other state policy indicators also significantly influence relevant fertility-related choices. However, for blacks they find that none of the economic or policy variables are "significant in a manner consistent with an economic model" (p. 190), a result that agrees with that of Duncan and Hoffman.[5]

Clarke and Strauss (1998) use aggregate state-level data to study the effect of the level of welfare benefits, female wages, and male wages on the illegitimacy rate. After controlling for the potential endogeneity of the state's AFDC generosity using a fixed effects approach that adds controls for state and year, they find real welfare benefits have a strong and robust positive relation to teen illegitimacy, while female wages are negatively related to this outcome. The wage effect is statistically significant for whites, and statistically insignificant (but of larger magnitude) for African-Americans. The wages of males, a proxy for spouse wages, are not significantly related to illegitimacy rates. The results are not robust but belong only to the fixed effects model.[6]

Finally, Rosenzweig (1999) employs a model of the initial childbearing and marriage decisions of young women that incorporates concern for child quality and assortative mating. A primary objective is to identify the independent effect of AFDC benefit levels on these choices. Using eight cohorts of women in the National Longitudinal Survey of Youth and a fixed effects model to control for unobservable and permanent differences across cohorts and states, he relates three mutually-exclusive marriage and fertility outcomes through age 22 to variables reflecting expectations of future choice-conditioned opportunities (including welfare benefits available to the young woman during her teenage years), and a measure of the

[5]The authors attribute these unexpected results to the small sample of black women, to the potential for under-reporting of several of events in some of the stages of the sequence, or to the existence of different racial responses to incentives.

[6]Moffitt (1998) criticizes the specification of the Clarke-Strauss model arguing that their instrument, state per capita income, probably belongs in their core or main equation.

woman's endowments. He finds that higher welfare benefits have a small positive, but statistically significant overall effect, but a large effect on women from low income families.[7]

Our approach extends these recent efforts to model the choices and behaviors of unmarried young women that may lead to a teen nonmarital birth event. Like these studies, we also view the choices of young unmarried women to be influenced by their expectations of the effects of alternative decisions among the options that are open to them. However, whereas prior research has focused on effects of alternative choices that derive from financial (welfare, personal, or family income) gains or losses, we also analyze the response of young women to the implications of having a nonmaritial birth on the likelihood that they will ultimately establish a long-term and stable family-type relationship.

While we emphasize the role of the choice-conditioned expectation regarding income and 'relationship stability,' we also include more extensive information on family characteristics and choices, neighborhood attributes and the policy environment in which the young women lives than used in prior studies. None of the earlier studies include information on the male partners of the women, as no longitudinal data set contains linked information on mothers' non-spousal male partners; our data are subject to the same limitation. Unlike Lundberg and Plotnick (1995), we do not jointly estimate the response to incentives of several sequential choices that result in a nonmarital birth; all of these prior choices are reflected in the nonmarital childbearing outcome which we study.

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[7]Rosenzweig's variable reflecting the "real" value of welfare benefits is plagued by missing values due to the NLSY data that he uses, and hence may mismeasure the benefits available to women who move during their teenage years. That variable may also confound welfare generosity with time-related changes in state-specific earnings opportunities for low earnings, low ability, and minority youths, because this latter variable remains unmeasured. Hence, his reported welfare effect could also be interpreted as a response to market opportunities. Hoffman and Foster (2000) reexamine the effects of AFDC benefits on nonmarital childbearing through age 22. They use an alternative data source—the Michigan Panel Study of Income Dynamics (PSID)—allowing analysis that includes more cohorts and superior information on welfare benefit levels, parental characteristics, and measures of nonmarital births. While they are able to reproduce Rosenzweig's main finding, they fail to find a 'welfare effect' on teen nonmarital births, but a large effect on the choices of women in their early 20s. The finding of significant welfare effects when both cohort and state fixed effects are controlled for is at odds with other research relying on fixed effects estimation (Moffitt, 1994; Hoynes, 1997).

III. OVERVIEW OF ESTIMATION APPROACH

The specification of our empirical model assumes that when young unmarried women make choices with implications for childbearing, they take into account the income and relationship stability implications of their choice. In forming estimates of these income and relationship consequences, these young women assess the experiences of girls ten years their senior who are similar to themselves in terms of observed characteristics, some of whom had an out of wedlock birth as a teenager and some of whom did not.

We express this intuition through a two-stage econometric model. In the first stage, we relate the income and relationship stability experiences of the older cohort of girls to their teen birth decisions and demographic characteristics. In the second stage, based on the coefficients from these regressions, we predict the income and relationship stability consequences for the younger girls conditional on having or not having a teen birth. We then estimate the probability of an out of wedlock birth for these teenage girls as a function of the predicted income and stability consequences and of other covariates.

This estimation strategy relies on two identification assumptions. First, we assume that these youths are unable to discern the effects of determinants of the nonmarital childbearing choices that are unobserved by the researcher, but which may have influenced the fertility choice of individuals in the secondary (older) sample. If the teenage girl observes these characteristics of the older cohort of girls that are not observed by us, our estimates of the effect of these income and stability consequences on the teen birth decision will be biased. Thus our model assumes that teen girls have only a crude sense of the characteristics of older girls who chose to have or not have a teen birth.[8] Second, as is common in two-

[8]In related work, we test the sensitivity or our results to those from a model that assumes that youths do perceive the effects of such unobserved factors in forming expectations. We estimated an alternative specification that attempts to statistically control for this selection, implying that the youths in the primary sample perceive this selection process in framing their prediction of expected personal income conditional on the nonmarital childbearing choice. In this alternative specification, a two-stage Heckman-type selectivity correction model (See Heckman, 1979) is fit over the secondary, older cohort to estimate the two, choice-specific expected personal income variables

stage models, the parameters in our model are identified by a broad array of exclusion restrictions and functional form assumptions that are described later in the paper.

IV. DATA ON THE TEEN UNMARRIED AND OLDER WOMEN COHORTS

Our estimates are based on two large longitudinal data sets constructed from a national stratified sample of families, the Michigan Panel Study of Income Dynamics (PSID).[9] The first data set—our primary sample composed of young women whose choices we model—includes 1,172 teen age women who were ages 0–9 in 1970; they were followed until 1992, at which time they are young adults, ranging in age from 22 to 31 years.[10] The weighted proportion of observations in this sample with a nonmarital birth by age 18[11] is 8.6 percent; among the Black members of the sample, the weighted proportion is a far

for each person in the primary sample. See Haveman, Wolfe, and Wilson (2001). The estimated effects of expected income in this alternative specification are very similar to those in the preferred specification reported below.

[9]The PSID data provides longitudinal information on over 5000 families beginning in 1968. We use available data covering 25 years of information. The choice of ages (0–9 in 1970) reflects a balance among several objectives and constraints, including the need for a sample size sufficient to secure a required number of premarital births, the need to constrain the projection of neighborhood data beyond those from the 1970 and 1980 Census records that were available at the time we assembled our data set, and the decision to attach neighborhood data to each child's record beginning at age 6 (requiring a maximum age of 9 years in 1970).

[10]Only those females who remained in the survey until age 19 are included. In a few cases, observations could not be used and are excluded from the analysis. These include persons with two or more contiguous years of missing data. Those observations with but one year of missing data were retained and the missing information was filled in by averaging the data for the two years contiguous to the year of missing data. For the first and last years of the sample, this averaging of the contiguous years is not possible. In this case, the contiguous year's value is assigned, adjusted if appropriate using other information that is reported. Studies of attrition in the PSID indicate that erosion of the sample has reduced its representativeness. See Becketti, Gould, Lillard, and Welch (1988), Lillard and Panis (1994), and Haveman and Wolfe (1994). A recent study by Fitzgerald, Gottschalk, and Moffitt (1998), however, finds that, while "dropouts" from the PSID panel do differ systematically from those observations retained, behavioral responses estimated from the data do not appear to be significantly affected.

[11]Numerous criteria could be used to define "teen births." We have chosen age 18 as the cutoff because most of the policy concern is directed at childbearing during ages when high school attendance is expected.

greater 29.6 percent.[12] A secondary sample is a somewhat older cohort of females who were aged 9–16 years in 1970, and who were 31 to 38 years old in 1992.[13]

For individuals in both cohorts, we have extensive longitudinal information on the status, characteristics, and choices of family members, family income (by source), living arrangements, and background characteristics such as race, religion, and location. In order to make comparisons of individuals with different birth years, we index the time-varying data elements in each data set by age. All monetary values are expressed in 1998 dollars using the Consumer Price Index for all items.[14]

We merged onto both data sets an extensive array of year-specific state or county data designed to characterize the policy environment or community attitudes within which the individual makes choices or forms income or relationship stability expectations. These variables include:

- state maximum welfare benefits per month,[15]
- state unemployment rates,
- state median family income,

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[12]14.4 percent of the unweighted observations, 169 out of 1172, had a nonmarital birth at some point during their teen years.

[13]For the secondary sample, we use women who remained in the survey until age 29. An older sample of 727 women is used for estimating the expected 'relationship stability' variables; the sample for estimated expected income is 733. Missing data account for the difference in sample size.

[14]While alternative indexes could be used, the Census Bureau describes the CPI as the best measure for adjusting payments to consumers when the intent is to allow them to purchase, at today's prices, the same market basket of consumer goods and services that they could purchase in an earlier reference period. "It is also the best measure to use to translate hourly and weekly earnings into inflation free dollars." http://stats.bls.gov/cpifaq.htm Question 1.

[15]For each state, we have annual data from 1968 to 1992 on the state maximum benefits for the Aid to Families with Dependent Children (AFDC) program, the maximum Food Stamp benefit, and the average Medicaid expenditures for AFDC families. In incorporating this information into our basic data set, we match maximum benefits (the maximum amount paid by the state as of July of that year to a family of four with no other income), for the years when the child is ages 6 to 21 (deflated by the personal consumption expenditure deflator). For Food Stamps, the benefit is the amount of the allotment (or the allotment minus the purchase requirement) for a family of four with no other income, again measured as of July of that year. Finally, average Medicaid expenditures for each state equal three times the state-specific fiscal year per child Medicaid expenditures for dependent children under 21 who are in categorically needy families plus the state-specific average per person annual Medicaid payments for adults in categorically needy families. These are deflated using the Current Price Index for medical care. We thank Robert Moffitt for providing these data.

- per capita state public expenditures on family planning,[16]
- state requires parental consent for abortions,
- state Medicaid program funds abortions,
- state restricted abortions pre Roe v. Wade,
- state teen birth rate,
- percent of state residents belonging to a religious organization,
- state divorce rate,
- state has a no fault divorce law,
- percent of state births out-of-wedlock.

These jurisdiction-based policy variables are matched to individuals during each of the teenage years depending on the jurisdiction of the girl's residence in each year.

Finally, we merged the following neighborhood-specific data to each person in our samples depending on their residence in each year from 1968 to 1985:

- unemployment rate,
- percent of workers in high status (professional/managerial) occupations,
- median family income,
- percent of families with low income (less than $10,000 in 1970 dollars)
- percent of families that are female headed,
- male/female ratio,
- the employed male/female ratio,
- percent of persons belonging to a religious organization.

[16] 1984 values are an average of 1983 and 1985 values for each observation; 1986 values are an average of 1985 and 1987 values.

This was accomplished by matching small area data from the 1970 and 1980 Censuses to each individual on the basis of their year-specific location.[17]

A number of these policy/community environment variables were added to the data set as they are likely to influence choices related to the nonmarital birth outcome. For example, state welfare generosity and the prevalence of teen or nonmarital births in the state or of female-headed families in the neighborhood are likely to be positively associated with this outcome. On the other hand, women living in states with restrictive state abortion laws or a strong religious orientation may be less likely to make choices leading to a nonmarital birth.

Other of these policy/community variables (e.g., the state/neighborhood unemployment rates, welfare generosity, state/neighborhood median income, the prevalence of poverty, the share of workers employed in high status occupations, and relative female employment) are measures of the overall economic status of the community or of labor market connections that are likely to influence the personal income expectations of these young women. Similarly, the prevalence of divorce or ease of obtaining a divorce, the preponderance of female-headed families and the religious orientation of state residents (as indicators of attitudes toward marital instability), and the (employed) male/female ratios (as measures of potential partners) will influence expectations regarding ‘relationship stability.’ Consistent with these expected patterns of effect, we selectively include these as control variables in the nonmarital choice, income and relationship stability models (see below). Appendix Tables 1 and 2 present a complete set of statistics for both samples.

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[17]The matching was done by combining geographic codes added to the annual PSID data over the years 1968 to 1985 by the Michigan Survey Research Center to 1970 and 1980 Census data. Using 1970 and 1980 Census data, we assign neighborhood values to the neighborhood in which each family in the PSID lived to Census data. In most cases, this link is based on a match of the location of our observations to the relevant Census tract or block numbering area (67.8 percent for 1970 and 71.5 percent for 1980). For years prior to 1970 we use 1970 data; for years after 1980 we use 1980 data while for years 1971–1979 we used a weighted combination of 1970 and 1980 data (weights are .9 (1970) and .1 (1980) for 1971; .8 (1970) and .2 (1980) for 1972 and so on).

V. INCOME AND 'RELATIONSHIP STABILITY' EXPECTATIONS WITH ALTERNATIVE CHILDBEARING CHOICES

We assume that the teen unmarried women in the primary sample form their expectations regarding the effects of alternative childbearing choices by observing the choice-conditioned outcomes and experiences of this older cohort; hence, we derive the choice-specific income and relationship expectation variables required for our model from information on this older cohort. Whereas all prior studies of the teen nonmarital birth outcome based on a choice-conditioned expectations approach assume that the choices of young women respond to choice-specific income flows, we employ two utility-based components—expected income and expected stability in marriage-type relationships (which we refer to as 'relationship stability').

We estimate separate conditional personal income variables for each woman in our analysis sample. Personal income is defined as the sum of the person's own earnings, asset income, transfer benefits (AFDC, SSI, other welfare, Social Security, veterans benefits, other retirement/pensions, unemployment insurance, and worker compensation) and unearned income from all other sources (child support, help from relatives, and "other" income.)[18] The (expected present value of discounted) personal income values are estimated from several years of longitudinal data on a slightly older cohort of women, some of whom did and others of whom did not have a teen nonmarital birth.

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[18]We use *personal income* rather than individual *earnings* since neither transfer income (including welfare benefits) nor child support is contained in earnings, hence omitting an important component of the relevant expected economic well-being concept specified in our model. We use personal income rather than *family income* since the latter incorporates issues of family composition and allocation which are outside of our model and, for the most part, our observation. These include a young woman living at home, with friends or at school. An alternative measure might be the expected difference in family income-to-needs. This measure would require a quite different set of implicit assumptions than use of the personal income variable. Because additional children increase the level of family needs, we would be assuming that these children reduce the mother's utility if there were no associated change in her expected income. Further, using family income relative to needs to proxy for utility in those cases in which the young woman lives with her parents implies that parental income increases the young woman's utility, and that there are no other utility costs associated with living in her parents home. Similarly, if the woman would marry or cohabit, this procedure would implicitly assume that all of the benefits of this living arrangement are reflected in the partner's income and that any costs are reflected in the increase in family needs due to the addition of another adult.

Our second choice determinant—the expectation of a stable marriage-type relationship—is more unconventional. There is little research on the value placed by young people on having a stable marriage (or cohabitational) partner, and no evidence on the effect of conditional expectations regarding this factor affect fertility choices. We construct alternative measures of relational stability that reflect both the benefits of a stable marriage-type relationship (including both marriage and cohabitation), and the costs associated with relationship dissolution. We estimate separate conditional expected values of relational stability variables for each women in our primary sample relying on both economic and demographic perspectives, and again use several years of longitudinal data from the older cohort of women.[19]

A. Choice-Conditioned Personal Income Expectations

The two choice-specific expected personal income variables for each of the 1,172 young women in the primary sample are obtained from estimated parameters of a series of personal income tobit equations fit over observations in the secondary sample, together with the relevant characteristics of the girls in our primary sample. Tobit maximum likelihood is used due to observations with no income, especially at younger ages.[20] We estimate equation (2) for each of the 11 years from ages 19 to 29[21] for each of two groups in the older cohort (women who gave birth while an unmarried teen, and women who

[19]The standard microeconomic approach to this issue views marriage (or cohabitational living arrangements) as an institution which allows two individuals to merge their individual attributes in the joint production of household goods so as to maximize expected joint lifetime utility or well-being (see for example Becker, 1974; Becker, Landes and Michael, 1977; McElroy, 1985). Complementary to this analytical approach to marriage is a more empirical and demographic literature relating to cohabitation, and the probability of marriage of women who give birth out of wedlock. (For example Bumpass, Sweet and Cherlin, 1991, and Bumpass and Lu, 1998, show that for women with a nonmarital birth, the likelihood of subsequent marriage was about 60 percent, and has been declining.)

[20]Across the years, an average of about 11 percent of the young women in the birth subgroup had no reported personal income; the maximum with no report is 18 percent at age 19. Among the women who did not give birth, an average of 15 percent report no personal income, with a maximum of nearly 29 percent at age 19.

[21]Given our desire to use neighborhood and childhood data, we are constrained from using information for ages greater than 29 years.

did not have a teen nonmarital birth),[22] for a total of 22 estimated equations.[23] The results of these estimations are available from the authors.

We use the relevant individual characteristics of each girl in our primary sample, together with the coefficients from the two sets of 11 Tobit estimations, to predict income values (for each of the ages from 19 to 29) for each primary sample observation. Two 11-year series of predicted income expectations are obtained for each teenage unmarried girl; one series representing her expected income trajectory conditional on giving birth, and another 11-year series representing her expected income trajectory if she does not give birth.[24]

The mean values of these predicted personal income expectations (and the standard deviation for each mean value) are shown in Table 1 for each of the 11 years for each of the assumed childbearing outcomes. These mean predicted values are shown for the entire primary sample, and separately for those

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[22]Women in the older cohort who had a nonmarital birth before age 19 are included in the childbearing group; women who did not have a nonmarital birth before age 19 form the no childbearing group. Of the 733 women in the older sample over whom the income equations are estimated, 132 gave birth as an unmarried teenager, and 601 did not.

[23]We included in these equations variables likely to be related to the personal income dependent variable, including race, family position (if first born), parental education, family structure, mother's employment, urban residence, region, family location changes, disability status of family head, family income, family poverty status, family welfare recipiency, neighborhood median income and percent of neighborhood residents in high status occupations, percent neighborhood residents with low income, neighborhood unemployment rate characteristics, and state welfare generosity, median income and unemployment rates. Most of these variables are measured over the girl's ages 12–15, which range is determined by the 25 years of observations that are available. The vectors of independent variables used in the income regressions do not vary between the two teen childbearing groups, with two exceptions: (1) parental education is limited to a high school or more in the with-birth estimation rather than the high school graduate and more than high school used in the no-birth estimations, and (2) state AFDC generosity is included only in the with-birth equations. The signs on some of the coefficients in the income regressions differ between the two groups. For example, growing up in a family which consistently received welfare benefits is associated with higher income for those women who had a teen nonmarital birth, but is negatively related to income for those who did not have a teen birth. Father's education is positively associated with income only in the estimates for those without a teen birth. Beyond these two examples, the variables have similar and expected effects on personal income for the two groups. The definitions, means, and standard deviations of these variables are shown in Appendix Table 1. The estimated relationships are available from the authors.

[24]These income terms are pre-tax income. It would be ideal if we could obtain estimates of disposable income by adjusting for taxes, particularly since welfare income (which is likely a larger component of personal income if the woman chooses the childbearing option than if she does not) and earned income are subject to different tax regimes. However, while we recognize this shortcoming, we are unable to reliably adjust for tax liability with the available data.

who did and did not give birth in that sample.[25] The childbearing-conditioned expected income patterns are revealing. For early ages, predicted income if the unmarried teen gives birth is lower than but similar to income if she does not give birth. However, the income trajectory in the birth option shows virtually no real growth. Mean expected income assuming no birth generally increases over the 11 years, and in all years exceeds predicted income if the unmarried girl gives birth. The predicted income trajectories suggest substantial gains to not giving birth as an unmarried teen beginning at age 21.

In the second two panels of Table 1, expected incomes for the unmarried teens who did not have a birth (with their characteristics) can be compared to those who did give birth. Interestingly, the income loss associated with choosing to give birth is substantially greater for those girls who did not, in fact, give birth out of wedlock as a teen. Giving birth as an unmarried teenager does not appear to carry as substantial an income penalty for the women who did in fact have a birth. These patterns suggest that the young women in our sample are, in fact, choosing rationally.

We discount each of the choice-conditioned age 19 to 29 expected personal income streams for each girl in the primary sample to age 16 (a likely age for making decisions that influence whether or not a teen birth occurs) using a discount rate of three percent. This procedure implicitly assumes that at age 16, each young unmarried woman in our primary sample forms her expectations of future childbearing-conditioned incomes by observing the realized incomes of women with her same characteristics who are ages 19 to 29. By including incomes during the late-teens and 20s, we capture the income foregone due to postponed working (or delayed marriage) associated with early childbearing; in this sense, our expected income terms may be superior to estimates of full lifetime incomes.[26]

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[25]The predicted incomes with and without giving birth are for the same individuals within each of the three panels—whole sample, those without teen birth and those with teen birth.

[26]We also experimented with assigning age 29 income for an additional ten years and using the earnings growth over the 10 years with observed income to create income for subsequent years. The basic results are invariant to these alternative measures of conditional income.

These present value estimates are shown at the bottom of each panel in Table 1. The expected present value of income for the average young, unmarried woman in the sample assuming no teen birth is $112,876; the average expected present value assuming a birth is $77,180, for a difference of $36,696. As noted earlier, the gain from not giving birth as a teen is far greater for those girls who did not, in fact, give birth ($38,182) than for those girls that did ($20,946).

B. Choice-Conditioned 'Relationship Stability' Expectations

We posit that choices regarding nonmarital childbearing affect a woman's well-being by influencing her future lifestyle and living arrangements, in addition to her future income trajectory. Perception of these choice-dependent effects will, in turn, influence the childbearing decisions that she makes. While numerous aspects of a teenage woman's future life-course are likely to be affected by a nonmarital birth event, we focus on future marriage-type relationships (defined to include both cohabitation and marriage), and account for the probability of their occurring, and their stability and durability.

The indicator of 'relationship stability' that we employ is defined as follows:

$$R = (10 + Y_m + 0.6\ Y_c) / [(1 + N_d + .6\ N_t)^2],$$

where:

Y_m = number of years married

Y_c = number of years cohabiting

N_d = number of divorces

N_t = number of cohabitations terminated

We measure this indicator for each woman in our secondary sample over the 11 year period covering their ages 19–29, using annual information on marriage, cohabitation, and year over year changes in these statuses. Each woman gets a base value of 10; each year of marriage increases this value by one unit and each year of cohabitation increases the value by 0.6. This “weight” is based on the long term probability a cohabitating relationship evolves into a marriage. A divorce reduces the value of the indicator more than does the termination of a cohabiting relationship, and multiple disruptions reduce the value at an increasing rate. The indicator is increasing with the years in a relationship: a woman who is single over the 11 years has an indicator value of 10; a woman who is married for all of the 11 years and has no divorce has the maximum stability value of 21; a woman who cohabitates over the 11 years without terminating the relationship has a value of 16.6. Conversely, the indicator is decreasing in the number of divorces or terminated cohabitations: a woman who is married for one year, and the marriage ends in a divorce has a value of 9 which is less than the value if she had remained single throughout the period; a woman who is married for 5 years and has one divorce has a stability value of 11; with two divorces the value falls to 6. While the parameters of this indicator are arbitrary, it captures aspects of the creation, existence, and termination of relationships that are consistent with the sketchy literature on this issue. We test the robustness of our results to a number of alternative parameterizations of this indicator.

For both women in the secondary sample who gave birth while an unmarried teen, and women who did not have a teen nonmarital birth,[27] we regress this relationship indicator on a set of variables that are expected to covary with relationship stability.[28] Then, using the estimated parameters from this pair of regressions, together with the relevant characteristics of the girls in our primary sample, we predict two

[27]Women in the older cohort who had a nonmarital birth before age 19 are included in the childbearing group; women who did not have a nonmarital birth before age 19 form the no childbearing group. Of the 728 women in the older sample, 132 gave birth as an unmarried teenager, and 596 did not.

[28]We included in these equations variables likely to covary with relationship stability, including race, if first born, parental education, family structure, mother’s employment, urban residence, region, family location changes, disability status of family head, family income, family welfare recipiency, being Catholic, whether mother was divorced, number of times mother was married, whether the state has no fault divorce laws, divorce rates in the state and ratios of males to females. Most of these variables are measured over the girl’s ages 12–15. This range is determined by the 25 years of observations that are available. The vectors of independent variables used in the relationship regressions are virtually the same between the two teen childbearing groups (father a college graduate was omitted in the with teen birth regression due to insufficient observations). Most of the variables have similar and expected effects on relationship stability for the two groups. The definitions, means, and standard deviations of these variables are shown in Appendix Table 1. The estimated relationships are available from the authors.

expected indicators of relationship stability for each primary observation—one representing her expected relationship stability index conditional on giving birth, and the other representing her expected indicator if she does not give birth.

The mean values of these predicted indicators (and the standard deviation for each mean value) are shown in Table 2 for each of the assumed childbearing outcomes. These values are shown for the entire primary sample, separately for those who did and did not give birth in that sample and by race. The childbearing-conditioned expected relationship stability patterns indicate that expected stability decreases substantially because of the teen nonmarital birth experience for all women and especially for nonblack women. For those all women who did not give birth (85.6 percent of the total) the index is 12.99 (standard deviation = 2.23); the indicator is 7.96 (4.40) for those that did give birth. For black women who gave birth, the value of the index is 9.30 (3.71), with an expected increase of 2.33 had they not given birth. The value of the index is 11.51 (1.86) for those who did not give birth, with a difference of 2.42 had they given birth. The average differences are far greater for nonblack women: for those who gave birth the mean difference is 6.7; for those that did not, the mean difference is 7.33.

VI. ESTIMATION OF THE TEEN CHILDBEARING CHOICE MODEL

Empirical estimation of the determinants of the teen nonmarital childbearing decision focuses on the roles played by each of the two expectations variables, one for expected income and the other for expected relationship stability. For each individual, the choice-conditioned differences ("if no teen birth" minus "if a teen birth") in income and relationship stability expectations are taken to reflect expected net opportunity gains associated with deciding to **not** bear a child out of wedlock. We estimate this model using a switching model, probit specification.[29] The dependent variable is equal to 1 if the young

[29]See Manski (1987) and Lee (1982). There is substantial overlap in the characteristics of the teen women who do and who do not give birth out of wedlock. A reduced form model predicting this choice fails to explain a high proportion of the choices made, suggesting but limited self selection in terms of the economic opportunities

unmarried woman gives birth before age 19 years, and 0 otherwise. Unweighted data are used for estimation; 169 (14.4 percent) of the young women in our primary sample gave birth while an unmarried teen.[30]

When the expected income difference and expected relationship stability variables are taken to be the only factors influencing the teen birth decision, both coefficients are negative and statistically significant.

	coefficient	t-statistic
Income difference	-.345	-3.07
Relationship stability difference	-.045	-4.47

The marginal probability on the income difference variable is -.075, while that on the relationship stability difference is -.01. To provide some idea of magnitude, we simulate that the expected reduction in the probability of a teen nonmarital birth in response to a twenty five percent change in the ln income difference is a decrease of about 7 percent while a twenty five percent change in the stability difference leads to an expected decrease of nearly 12 percent. However, while these strong effects suggest that young women respond in expected ways to both economic opportunities and gains in relationship stability in making childbearing choices, they do not control for family and neighborhood characteristics, nor for the direct influence of the policy environment on this choice.

Table 3 presents our preferred estimate of the determinants of the teen childbearing choice. This specification includes a number of family, neighborhood and policy environment variables, in addition to

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facing young women in their choices of child birth options; adolescents with both low and high foregone income associated with giving birth are observed to both give birth and to refrain from giving birth. This avoids a potential identification problem in the use of these income expectation variables to explain the observed childbearing choice.

[30]The women in our sample are teens with risk of a nonmarital teen birth during years 1982–1990. During this period, the nonmarital birth rate among girls aged less than 20 was about 11 percent (Mosher and Bachrach, 1996). The rate among African-American teens was far higher than among whites. Our statistic is not rate per year but a cumulative rate over the teen years. African-Americans are oversampled in our data; we conclude that our higher rates are consistent with the observed rates.

the expected income and expected relationship stability variables.[31] The log-likelihood test statistic indicates that the entire equation is significant at the .01 level.

The coefficient on the variable reflecting the expected net income gain from foregoing childbearing is negative and statistically significant at about the 5 percent level, which supports the hypothesis that expectations regarding the economic consequences of nonmarital childbearing do influence the choices of young women; increasing the expected gain to foregoing childbearing while an unmarried teen seems likely to reduce the prevalence of this behavior.[32] Converting the income coefficient into a marginal probability, the estimate is -.053. The coefficient on the expected difference in relationship stability is negative and marginally significant (t-statistic = 1.80), indicating that concerns over the future structure of partner and family relationships also play some role in teen unmarried girls' choices regarding sexual activities and behavior. The marginal effect on the overall probability associated with the coefficient is -.01.[33]

The results of this specification are also consistent with many social science models of children's attainments that indicate that family characteristics are strongly related to the probability that a girl will give birth out of wedlock as a teenager (see Haveman and Wolfe, 1995). Those whose mother has little education, those who are African-American, and those growing up in a single parent family (t-statistic = 1.33) are more likely to have a teen nonmarital birth than are girls without these characteristics; girls whose religion is Catholic are less likely to have a teen birth out of wedlock.

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[31]The means and standard deviations of these variables are shown in Appendix Table 2.

[32]The standard errors in these probit estimations have not been corrected for the use of a predicted value. According to Hsiao (1986) if the income equations are estimated over a sample that is independent of the sample used for the teen birth probit, conditional on the regressors, then the standard errors do not need to be corrected.

[33]A referee for this journal has noted that this variable may also be reflecting the added income of a spouse if married. Since we define our income variable as personal income, which excludes income from a partner, we agree with this caveat to our interpretation.

The results for the direct effects of the policy variables are also consistent with previous research. The family planning expenditure variable is negatively and significantly related to the nonmarital childbearing outcome, suggesting an important potential role of this intervention in decreasing the prevalence of nonmarital childbearing. Similarly, the prevalence of religious organization membership in the community is negatively and significantly associated with the probability of a nonmarital teen birth.

A Note on Model Identification

We identify this model through exclusion restrictions in the first stage income and relationship stability models, through the nonlinear specification of the income difference terms, and through timing. A standard approach to identifying the first stage (income and relationship stability) models is to include in these specifications at least one variable expected to affect expectations but not the birth choice (other than through the income and relationship stability terms). In our personal income estimation, multiple variables which are traditionally related to earnings provide this identification for each age over which income is estimated. State level variables include the unemployment rate and median family income; neighborhood variables include median family income, percent with low income, the unemployment rate, and proportion in high status occupations. In the first stage relationship stability estimation, whether the girl's mother was ever divorced, the number of times the mother was married, whether the state has a no fault divorce law, the divorce rate in the state and the two male/female ratios are included in the estimation of stability, but not in the final stage teen birth equation.

Identification is also achieved through the nonlinear functional forms utilized in the estimation. The predicted income term in the final stage estimation is the difference in the natural logs of predicted income, and hence is not a linear combination of the other independent variables. In addition, the period over which family variables are measured differs between the analyses of the secondary sample of older women and the primary sample, and this difference also contributes to model identification.[34]

In order for the exclusion restrictions to provide valid identification, the variables must be correlated with income (relationship stability) but must not be correlated with the error term of the teen birth equation. The economic intuition for the correlation between our instruments and income is very straightforward: state income, the state unemployment rate, neighborhood median income, proportion with low income, and the proportion of persons in the neighborhood in high status occupations are all labor market measures that are closely related to earnings prospects and income. A similar rationale stands behind our choice of variables in the relationship stability equations. The mother's own divorce experience and number of marriages capture the effect that the mother's relationship stability has on the daughter's stability including attitudes toward divorce. State divorce laws and divorce rates influence the probability of divorce while male to female ratios represent opportunities for current and future relationships. There is little theoretical or observational reason to expect these variables to be related to the teen nonmarital birth outcome.[35]

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[34]The family variables used in the income and stability tobit equations are measured over ages 12–15 of the women in the secondary sample, while these family variables are measured over the longer ages 6–15 period in the final stage estimation. We are assuming that childhood environment during the girl's entire childhood affects teen childbearing, but only late childhood environment (ages 12 to 15) is related to her future income, and future relationship stability.

[35]Bound, Jaeger, and Baker (1995) indicate the importance of having instruments that are not just weakly correlated with the endogenous variable. Focusing on Angrist and Krueger's (1992) use of quarter of birth as an instrument for years of education, they show how biased estimates can result if the correlation between the instruments and the endogenous variable is weak, even thought the estimated relationship is statistically significant (because of, say, large sample size). Thus, economic significance is important as well as statistical significance. The economic significance of our instruments in determining income is well supported by the literature [see Datcher(1982); Corcoran and Adams (1997)]. In OLS estimation of our income equations at age 29 for girls who had a birth, the R-squared indicator of correlation is .225 when only the instruments are included in the specification. The R-squared statistic is .293 for the regression with the full of set of explanatory variables. Likewise, R-square is .107 when only the instruments are included in the income without a birth equation, compared with .109 with the full set of variables. In the relationship stability with a teen birth equation, the R-squared statistic is 0.04 when we regress the stability index on the instruments alone. In contrast, the R-square statistic is 0.23 when all the explanatory variables are included; the instruments account for about 17 percent of the full R-square indicator. Our instruments have even more explanatory power in the relationship stability without a teen birth

The presence of more than one identifying variable allows for the testing of overidentification restrictions for correlation between the instruments and the error term in the teen birth equation. The test involves regressing the residuals from the teen birth probit on the instruments with the hypothesis that the instruments are uncorrelated with the residuals. The test statistic is the uncentered R-squared multiplied by the number of observations, and this test statistic is distributed chi-squared with degrees of freedom equal to the number of overidentifying restrictions.[36] Using the residuals from the stability model, the test-statistic has a value of 10.20, well below the critical value of 18.31 (chi-squared with ten degrees of freedom) for statistical significance, and indicate that the instruments in the relationship stability model are uncorrelated with the residuals from this final stage estimate. Similarly the residuals from our predicted income term give a test-statistic of 12.89 (chi-squared with eighteen degrees of freedom), again well below the critical value of 28.87 for statistical significance.

VII. ROBUSTNESS TESTS

While our preferred model reflects our best judgments on a variety of theoretical and empirical estimation issues, it is important to determine if our estimates are robust to alternative reasonable assumptions. Hence, we have tested the robustness of our Table 3 estimates by systematically altering the specification of the model in a variety of dimensions. The results of these robustness tests are summarized in Table 4, where we present the coefficient and t-statistic on both the income and relationship stability variables. For each test, the specification of the family, policy and neighborhood variables are the same as in Table 3.The first row shows these statistics for the preferred model, presented in Table 3. The t-statistic on the log of the difference in the expected personal income variables indicates that this variable is

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equation. In that equation, the R-square statistic is 0.07 when we use only the instruments as explanatory variables, compared with 0.11 with the full set of variables. In this case, the instruments account for about 60 percent of the full R-square indicator.

[36]See Johnston and DiNardo (1997), pages 336–338. This is asymptotically equivalent to a Basmann test.

TABLE 1
Predicted Personal Incomes (in 1998 $)

	With Teen Birth		No Teen Birth	
	Mean	Std. Dev.	Mean	Std. Dev.
Whole Sample (N = 1172)				
Age 19	$6,332	$3,221	$6,767	$2,477
Age 20	4,696	2,644	7,821	2,567
Age 21	6,496	3,844	9,501	2,717
Age 22	7,770	2,912	11,206	3,536
Age 23	9,863	5,430	12,860	3,598
Age 24	8,833	3,763	13,745	3,976
Age 25	12,100	7,271	14,639	4,584
Age 26	9,130	3,917	16,235	5,201
Age 27	11,449	3,533	16,624	4,158
Age 28	11,589	4,102	18,482	4,335
Age 29	11,224	5,784	18,465	4,315
Net Present Value	$77,180	$23,606	$112,876	$28,777
Those With Teen Birth (N = 169)				
Age 19	$5,763	$2,774	$5,443	$2,093
Age 20	5,546	2,332	6,580	2,113
Age 21	6,721	3,667	8,157	2,252
Age 22	7,872	2,864	9,463	3,116
Age 23	9,292	5,167	10,933	2,930
Age 24	8,637	3,473	11,622	3,145
Age 25	11,335	5,452	12,284	3,393
Age 26	8,824	4,062	13,553	3,548
Age 27	10,975	4,047	14,415	3,615
Age 28	11,374	4,545	16,552	3,936
Age 29	10,918	5,803	16,345	3,906
Net Present Value	$75,559	$24,292	$96,505	$23,815
Those Without Teen Birth (N = 1003)				
Age 19	$6,428	$3,282	$6,990	$2,468
Age 20	4,552	2,668	8,030	2,579
Age 21	6,458	3,874	9,728	2,724
Age 22	7,753	2,921	11,500	3,520
Age 23	9,960	5,470	13,185	3,600
Age 24	8,866	3,810	14,103	3,990
Age 25	12,229	7,529	15,036	4,641
Age 26	9,182	3,891	16,687	5,299
Age 27	11,529	3,434	16,996	4,130
Age 28	11,626	4,024	18,807	4,316
Age 29	11,276	5,782	18,822	4,280
Net Present Value	$77,453	$23,490	$115,635	$28,633

statistically significant at about the .05 level, that for the relationship stability variable indicates significance at the .07 percent level.

The first set of robustness tests modify our index of relationship stability. We view these tests as particularly important tests of the model given the arbitrary nature of our 'preferred' measure. In alternative (1) we modify the relationship stability measure to assign a weight of 5 to being single. In this case, the income difference is statistically significant at the .05 level, the stability difference is negative and significant at the .10 level. The coefficients are similar to those in the preferred specification. In alternative (2) we assign single a weight of 2. In this case, the log income difference term is statistically significant at the .05 level, but the stability difference term is not quite significant at the .10 level. In alternative (3), we assign a weight of zero to being single; the results are similar although the statistical significance of the relationship variable is again reduced. The value of the coefficients on these variables are similar across these 3 alternatives.

In alternative (4) we replace our difference in expected relationship stability measure with the ratio of the expected relationship without a birth to that with a birth. In this estimate, the income difference term is robust and statistically significant at nearly the .05 level, but the stability ratio variable is not at all statistically significant, and instead has an unexpected positive coefficient.

In alternative (5), we allow the effect of relationship stability to vary depending on the childbearing outcome by entering the two predicted stability variables separately into the childbearing equation. The coefficient on expected relationship stability if no birth is negative but not at all statistically significant, while the coefficient on the expected relationship variable if the girl has a teen birth is positive and statistically significant at the .07 level of significance. The pattern implies that expected relationship stability if gave birth as a teen is more important in the decision making of a teen unmarried woman than expected relationship stability if no birth. This seems reasonable intuitively.

Finally we alter the measure of relationship stability by replacing the index we created with the first principal factor of a factor analysis. This factor combines a variety of dimensions of relationships without consideration of relationship demise. Alternative (6) presents the results of the childbearing equation in which we use this factor. In this case, the relationship variable has the expected negative sign but it is not at all significant. This suggests that it is not only the probability of having a long term relationship that is important for teenagers but also avoiding divorce or separation. The other variables remain largely unchanged.

In the next set of tests, we focus on the income term. Although the log specification is a common one, it lacks a strong theoretical justification. To ensure that our nonlinear functional form assumption is not driving our results, robustness test (7) takes the absolute difference rather than the difference in the logs. The estimate of the coefficient on the income variable is statistically significant at the 5 percent level (t-statistic=2.41); the significance of the stability variable is little changed. As an alternative to defining the income expectation term as the difference in the logarithm of the present value of expected incomes, we also created a ratio variable of the two conditional expected values, placing the without-birth expected income value as the numerator. As alternative (8) of Table 4 indicates, the results are quite consistent with our preferred model and the income variable is statistically significant at the 10 percent level as in our preferred model (t-statistic=1.61). We conclude that while functional form contributes to the identification of the preferred model, the results are robust to both a linear income specification which eliminates the functional form basis for identification and alternative functional forms.

In the base results, the effect of income on utility is independent of whether the individual gave birth as a teen. In alternative (9), we allow the effect of the income term to vary depending on childbearing outcome by entering the two expected income variables separately into the final equation. The results indicate that the coefficient on expected income without a teen birth is negatively and significantly related to the probability of a teen birth; the level of expected income if the woman has a child is positively related to the probability of a teen birth, but it is not at all significant. This pattern implies that expected income opportunities conditional on not having a birth are more important in the decision of a teen unmarried woman than expected income opportunities with a teen birth. This is consistent with the pattern estimated by Duncan and Hoffman (1990).[37]

Finally, in alternative (10) we estimate the model over black women only. We do this because the rate of teen nonmarital childbearing is far higher among blacks than nonblacks (except for Hispanics) and because other studies have found differences by race [see Moffitt (1998) for examples of these models]. The results on expected relationship stability are nearly identical to those of the model estimated over the entire population: the expected relationship stability difference measure is statistically significant at the .10 level of significance and the coefficient is negative and similar (though somewhat smaller) in magnitude. Alternatively the difference in expected incomes is not at all statistically significant for this group of women. Lundberg and Plotnick also fail to find an income incentive effect for Blacks [also see Moffitt (1998)].

VIII. SIMULATED EFFECTS OF SELECTED VARIABLES

The coefficient estimates of our preferred model indicate the sign and statistical significance of the effect of expected income and relationship stability differences on the probability of a teen nonmarital birth. Although these coefficients reveal little regarding the quantitative impact of changes in these variables on this choice, using these coefficient estimates together with assumed changes in these variables and weighting each observation, it is possible to simulate the quantitative effect of these changes on the teen birth outcome.

The base predicted probability in our weighted sample is .078, or nearly 8 percent. When the expected income difference is increased by 25 percent, we simulate that the probability of a nonmarital

[37]An alternative estimate in which both expected income and relationship stability are entered in separately shows a similar pattern.

birth would be decreased to .0745 or about 4.5 percent.[38] Alternatively, when we simulate the impact of increasing the difference in expected marital stability by 25 percent, we estimate a somewhat larger reduction in the probability of a nonmarital birth. In this simulation, the weighted probability of a teen nonmarital birth is .0732, a reduction slightly greater than 6 percent. We also simulated the effect of expected income and relationship stability differences for the sample of black women only. An increase of 25 percent in the expected income difference variable changes the probability of a nonmarital birth from the base probability of .270 to a predicted probability of .268, or a reduction of around 1 percent; an increase in the expected relationship stability variable yields a predicted probability of .266, or a reduction of around 1.5 percent.

In addition to the impact of the expected income and relationship stability variables, we use our model to estimate the effects of simulated changes in family planning expenditures on the probability of a nonmarital birth. Our model suggests that if state family planning expenditures were increased by 25 percent, the rate of nonmarital childbearing would decrease from .078 to about .0627, a reduction of over 19 percent; for black women only, the reduction is from .270 to .214, or over 20 percent.

IX. CONCLUSION

These estimation and simulation results suggest that choice-specific income and relationship stability expectations have a persistent influence on the childbearing decisions of teen unmarried women. Policy measures designed to increase the net return to not having a birth out of wedlock—by either increasing expected income if a birth is foregone, or reducing income expectations conditional on having a birth—may be worthwhile interventions for securing reductions in teen nonmarital childbearing. Recent experience following the 1996 welfare reform is consistent with this finding. Somewhat ironically, but

[38] We used the estimated coefficients and the assumed change in the variable to estimate the change in the probability of a teen nonmarital birth for each of the unweighted observations. We then weighted the observation specific changes by the relevant population weight to obtain the estimate of the overall population change.

not unexpectedly, the results on expected relationship stability suggest that decreasing expected relationship stability among young adults who gave birth as an nonmarried teenager would have a greater impact on reducing the probability of teen births than would increasing expected relationship stability among those young women who did not give birth as a teen. The results also suggest that increasing family planning expenditures may be an efficient instrument for reducing the prevalence of this problem.

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TABLE 2
Expected Relationship Stability Indicators
(N = 1172)

	If No Birth		If Birth		
	Mean	Standard Deviation	Mean	Standard Deviation	No Birth - Birth Mean Difference
All	12.99	2.23	7.96	4.40	5.03
Those Gave Birth					
Black	11.63	1.93	9.30	3.71	2.33
Nonblack	13.96	1.86	7.26	4.84	6.70
Those with No Teen Birth					
Black	11.51	1.86	9.09	3.88	2.42
Nonblack	14.25	1.69	6.92	4.58	7.33

TABLE 3
Teen Nonmarital Childbearing Model
(N = 1172)
probit maximum likelihood

	Coefficient	Std. Err.
Expected Income LN[Predicted Income if No Birth]-LN[Predicted Income of Birth]	-0.297*	0.154
Expected Relationship Stability [Predicted Relationship Stability if No Birth]-[Predicted Relationship Stability if Birth]	-0.029*	0.016
Individual and Family Background Characteristics		
Race (African American = 1)	0.524**	0.167
Proportion of Years Lived with Single Parent, Ages 6–15	0.199	0.150
Mother High School Graduate = 1	-0.386**	0.133
Mother Attend College = 1	-0.846**	0.245
Missing Mother Education = 1	-0.558**	0.216
Mother Gave Birth as a Teen (yes = 1)	0.100	0.138
Mother Teen Birth Information Missing	-0.138	0.191
Proportion of Years in Poverty, Ages 6–15	0.132	0.193
Belong to Catholic Church = 1	-0.460**	0.202
State Choices		
Whether State Restricted Abortion pre Roe vs. Wade	0.229	0.313
Average Public Family Planning Expenditures per capita, Ages 13–18	-0.590**	0.209
Whether State Medicaid Funds Abortions, ages 13–18	-0.168	0.170
Whether State Required Parental Consent for Abortion, ages 13–18	-0.183	0.257
Average State Teen Birth Rate, Ages 13–18	0.006	0.007
Average State Percentage of Births Out-of-Wedlock, Ages 13–18	-0.003	0.009

(table continues)

TABLE 3, continued

	Coefficient	Std. Err.
Neighborhood Attributes		
Percent of Families Headed by a Female, 6–15	0.002	0.005
Percent of Individuals belong to Religious Organization	-1.769**	0.739
Constant	-0.119	0.478
LR chi2(19) =	158.970	
Prob > chi2 =	0.000	
Log likelihood =	-403.979	
Pseudo R2 =	0.164	

*t-statistic is between 1.80 and 1.96, and is interpreted as being marginally significant.
**t-statistic is 1.96 or more, and is interpreted as being significant.

TABLE 4

TESTS OF ROBUSTNESS

	Coeff	Std. Err.
Preferred Model from Table 4 (where weight on single status = 10)		
LN[Predicted Inome if No Teen Birth]- LN[Predicted Income if Teen Birth]	-0.297	0.154
[Relationship Stability if No Teen Birth]- [Relationship Stability if Teen Birth]	-0.029	0.016
TESTS ON ROBUSTNESS OF RELATIONSHIP STABILITY MEASURE		
(**1) Single Weight = 5**		
LN[Predicted Inome if No Teen Birth]- LN[Predicted Income if Teen Birth]	-0.305	0.154
[Relationship Stability if No Teen Birth]- [Relationship Stability if Teen Birth]	-0.037	0.022
(2) Single Weight = 2		
LN[Predicted Inome if No Teen Birth]- LN[Predicted Income if Teen Birth]	-0.311	0.154
[Relationship Stability if No Teen Birth]- [Relationship Stability if Teen Birth]	-0.041	0.027
(3) Single Weight = 0		
LN[Predicted Inome if No Teen Birth]- LN[Predicted Income if Teen Birth]	-0.314	0.155
[Relationship Stability if No Teen Birth]- [Relationship Stability if Teen Birth]	-0.042	0.032
(4) Using a Ratio of Stability-Without-Birth/Stability-With-Birth		
LN[Predicted Inome if No Teen Birth]- LN[Predicted Income if Teen Birth]	-0.296	0.154
[Relationship Stability if No Teen Birth]÷[Relationship Stability if Teen Birth]	0.003	0.006

(table continues)

TABLE 4, continued

	Coeff	Std. Err.
(5) Entering Relationship Stability With- and Without- a Birth Separately		
LN[Predicted Inome if No Teen Birth]- LN[Predicted Income if Teen Birth]	-0.292	0.154
E[Relationship Stability] if No Teen Birth	-0.017	0.033
E[Relationship Stability] if Teen Birth	0.032	0.018
(6) Using First Principal Component as Substitute Relationship Measure[a]		
LN[Predicted Inome if No Teen Birth]- LN[Predicted Income if Teen Birth]	-0.285	0.155
[Relationship Factor if No Teen Birth]- [Relationship Factor if Teen Birth]	-0.050	0.125
TESTS ON ROBUSTNESS OF EXPECTED INCOME		
(7) Expected Income		
[Predicted Inome if No Teen Birth]-[Predicted Income if Teen Birth]	-4.590	0.190
[Relationship Stability if No Teen Birth]- [Relationship Stability if Teen Birth]	-0.028	0.016
(8) Ratio of LN Income if No Birth to LN Income if Teen Birth		
LN[Predicted Inome if No Teen Birth]÷LN[Predicted Income if Teen Birth]	-0.151	0.019
[Relationship Stability if No Teen Birth]- [Relationship Stability if Teen Birth]	-0.030	0.016
(9) Enter Income With- and Without- a Birth Separately		
LN[Predicted Inome if No Teen Birth]	-0.607	0.253
LN[Predicted Income if Teen Birth]	-0.094	0.202
[Relationship Stability if No Teen Birth]- [Relationship Stability if Teen Birth]	-0.023	0.017

(table continues)

TABLE 4, continued

	Coeff	Std. Err.
FURTHER TESTS OF ROBUSTNESS		
(10) Estimated Over Blacks Only		
LN[Predicted Inome if No Teen Birth]- LN[Predicted Income if Teen Birth]	-0.120	0.141
[Relationship Stability if No Teen Birth]- [Relationship Stability if Teen Birth]	-0.031	0.019

[a]The factor combines five measures of relationships including whether in a single intact relationship, relationship experiences from ages 24–34, and number of relationships.

APPENDIX TABLE 1
Variables Used in Estimation of Relationship Stability and Income Prediction Equations
(N = 962)

Variable	Mean	Std. Dev.	Min	Max
Individual and Family Background Characteristics (unweighted)				
Gave birth as an unmarried teen	0.1798	0.3842	0	1
Father High School Graduate	0.340	0.474	0	1
Missing Father Education = 1	0.236	0.425	0	1
Mother Ever Divorced = 1	0.216	0.412	0	1
Number of Marriages of Mother	1.041	0.675	0	6
Mother Marital History Missing = 1	0.142	0.350	0	1
Belong to Catholic Church = 1	0.221	0.415	0	1
Belong to Religion other than Catholic = 1	0.727	0.446	0	1
Mother High School Graduate = 1	0.298	0.458	0	1
Mother Attend College = 1	0.141	0.349	0	1
Missing Mother Education = 1	0.051	0.220	0	1
Race (African American = 1)	0.470	0.499	0	1
Proportion of Years Mother Worked, Ages 12–15	0.529	0.418	0	1
Proportion of Years Lived with One Parent, Ages 12–15	0.274	0.421	0	1
Proportion of Years on AFDC, Ages 15–15	0.135	0.294	0	1
Firstborn = 1	0.181	0.385	0	1
Proportion of Years with a Locational Move, Ages 12–15	0.117	0.195	0	1
Proportion of Years Lived in SMSA, Ages 12–15	0.741	0.421	0	1
Proportion of Years Family Head is Disabled, Ages 12–15	0.220	0.368	0	1
Proportion of Years in Northeast, Ages 12–15	0.186	0.387	0	1
Proportion of Years in West, Ages 12–15	0.127	0.330	0	1
Proportion of Years in South, Ages 12–15	0.444	0.495	0	1

(table continues)

APPENDIX TABLE 1, continued

Variable	Mean	Std. Dev.	Min	Max
State Choices				
Average State Maximum Welfare Benefits per Month	265.351	109.084	60.06638	455.7866
Average Unemployment Rate	5.120	1.400	2.15	9.525
Average State Median Family Income	14639.110	2222.707	9475.325	18301.47
State has No Fault Divorce Law, Ages 19–30	0.517	0.455	0	1
Divorce Rate in State, Ages 19–30	4.793	1.053	3.045833	7.65
Percent of Individuals belong to Religious Organization in State	0.237	0.112	.031026	.4196565
Neighborhood Attributes				
Average Neighborhood Unemployment Rate	5.978	3.549	.225	24.625
Average Neighborhood Median Family Income	14463.270	5643.881	5160.599	66360.49
Proportion of Neighborhood Employed in High Status Occupations[a]	19.231	10.468	1.875	60
Proportion of Neighborhood with Low Income	0.264	0.158	.0132372	.7997109
Ratio Males to Females, Ages 19–30	95.719	13.245	57.60833	216.9167
Ratio Employed Males to Females, Ages 19–30	60.482	13.507	20.76667	119.5
Percent of Families Headed by a Female, Ages 6–15	17.684	11.874	2.1	74.95

[a]Professional or Managerial.

APPENDIX TABLE 2
Variables Used in Teen Birth Model Estimates
(N = 1172)

Variable	Mean	Std. Dev.	Min	Max
Gave birth as an unmarried teen	.1442	0.3514	0	1
Expected Income				
LN[Predicted Income if No Birth]-LN[Predicted Income of Birth]	0.394	0.418		
Expected Relationship Stability				
[Predicted Relationship Stability if No Birth]	12.989	2.230	6.09	20.44
[Predicted Relationship Stability if Birth]	7.955	4.397	-5.64	24.12
Individual and Family Background Characteristics				
Race (African American = 1)	0.462	0.499	0	1
Proportion of Years Lived with Single Parent, Ages 6–15	0.254	0.383	0	1
Mother High School Graduate = 1	0.369	0.483	0	1
Mother Attend College = 1	0.141	0.348	0	1
Missing Mother Education = 1	0.068	0.252	0	1
Whether State Restricted Abortion pre Roe vs. Wade	0.044	0.201	0	1
Mother Gave Birth as a Teen (yes = 1)	0.146	0.353	0	1
Mother Teen Birth Information Missing	0.081	0.273	0	1
Proportion of Years in Poverty, Ages 6–15	0.223	0.317	0	1
Father High School Graduate = 1	0.268	0.443	0	1
Father Attend College = 1	0.183	0.387	0	1
Missing Father Education = 1	0.190	0.393	0	1
Belong to Catholic Church = 1	0.178	0.383	0	1

(table contnues)

APPENDIX TABLE 2, continued

Variable	Mean	Std. Dev.	Min	Max
State Choices				
Average Public Family Planning Expenditures per capital, ages, 13–18	1.020	0.353	.2845934	2.481341
Whether State Medicaid Funds Abortions, ages 13–18	0.540	0.425	0	1
Whether State Required Parental Consent for Abortion, ages 13–18	0.070	0.223	0	1
Average State Teen Birth Rate, Ages 13–18	54.679	13.571	29	83
Average State Percentage of Births Out-of-Wedlock, Ages 13–18	20.318	7.196	6.2	56.5
Neighborhood Attributes				
Percent of Families Headed by a Female, Ages 6–15	19.110	12.977	1.16	72.35
Percent of Individuals belong to Religious Organization in State	0.241	0.110	.031026	.4196565

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