TEENAGE SOCIALIZING AND HIGH SCHOOL COMPLETION

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ABSTRACT

This paper uses data from the 1997 cohort of the National Longitudinal Survey of the Youth (NLSY97) to examine the extent to which the probability of high school completion is influenced by the choice teenagers make as to when to start dating and engage in sexual activities. Indicators of parental and peer religiosity are used as instruments to address endogeneity of the teenager's involvement in sex and dating activities in the models for schooling. The results suggest that the age at which the teenager starts dating and sex could have a significant effect on his/her probability of high school completion. For example, my preferred estimates indicate that delaying the first sex by an additional year increases the probability of high school completion by the teenager by as much as 9.5%. It doesn't seem that age at first sex is simply capturing the effects of the consequences of teenage dating and sex such as child birth or related factors like teenage marriage since the coefficients remain nearly intact when controls are included for these variables. **JEL Classification:** I21, I29

INTRODUCTION

Recent empirical studies show that about one-fifth of students in the U.S. fail to graduate with a high school diploma. While the official estimates based on 'status completion' show high school graduation rates as high as 88% (Heckman and Lafontaine 2010), various studies have used alternative methods and data sources to come up with much lower and slightly declining graduation rates over the last three decades. For example, Miano and Haney (2004) report national high school graduation rates ranging between 66% and 80% for the period from 1973 to 2001, slightly declining[1] particularly after the early 1990s. Heckman and LaFontaine (2010) focused on earning a formal high school diploma (i.e., not including those with a general educational development certificate, GED) as a more appropriate measure of high school graduation and compared alternative data sets to conclude that the graduation rates based on the latter are much lower than the officially reported rates and have in fact declined over much of the last decade[2]. And a number of empirical studies have tried to identify the main socio-economic factors that influence schooling outcomes in general and high school graduation rates in particular. The outcomes of the existing studies, however, don't seem to have helped in significantly reversing the trend since unacceptably large number of students still fail to graduate from high school. The purpose of this paper is, therefore, to contribute to our understanding of

the underlying causes for students dropping out from high school by examining the direct influence of the choice a teenager makes as to when to start dating and engage in sexual activities on his/her probability of high school completion.

The mainstream economics literature on schooling largely focused on the role of the factors unrelated to the choices that the child him/herself makes. These include family income and financial constraints (e.g. Cameron and Heckman 1998; Mayer 1997; Levy and Duncan 2000; Cameron and Taber 2004; Keane and Wolpin 2001; Carneiro and Cameron 2002), parental education (e.g. Keane and Wolpin 2001; Haveman and Wolfe 1995; Behrman and Rosenzweig 2002; Plug 2004; Farré, Klein, and Vella 2009), and other family characteristics including parents' labor force status and occupation, wealth, race, age, marital status, number of siblings, birth order, ethnicity, language, and urban/rural residence (see Haveman and Wolfe 1995). Other studies have examined the influence of child endowments and environmental factors that are largely beyond the control of the family and the child (e.g., Behrman, Rosenzweig and Taubman 1994; Ashenfelter and Krueger 1994). Some studies have also looked at the role of government policies, neighborhood characteristics, school types and amenities (see Haveman and Wolfe 1995 for details).

The differences in school outcomes across individuals, however, could not be fully explained by factors beyond the control of the individual himself/herself. As a result, the economics literature on the determinants of school attainment has lately expanded to incorporate variables that are directly related to the choices that the child himself/herself makes like involvement in crime, drug use, alcohol consumption, and smoking. Some of these choices may affect educational achievements not only because of their effect on cognitive and physical health through addiction, but also because of their potential effect on social status. The consequences of such choices have been subject to empirical and theoretical research in other social science disciplines like sociology and psychology for a long time (e.g. Jenkins 1995; Kenkel 1991) but it is relatively recently that such issues have started to be addressed in the economics literature. For example, Register, Williams and Grimes (2001) analyze the effect of drug use on the number of years of schooling completed and find strong negative correlation. Chatterji (2006) finds similar results after accounting for endogeneity of drug use. DiSimone and Wolaver (2005) find alcohol consumption to have strong negative effect on educational attainment for risk averse students after accounting for unobserved heterogeneity. Of course, any serious investigation of the effects of such personal choice variables has to address the apparent simultaneity between these variables and the schooling outcomes, but many studies, including some recent ones like Register, Williams and Grimes (2001), fail to do so.

What appears to be largely missing from the economics literature on the relationship between the choices made by the child and schooling outcomes is the direct effect of participation in dating and sexual activities. One related issue whose effect on educational attainment has long attracted attention is teenage pregnancy and child bearing. There exists a voluminous empirical literature on this issue including but not limited to Bronars and Grogger (1994), Geronimus and Korenman (1992), Hoffman, Foster, and Furstenberg (1993), Ahn (1994), Klepinger ,Lundberg, and Plotnick (1999), Hofferth, Lori, and Frank (2001) and Hotz, McElroy, and Sanders (2005). The overwhelming evidence is that teenage pregnancy and childbearing have a strong negative effect on educational attainment although the effects are smaller once unobserved heterogeneity is accounted for. However, there could be other social,

psychological and physiological reasons why teenage engagement in dating and sexual activities could affect schooling outcomes even when it does not result in pregnancy and childbearing. For example involvement in such activities may lead to reduced focus on long-term objectives, changing priorities in time use, and changing attitudes towards academic achievement (Billy et al. 1988).

There are a few studies, particularly in sociology and psychology, that tried to examine the effect of early involvement in sex on schooling outcomes (e.g., Mott and Marsiglo 1985; Billy et al. 1988; Schvaneveldt et al. 2001; Rector and Johnson 2005). There is also one recent study in urban Kenya (Clark and Mathur 2012) that examines the effect of dating and sex on schooling. The findings are mixed but these studies are based on simple correlations failing to recognize the possible endogeneity of the teenagers' decisions to engage in dating and sexual activities in the models for academic achievement and hence their estimates may not represent causal effects. For example, it might be the case that those who opt to spend a lot of time in dating and sex are those who are less capable and hence have limited prospects of doing well at school.

There are two recent studies by Sabia (2007a, 2007b) that recognized the potential endogeneity of teenage sex in the models for school achievement and tried to correct for the potential bias. Using data from National Longitudinal Study of Adolescent Health, the author estimates the effect of loss of virginity on school attachment and achievement in the form of GPA controlling for possible unobserved heterogeneity using fixed effects and instrumental variables estimation techniques. He concludes that losing virginity by teenagers has negligible or no effect on school attachment and achievement in the form of GPA once controlling for the endogeneity. However, his results might not be conclusive given the narrow definition of involvement in sexual activity and school achievement he adopted[3].

This paper contribute to the existing literature in this area by investigating the extent to which the probability of high school completion is influenced by the choice teenagers make as to when to start dating and/or engage in sexual activities. While age at first date and age at first sex could have mostly overlapping effects, the teenager may not always start dating and sex at the same time and his/her emotional involvement in the two activities might not necessarily be the same. Therefore, the effects of age at first date and age at first sex on the probability of high school completion are separately estimated. Since teenage dating and sex are endogenous in the model for schooling as stated earlier, indicators of parental and peer religiosity are used as instruments to identify their effects. An attempt is also made to more accurately estimate the effects of age at first date and sex on the probability of high school completion by controlling for teenage pregnancy and child birth as well as cohabitation and early marriage, the effects of which may be confounded with the direct effects of sex and dating if we fail to control for the latter.

The rest of the paper is organized as follows. The next section briefly describes the theoretical context for the research question addressed in this paper. The estimation methodology is explained in section 3. Description of data and summary statistics are presented in section 4 followed by estimation results and discussion in section 5. Conclusions are drawn in the last section.

THEORETICAL FRAMEWORK

In Becker's (1991) single-person family utility maximization model, a child's (teenager's) decision problem involving schooling, dating, sex and other sources of satisfaction can be modeled treating schooling as one of the z-goods for the child. Since the focus of this paper is on the role of the choices made by the child himself/herself, the parental preferences and resources are assumed to be part of the environmental variables for the child. Ignoring sex for the time being, suppose the teenager generates utility directly from schooling(*S*), dating (*D*), and (*Z*)-all other sources of welfare including leisure, sleeping, etc.

$$U=U(S, D, Z) \tag{1}$$

The child is both a producer and consumer of *S, D* and *Z* and the production of each of these requires material inputs purchased in the market (*x*) as well as time inputs (*t*) from the child. For example material inputs of schooling will include books and material inputs of dating will include drinks. In other words, the production functions for *S, D,* and *Z* will look like,

$$S=f_s(x_s, t_s; A) \tag{2}$$

$$D=f_d(x_d, t_d; A) \tag{3}$$

$$Z=f_z(x_z, t_z; A) \tag{4}$$

where *A* represents factors like the child's ability, motivation, psychological health, plus environmental variables such as parental preferences and resources that the child cannot directly control. Substituting (2), (3) and (4) into (1) the utility function of the child becomes,

$$U = U[f_s(x_s, t_s; A), f_d(x_d, t_d; A), f_z(x_z, t_z; A)] \tag{5}$$

Suppose p_i^x represents the market price of the *x* inputs where *i=s,d,z* and *w* represents the opportunity cost of time for the teenager; i.e., *w* is the wage rate he/she could earn if he/she were to work (or whatever the valuation placed on activities foregone). Also suppose the teenager spends a total time of t_w working. Then the total time constraint is,

$$t_s+t_d+t_z+t_w=t \tag{6}$$

and the full income budget constraint for the child will be,

$$p_s^x x_s + p_d^x x_d + p_z^x x_z + w(t_s + t_d + t_z) = w(t - t_s - t_d - t_z) + v = F \quad (7)$$

Here, v is the non-labor income of the child including the direct transfers from the parents that the child can decide upon how to spend. Maximizing (5) subject to (7) with respect to x_i and t_i gives us the optimal amount of purchased and time inputs into each of the commodities as a function of the predetermined variables as,

$$x_i^* = x_i(p_s^x, p_d^x, p_z^x, w, F, A), \quad \text{where } i=s, d, z \quad (8)$$

$$t_i^* = t_i(p_s^x, p_d^x, p_z^x, w, F, A), \quad \text{where } i=s, d, z \quad (9)$$

Substituting (8) and (9) into (2), (3) and (4) gives us *S, D* and *Z* as a function of the material input prices, the full income (*F*) and the endowment and environmental variables (*A*). However, we can use the input prices to calculate the costs of producing the commodities that directly enter the child's utility function (*S,D* and *Z*) that represent their shadow prices(π) as,

$$\pi_s = p_s^x \frac{x_s^*}{S} + w\frac{t_s^*}{S} \quad (10)$$

$$\pi_d = p_d^x \frac{x_d^*}{D} + w\frac{t_d^*}{D} \quad (11)$$

$$\pi_z = p_z^x \frac{x_z^*}{Z} + w\frac{t_z^*}{Z} \quad (12)$$

Then, the full income budget constraint can be written in terms of the shadow commodity prices as,

$$\pi_s S + \pi_d D + \pi_z Z = F \quad (13)$$

Taking the other commodities (*Z*) as the base category, we can obtain the demand functions[4] for *S* and *D* as functions of shadow prices, the full income and the environmental and endowment variables as,

$$S^* = S(\pi_s, \pi_z, F, A) \quad (14)$$

$$D^* = S(\pi_d, \pi_z, F, A) \quad (15)$$

A demand function similar to (15) can also be derived for involvement in sexual activities by a teenager following the same procedures. Clearly, the demand equations for schooling and dating are highly interdependent not only because of the way the shadow prices are defined but also because of the presence of common endowment and environmental variables in both equations. Since time allocations have to add

up to a fixed time endowment as per equation (6) and since dating and schooling may compete for the same material inputs (x), their shadow prices are interdependent. The nature of the interdependence may depend on whether dating and schooling are substitutes or complements to each other. For example, if dating involves studying together and sharing school materials with your dating-mate, then dating and schooling could be considered complements to each other and increased allocation of time and resources for one could increase production of the other as well. However, if the only purpose of dating is something unrelated to schooling including romance and hanging out together, then dating could lead to less time, attention and motivation for studying and may result in diminished schooling outcome. In addition, dating may affect one's mood, degree of happiness or motivation (based, for example, on one's partner's attitude toward schooling) that can either improve (complement) or worsen (substitute) school outcomes. Therefore, the effect of dating on schooling outcomes is theoretically ambiguous. Depending on whether the complementarity or substitution effect is stronger, we may observe negative, positive or no empirical correlation between indicators of dating and schooling outcomes. Similar arguments can be made for involvement in sexual activities. The effects of the substitutes and complements for dating and sex such as cohabitation, marriage, pregnancy and having children come into play through their shadow prices (π_z).

METHODOLOGY

The focus of analysis in this paper is on how high school completion is affected by involvement in dating and sex as a teenager. To define an empirical model for high school completion, suppose s_i* represents the indirect utility for child i obtained by substituting the optimal amounts of schooling and other activities into the child's utility function described in the previous section. The indirect utility is unobserved to the researcher but whether the child graduates from high school or not is observed and assumed to depend on whether or not this maximized utility takes at least a minimum threshold value. The indirect utility depends on the shadow prices of schooling and other activities that represent opportunity costs, anticipated returns to schooling, the full income as well as child endowment and environmental variables. Suppose s_i* is linearly related to these factors such that,

$$s_i^* = X_i'\beta + e_i \qquad (16)$$

where, X_i' represents a vector of observable variables like shadow prices of schooling, shadow prices of dating or sex and their substitutes and complements, child's full income including transfers from parents, and other parental resources. Unobservable endowments and environmental variables like motivation and ability fall into the error term e_i that is assumed to be normally distributed with mean 0 and variance 1. Now, let s_i represent high school completion status of individual i that takes a value of 1 if the maximized utility s_i* is positive and zero otherwise i.e.

$$s_i = \begin{cases} 0 \text{ if } s_i^* \leq 0 \\ 1 \text{ if } s_i^* > 0 \end{cases} \quad (17)$$

The distribution of s_i conditional on X_i' can then be modeled as probit or can be approximated by a linear probability model. In this paper, the following simple linear probability model is estimated for high school completion (s_i) mainly because the Sargan's (1958) and Basmann's (1960) chi-squared tests for validity of the instrumental variables that I report later are not readily available for a probit[5] model.

$$s_i = X_i'\beta + \varepsilon_i \quad (18)$$

If observations on all the components of X_i' in (18) including the shadow prices of dating or sex and their substitutes and complements were available and exogenous, we could regress the dichotomous outcome for high school completion (s_i) on these covariates and try to infer the effects of dating or sex variables on the basis of the estimates for their component variables. While theoretically the shadow prices could be calculated from the observed input prices as described in the previous section, in practice this is impossible because observations on the inputs and their prices are unavailable. Alternatively, therefore, the observed involvement in dating and sex by the teenager are treated as direct covariates in the model for schooling, but their endogeneity is recognized. The specific indicators of teenage involvement in dating and sex whose effects are separately estimated in this paper are age at first date and age at first sex. Controls for teenager's choices or their outcomes that could be substitutes or complements to sex and/or dating like cohabitation, marriage, and teenage child birth are included in the models since sex and dating variables could simply be capturing the effects of these variables. In addition, an indicator for above or below mean family income is included as a proxy for the availability of parental resources. Parental education, race and residence at age 17 are also included as additional controls.

One of the possible reasons for the endogeneity of age at first date and age at first sex is that both school outcome (high school completion) and the decision to engage in dating and sexual activities may be influenced by common unobserved individual and family characteristics. For example, it might be the case that those who choose to spend time in dating and sex are those who are less capable and hence have limited prospects of doing well at school. If this is the case the simple OLS estimates will tend to overestimate the causal effects of the teenage dating and sex on schooling. Another source of bias in the OLS estimates could be the under-reporting of engagement in sexual/dating activities by the teenagers at an early age. The under-reporting may lead to understatement of the effects of teenage dating and sex on schooling outcomes. The various sources of bias may thus tend to offset each other.

The fact that age at first date and sex are endogenous in the models for schooling means that identification of their causal effect requires the existence of variables that influence the taste for sex or dating but do not directly affect schooling. The data from the 1997 cohort of the National Longitudinal Survey of Youth (NLSY97) that are used for analysis in this paper contain information on the frequency of church visits by parents and percent of peers who go to church regularly, both of which may influence the teenager's inclination towards engaging in sexual activities[6] but do not seem to have apparent direct effect on schooling outcomes. Therefore, indicators of parental

and peers' religiosity are used as instruments for age at first date and sex, in an attempt to estimate their causal effects on the probability of high school completion.

It is worth noting that most of the control variables included in the models like cohabitation, marital status, and child bearing might also be endogenous. As a result the estimated coefficients of such variables may not necessarily represent their causal effect on the school outcome variables. My principal interest, however, is not in estimating and interpreting the causal effects of these variables since that has been done elsewhere, but rather to control for the potential omitted variable bias in the estimated coefficients of dating and sex variables that may arise as a result of their correlation with these control variables. As such, the properly estimated coefficients of age at first date and age at first sex are expected to be valid even when some of the other regressors in the models are endogenous. The control variables are sequentially introduced into the models so that we can see how much of the observed relationship between age at first date/sex and the probability of high school completion was due to other observable variables that are correlated with sex or dating. Separate results for boys and girls are also estimated and reported to see if the effects of teenage dating and sex vary by gender. The models for girls include teenage pregnancy as an additional control variable since teenage pregnancy could have lasting psychological or physiological effects even if it doesn't lead to child bearing. The definition and summary statistics for all the variables used in the models are presented in the next section.

DATA AND DESCRIPTIVE STATISTICS

Analysis in this paper is based on data from the 1997 cohort of the National Longitudinal Survey of Youth (NLSY97). The choice of this data set for the current study is dictated by both relevance and practicality considerations. The NLSY97 is one of the two major longitudinal data sets that contain detailed information on the teenage involvement in sexual and dating activities in the U.S., the other being National Longitudinal Study of Adolescent to Adult Health (Add Health). While both surveys were initiated in the 1990's, the first round of Add Health was conducted in 1994 making data from the NLSY97 relatively more recent. In addition, data from Add Health have been already used in at least two other studies (Sabia 2007a, 2007b) that examined the relationship between teenage sexuality and school performance as cited previously. Therefore, NLSY97 is a better choice for this study in terms of originality as well, although the specific research questions addressed in this paper and Sabia's papers are different. Even though the first round of NLSY97 was conducted in 1997, the data gathered through the several rounds of this survey remain relevant for the research questions addressed in this paper for at least two reasons. First, the actual data used in this paper are not just from 1997 but from several subsequent years, the latest being from 2004 when those who were 12 years old in 1997 graduated from high school. The second and perhaps the more important reason is that the relationship between teenage sexuality and schooling examined in this paper is not a behavior that can considerably change in a matter of a decade or so and the low high school graduation rate still remains a major concern in the U.S. Therefore, the author believes NLSY97 is an appropriate choice as a source of data for this paper and the findings from these data should still be informative in terms of better understanding

the relationship between teenage dating/sex and schooling.

The original sample for the NLSY97 cohort consisted of 8984 young men and women aged 12 to 16 on December 31, 1996. The data from the first 15 rounds of the survey are publicly available and contain detailed information on the individual and family characteristics as well as processes and outcomes for the youth. The key outcome variable of interest for this paper is whether the youth have completed high-school at or before age 19. The weighted summary statistics for this and other variables used in the models are presented in table 1. The summary statistics disaggregated by gender are presented in table 2. The estimation sample consists of 6026 youth with complete data for all the variables of interest out of which 3054 are girls and the balance are boys.

As briefly stated in the introductory section, there is no consensus as to how to measure high school graduation rate. Status completion rates that include the recipients of the GED and certificates of attendance often show a much higher graduation rate than the rates that count only those who have received formal high school diploma. This is true in my sample as well 88.7% of the youth having completed high school while only 81.8% have formal high school diplomas. The high school completion rate obtained for this sample of youth is very close to the estimated completion rate of 88% issued by the National Center for Educational Statistics (NCES). The econometric analysis in this paper focuses on the high school completion that includes GED recipients instead of only graduates with diploma since the GED is "generally accepted as the equivalent of a high school diploma for college admissions" (Heckman and LaFontaine 2010).

The summary statistics for boys and girls presented in table 2 show that both the high school completion rate and high school graduation rate (with a diploma) are higher for girls than boys, the gap being slightly larger in the latter case with 83.8% of the girls having a high school diploma compared to 79.7% of boys. The gender disparities observed in these data are consistent with the general pattern in the U.S. (and other developed countries) that girls on average do better in terms of high school and undergraduate educational outcomes.

Table 1 also presents summary statistics for sexual and dating experience of the respondents as teenagers. The evidence shows that about 51.3% of the respondents have reported to have had sex under age 18 including 18.1% who have already begun sex under 15. A larger percentage of boys appears to have started sex under 15 than girls although the proportion is roughly the same for boys and girls for the under 18 sexual experience. The fact that boys on average appear to start sex earlier than girls is somewhat surprising given that girls mature earlier than boys and men generally date younger girls. It is possible that girls are more shy or secretive about revealing their early sexual experience or boys could be defining sex and dating more loosely than girls or may be bragging about their early sexual experience. The teenage dating experience follows a similar general pattern to that of teenage sex experience in terms of gender disparity in the starting age. According to the evidence presented in table 2, girls on average start dating later than boys. About 66.6% of boys and 53.3% of girls reported to have started dating under age 15 while 93.7% of boys and 93.5% of girls already started dating under age 18 .

It is important to note that the mean age at first sex/date reported in the tables is less informative given that it is top-coded at 18; i.e., everybody who reported to have had no first sex/date before age 18 are all recorded at 18. Age at first sex/date is top-

coded at 18 since the main purpose of the paper is to examine the effects of sex/dating as a teenager on the probability of high school completion and first date and sex after age 18 are basically irrelevant for high school completion. In the regression equations, age at first sex/date is expected to capture the effect of waiting at least up to age 18 and still account for the effect of the variation in the sex/dating–start age as a teenager (unlike the under 18 sex/dating dummy that doesn't capture this variation).

The summary tables also contain descriptive statistics for the control variables including teenage marriage, cohabitation, pregnancy and child birth. We observe a much higher prevalence of teenage marriage and cohabitation among girls which is not surprising given their much quicker biological maturity than boys. There is also a much higher prevalence of teenage child birth among girls than boys with 20.1% of girls having a kid under age 18 compared to just 6.4% of boys. The estimated effects of age at first date and age first sex on high school completion obtained after controlling for these and other child and family characteristics are discussed in the next section.

ESTIMATION RESULTS

As stated in the methodology section, the linear probability models for high-school completion[7] are estimated treating age at first sex and age at first date as endogenous regressors. The effects of age at first date and age at first sex are separately estimated since they mostly contain overlapping information about the teenager's behavior and the instruments may not identify their separate effects if both variables are included in the model at the same time. The controls for teenage pregnancy and child bearing as well as marriage and cohabitation are sequentially introduced into the equations so that we can see how much of the observed relationship between the probability of high school completion and age at first date/sex was due to other observable variables that are correlated with sex or dating. Robust standard errors are used to correct for the inefficiency arising from heteroskedastic errors in the linear probability models. The instruments are tested for over-identification using Sargan and Basmann's chi-squared test and the first stage results for the main models are reported in table 6.

While the summary statistics reported in the previous section were weighted using the sampling weights, the regression results reported and discussed in this section are unweighted. Using sample weights in the regressions is generally recommended when the interest is in obtaining the estimates representative of the entire population. Weighted estimators, however, tend to be more variable than the unweighted estimators as demonstrated for example in Korn and Graubard (1995). Hence, sample weights were not used in the regressions reported here. As such, the estimates reported in this section may not strictly represent the characteristics of the entire U.S. population since variable probabilities of selection into the sample were used for various groups.

The linear probability estimates of the effects of age at first sex and age at first date on the probability of high school completion are presented in Table 3. The first stage results for the 2SLS results in table 2 are reported in table 6. The first stage results show that the chosen instruments for age at first sex are both individually and jointly significant in the first stage equations with values of the F-statistic well over the commonly suggested threshold value of 10 for strong instruments (see Stock, Wright and Yogo 2002). Frequency of parental and peer church visits have strong positive

effect on age at first sex indicating that parental and peer religiosity is an important constraint to involvement in sexual activities by teenagers. In addition, the Sargan and Basmann chi-squared test for over-identification does not reject exogeneity of these instruments for age at first sex in the models for high school completion. Therefore, instruments capturing parental and peer religiosity appear to be valid for age at first sex.

The instruments also appear to be generally valid for age at first date both in terms of explanatory power and exogeneity as demonstrated by the statistics for joint significance as well as the test for over-identification. The instruments are jointly significant in all of the first stage equations for age at first date as well with F-values greater than the threshold suggested threshold value of 10. In addition, the Sargan and Basmann chi-squared test for over-identification does not reject exogeneity of the instruments at 1% or 5% in all of the first stage equations for age at first date. However, some of the dummy variables representing the frequency of parental and peer church visits are not individually significant in the first stage equations for age at first date. Therefore, parental and peer church religiosity does not seem to constrain the teenagers involvement in dating activities as strongly as it does to his/her involvement in sexual activities.

The estimates for the effects of age at first sex on the probability of high school completion are reported in the first row of Table 3. While the coefficient of age at first sex is positive in sign and highly significant in all of the OLS and 2SLS estimates, its magnitude is nearly 4 times larger in the case of 2SLS. Controlling for teenage marriage, cohabitation and child birth has little effect on the coefficient of age at first sex. My preferred estimate obtained by including all the control variables shows that delaying initiation of sex by an additional year increases the teenager's probability of high school completion by 9.5% which would translate into about 1% percentage point reduction in the overall high school dropout rate. Since about 11% of the teenagers fail to complete high school in these Therefore, it appears that there is considerable benefit to delaying initiation of sex in terms of enhancing the chances of high school completion.

The effects of age at first date on the probability of high school completion reported in table 3 essentially mimic the corresponding estimates for age at first sex in terms of sign and statistical significance but the 2SLS estimates for age at first date are somewhat larger in magnitude. In the model in which all the controls are included, delaying age at first date by an additional year increases the probability of high school completion by about 12% compared to 9.5% for age at first sex. The larger effect of age at first date could be reflecting the fact that teenage dating on average starts much earlier than teenage sex (see table 1) and perhaps involves more partners and more time investment (or distraction from school related activities).

Tables 4 and 5 present the estimates for boys and girls[8] separately to see if there are gender differences in the effects of teenage involvement in dating and sexual activities. The models for girls include teenage pregnancy as an additional control variable. According to these results, delaying initiation of teenage sex by an additional year appears to have larger benefit for boys than girls. As shown in tables 4 and 5, delaying age at first sex by an additional year increases the probability of high school completion for girls by 6.2% compared to 10.3% for boys.

It is also important to note that controlling for teenage pregnancy and child birth in the equations for girls substantially reduces the magnitudes of the coefficients of

age at first sex as shown in the last column of table 4. On the other hand, controlling for teenage child birth for boys leaves the coefficient of age at first sex unchanged as shown in the last column of table 5. This implies that some of the effects of age at first sex for girls is reflecting the effects of the resulting pregnancy and child-bearing while for boys the effects are essentially unrelated to teenage child birth.

As in the case of teenager's age at first sex, the effects of age at first date are separately estimated for boys and girls to see if its effects on the probability of high school completion vary by gender. As in the case of age at first sex, age at first date has a larger effect on school outcomes for boys than girls. In the models where all the controls are included, delaying the initiation of teenage dating by a year increases the probability of high school graduation for boys by 14.4% compared to 6.8% for girls. In addition, substantial reduction in the coefficient of age at first date is observed for girls when we include controls for teenage pregnancy and child bearing while inclusion of teenage child birth leaves the coefficient nearly unchanged in the models for boys. This pattern in the estimates for the coefficient of age at first date indicates that age at first sex and age at first date are mostly capturing the same information about the teenager's behavior.

According to these results, therefore, the age at which the teenager starts to engage in sexual and dating activities can significantly influence educational outcomes. It doesn't seem that these variables are simply capturing the effects of the consequences of sex like child birth or related variables like teenage marriage since we mostly observe little changes in the coefficients when we control for these variables. In addition, there are some differences in the effects of teenage dating and sex on the outcomes for boys and girls. While the underlying physiological, psychological or other reasons for gender differences in the effects of teenage sex on educational outcomes will need further investigation that is beyond the scope of this paper, it appears that the differences are non-trivial and survive the controls for teenage pregnancy that could potentially explain some of the differences.

However, the substantial differences between the OLS and the 2SLS estimates raise some questions as to whether the absolute magnitudes of the estimated coefficients are realistic. One possible reason for the attenuation of the OLS estimates could be that the downward bias in the estimates due to the under-reporting of teenage sex could be strongly offsetting the upward bias because of the other sources of endogeneity such as unobserved ability and motivation. Another possibility is that the complementary (positive) and substitution (negative) effects of teenage sex on schooling might be canceling out each other. On the other hand, the instruments based on parental and peer religiosity could only be identifying the negative effects of teenage sex and dating. For example, if religious parents impose more discipline even in matters unrelated to sex, the religiosity instruments might be attributing the effects of these other elements of personal discipline on schooling to teenage sex. It could also be the case that children who belong to highly religious parents derive little positive stimulus from engaging in sexual activities perhaps because of what they have been taught about the unacceptability of premarital sex. In addition, the religiosity instruments may not be correcting for the reporting error bias in the estimates. Until all these issues are addressed in a future study perhaps using more detailed data for example on attitudes towards premarital sex and personal discipline, the magnitudes of the estimates reported in this paper should be interpreted with caution.

CONCLUSION

This paper uses data from the 1997 cohort of the National Longitudinal Survey of the Youth (NLSY97) to examine the extent to which the probability of high school completion are influenced by the choice teenagers make as to when to start dating and/or sex, how many dating and/or sex partners to maintain, and how frequently to engage in sexual and/or dating activities. Indicators of parental and peer religiosity as instruments to address endogeneity of the teenager's involvement in sex and dating activities.

The results indicate that the age at which the teenager starts to engage in dating and sexual activities could significantly influence whether the child completes high school or not. For example, my preferred 2SLS estimates indicate that delaying initiation of sex by an additional year increases the probability of high school completion by 9.5%. It doesn't seem that age at first sex is simply capturing the effects of the consequences of sex such as child birth or related variables like teenage marriage since we typically observe small changes in the coefficients when we control for these variables. However, the effects of age at first sex on the probability of high school completion are somewhat different for boys and girls. While the underlying physiological, psychological or other reasons for gender differences in the effects of teenage sex on educational outcomes will need further investigation that is beyond the scope of this paper, it appears that the differences are non-trivial and survive the controls for teenage pregnancy that could potentially explain some of the differences.

In the models for high school completion, the identifying instruments did not perform as well for age at first date as they did for age at first sex. Perhaps the constraints the religious values of parents and peers impose on the teenagers are less important in influencing their dating behavior in general than their involvement in sexual activities. However, the instruments are generally valid for age at first date as well whose effects appear to mimic age at first sex in terms of sign and statistical significance of its estimated effect except that age at first date has a somewhat larger effect on the probability high school completion. In the model in which all the controls are included, the results show that delaying age at first date by an additional year increases the probability of high school completion by about 12% compared to 9.5% for age at first sex. The larger effect of age at first date could be reflecting the fact that teenage dating on average starts much earlier than teenage sex and involves more partners and perhaps more time investment.

The fact that parental and peer religiosity appears to constrain the teenagers' involvement in sex and dating (the effect being stronger on teenage sex) and the fact that the latter influence schooling outcomes implies that religious morality could be one (but not the only) way to influence schooling outcomes by imposing more discipline on the teenagers in terms of delaying initiation of sex and dating. This poses an important policy dilemma (including some constitutional issues) regarding the extent to which religious morality can be promoted in order to improve schooling outcomes.

ENDNOTES

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[1]The latest report on public high school graduation rates from the National Center for Education Statistics (2014) indicates a turnaround in the declining trend at the end of the last decade with, the graduation rate reaching 79% in 2010/2011, but even this improved graduation rate is still alarmingly low.

[2]The distinction between high school graduation with the standard diploma and just GED is important because there is now a substantial literature, cited in Heckman and Lafontaine (2010), indicating that the GED provides far lower returns than the standard high school diploma.

[3]For example losing virginity at age 12 and age 16 may not have the same effect on schooling outcomes. The detailed characterizations of the demand functions in the *z*-goods context are available in Becker (1991).

[4]The detailed characterizations of the demand functions in the *z*-goods context are available in Becker (1991).

[5]Linear approximations of such models provide consistent estimates of the average treatment effects even when the first stage is mis-specified (Angrist and Krueger 2001).

[6]See Evans, Oates and Schwab (1992) for peer group effects and L'Engle, Christine, and Brown et al. (2006) and Brewster (1998) for the effect of religion on teenage sex.

[7]The qualitative aspects of the results remain the same when I use high school graduation with a formal diploma instead of the status completion as the dependent variable but the magnitudes of the estimates are mostly larger in the case of high school diploma.

[8]An attempt was also made to see if results vary by racial groups by separately estimating the models for blacks, Hispanics and whites. For whites (n=3480) the results are both qualitatively and quantitatively similar to those I obtained for the total sample. For blacks (n=1578) and Hispanics (n=622), the signs of the estimated coefficients are largely similar to those obtained for the total sample, but the magnitudes mostly differ and the coefficients are mostly statistically insignificant except age at first sex for blacks.

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TABLE 1. DESCRIPTION AND WEIGHTED SUMMARY STATISTICS FOR THE VARIABLES USED IN THE ECONOMIC MODELS

Variable	Description	Mean	Std. Dev.
Schooling Outcome			
High School Completion	Dummy=1 if completed high school at/before age 19	0.887	0.317
High School Diploma	Dummy=1 if graduated with high school diploma	0.818	0.386
Teenage Sex Indicators			
Had Sex Under 15	Dummy=1 if had sex under 15	0.181	0.385
Had Sex Under 18	Dummy=1 if had sex under 18	0.513	0.500
Age at 1st sex	Age at first sex	16.09	2.101
Teenage dating indicators			
Had Date Under 15	Dummy=1 if had date under 15	0.599	0.490
Had Date Under 18	Dummy=1if had date under 18	0.936	0.245
Age at 1st Date	Age at first date	14.04	1.954
Controls for Family Background and demographics			
Male	Dummy=1 if male	0.496	0.500
Black	Dummy=1 if race is black	0.156	0.363
Hispanic	Dummy=1 if race is Hispanic	0.059	0.236
White (excluded)	Dummy=1 if race is white	0.723	0.448
Dad college educated	Dummy=1 if dad is college educated	0.529	0.499
Mom college educated	Dummy=1 if mom is college educated	0.511	0.500
Above mean income	Dummy=1 if family earns above mean income	0.464	0.499
Rural at age 17	Dummy=1 if rural resident at age 17	0.281	0.449
Controls for teenage marriage and cohabitation			
Married under 18	Dummy=1 if married under age 18	0.159	0.366
Cohabited under 18	Dummy=1 if cohabited under age 18	0.290	0.454
Controls for teenage pregnancy and child bearing			
Pregnant under 18 (girls)	Dummy=1 if ever pregnant under age 18	0.216	0.411

Had kids under 18	Dummy=1 if had kids under age 18	0.133	0.339
Instruments			
Parental church visit1	Dummy=1 if parent visited church once or less per		
	month in 1997	0.505	0.500
Parental church visit2	Dummy=1 if parent visited church twice per month		
	in 1997	0.121	0.326
Parental church visit3	Dummy=1 if parent visited church once a week in		
	1997	0.264	0.441
Parental church visit4	Dummy=1 if parent visited church several times a		
	week in 1997	0.108	0.310
Parental church visit5	Dummy=1 if parent visited church every day in 1997	0.003	0.054
Peer church visit	Dummy=1 if more than 50% of peers visited church		
	in 1997	0.260	0.439

Source: Various rounds of NLSY97.
Notes: N=6026, Number of Girls=3054. About 5.7 of the sample are from other races. In the regression equations these are included in the excluded category (whites).

TABLE 2. DESCRIPTION AND WEIGHTED SUMMARY STATISTICS BY GENDER FOR THE VARIABLES USED IN THE MODELS

Variable	Boys (N=2972)		Girls (N=3054)	
	Mean	Std. Dev.	Mean	Std. Dev.
Schooling Outcome				
High School Completion	0.875	0.331	0.898	0.302
High School Diploma	0.797	0.402	0.838	0.369
Teenage Sex Indicators				
Had Sex Under 15	0.203	0.402	0.160	0.366
Had Sex Under 18	0.504	0.500	0.522	0.500
Age at 1st sex	16.926	3.707	17.142	3.212
Teenage dating indicators				
Had Date Under 15	0.666	0.472	0.533	0.499
Had Date Under 18	0.937	0.243	0.935	0.247
Age at 1st Date	16.673	24.673	10.645	16.058
Controls for Family Background and demographics				
Black	0.151	0.358	0.161	0.367
Hispanic	0.061	0.239	0.057	0.233
White (excluded)	0.724	0.447	0.721	0.448
Dad college educated	0.533	0.499	0.526	0.499
Mom college educated	0.506	0.500	0.516	0.500
Above mean income	0.474	0.499	0.455	0.498
Rural at age 17	0.279	0.448	0.282	0.450
Controls for teenage marriage and cohabitation				
Married under 18	0.114	0.318	0.204	0.403
Cohabited under 18	0.220	0.414	0.359	0.480
Controls for teenage pregnancy and child bearing				
Pregnant under 18 (girls)	-	-	0.216	0.411
Had kids under 18	0.064	0.244	0.201	0.401
Instruments				
Parental church visit1	0.501	0.500	0.508	0.500
Parental church visit2	0.123	0.329	0.119	0.323
Parental church visit3	0.269	0.444	0.258	0.437
Parental church visit4	0.104	0.305	0.112	0.315

Parental church visit5	0.002	0.049	0.003	0.059
Peer church visit	0.257	0.437	0.263	0.440

Source: Various rounds of NLSY97.

TABLE 3. TEENAGE DATING/SEX AND HIGH SCHOOL COMPLETION BY AGE 19- ESTIMATES FROM LINEAR PROBABILITY MODELS

	OLS			2SLS		
	(1)	(2)	(3)	(4)	(5)	(6)
Age at 1st sex	0.028***	0.025***	0.022***	0.099***	0.101***	0.095***
	(0.002)	(0.002)	(0.002)	(0.014)	(0.017)	(0.017)
Age at 1st date	0.017***	0.015***	0.014***	0.136***	0.132***	0.121***
	(0.002)	(0.002)	(0.002)	(0.025)	(0.029)	(0.028)
Control Vars.						
Background & Demo-graphics	Yes	Yes	Yes	Yes	Yes	Yes
Cohabitation & Marriage	No	Yes	Yes	No	Yes	Yes
Teenage Children	No	No	Yes	No	No	Yes
Observations	6026	6026	6026	6026	6026	6026

Notes: Robust standard errors are in parentheses. ***denotes p-value for two-tailed test is <0.01; **p-value<0.05; *p-value<0.1. The coefficients for age at first sex and age at first date were estimated running separate regressions with similar control variables.

TABLE 4. AGE AT FIRST DATE/SEX AND HIGH SCHOOL COMPLETION FOR GIRLS BY AGE 19- ESTIMATES FROM LINEAR PROBABILITY MODELS

	OLS			2SLS		
	(1)	(2)	(3)	(4)	(5)	(6)
			Girls			
Age at 1st sex	0.030***	0.025***	0.013***	0.083***	0.080***	0.062***
	(0.004)	(0.004)	(0.004)	(0.015)	(0.019)	(0.022)
Age at 1st date	0.015***	0.012***	0.007**	0.110***	0.097***	0.068*
	(0.003)	(0.003)	(0.003)	(0.030)	(0.038)	(0.037)
Control Vars.						
Background & Demographics	Yes	Yes	Yes	Yes	Yes	Yes
Cohabitation & Marriage	No	Yes	Yes	No	Yes	Yes
Teenage Children	No	No	Yes	No	No	Yes
Observations	3054	3054	3054	3054	3054	3054

Notes: Robust standard errors are in parentheses. ***denotes p-value for two-tailed test is <0.01; **p-value<0.05; *p-value<0.1. The coefficients for age at first sex and age at first date were estimated running separate regressions with similar control variables.

TABLE 5. AGE AT FIRST DATE/SEX AND HIGH SCHOOL COMPLETION FOR BOYS BY AGE 19- ESTIMATES FROM LINEAR PROBABILITY MODELS

	OLS			2SLS		
	(1)	(2)	(3)	(4)	(5)	(6)
			Boys			
Age at 1st sex	0.025***	0.023***	0.022***	0.102***	0.103***	0.103***
	(0.003)	(0.003)	(0.003)	(0.024)	(0.027)	(0.027)
Age at 1st date	0.017***	0.015***	0.015***	0.151***	0.145***	0.144***
	(0.003)	(0.003)	(0.003)	(0.041)	(0.043)	(0.043)
Control Vars.						
Background & Demo-graphics	Yes	Yes	Yes	Yes	Yes	Yes
Cohabitation & Marriage	No	Yes	Yes	No	Yes	Yes
Teenage Children	No	No	Yes	No	No	Yes
Observations	2972	2972	2972	2972	2972	2972

Notes: Robust standard errors are in parentheses. ***denotes p-value for two-tailed test is <0.01; **p-value<0.05; *p-value<0.1. The coefficients for age at first sex and age at first date were estimated running separate regressions with similar control variables.

TABLE 6. FIRST STAGE ESTIMATES FOR THE 2SLS RESULTS REPORTED IN TABLE 2 IN THE MAIN TEXT

	Endogenous Regressor					
	Age at 1st Sex			Age at 1st Date		
VARIABLES	(4)	(5)	(6)	(4)	(5)	(6)
Church Visit2	0.236***	0.202**	0.202**	0.136*	0.115	0.115
	(0.086)	(0.085)	(0.085)	(0.077)	(0.076)	(0.077)
Church Visit3	0.532***	0.452***	0.431***	0.329***	0.283***	0.279***
	(0.066)	(0.065)	(0.065)	(0.060)	(0.060)	(0.060)
Church Visit4	0.633***	0.531***	0.513***	0.573***	0.501***	0.497***
	(0.085)	(0.084)	(0.084)	(0.080)	(0.080)	(0.080)
Church Visit5	0.894**	0.828**	0.801**	0.633	0.608	0.603
	(0.406)	(0.393)	(0.400)	(0.559)	(0.562)	(0.565)
Peer Church	0.376***	0.309***	0.280***	0.063	0.031	0.025
	(0.060)	(0.059)	(0.059)	(0.058)	(0.058)	(0.058)
Male	-0.532***	-0.654***	-0.753***	-0.774***	-0.821***	-0.841***
	(0.054)	(0.054)	(0.054)	(0.049)	(0.049)	(0.050)
Black	-1.007***	-1.112***	-1.018***	0.362***	0.332***	0.352***
	(0.071)	(0.070)	(0.070)	(0.061)	(0.061)	(0.062)
Hispanic	-0.238**	-0.280***	-0.242**	0.161*	0.133	0.141*
	(0.103)	(0.101)	(0.101)	(0.083)	(0.083)	(0.083)
Dad Col. Educated	0.219***	0.187***	0.189***	0.141***	0.125**	0.125**
	(0.059)	(0.058)	(0.057)	(0.052)	(0.052)	(0.052)
Mom Col. Educated	0.292***	0.237***	0.207***	-0.043	-0.066	-0.073
	(0.059)	(0.058)	(0.057)	(0.054)	(0.054)	(0.054)
Above Mean Income	0.435***	0.348***	0.300***	0.022	-0.013	-0.023
	(0.059)	(0.058)	(0.058)	(0.054)	(0.054)	(0.054)
Rural at Age 17	0.145**	0.144**	0.126**	0.327***	0.316***	0.312***
	(0.063)	(0.062)	(0.062)	(0.057)	(0.057)	(0.057)
Married Under 18		-0.247***	-0.077		0.080	0.115*
		(0.073)	(0.074)		(0.063)	(0.064)
Cohabited Under 18		-0.873***	-0.732***		-0.465***	-0.436***

		(0.061)	(0.062)		(0.052)	(0.053)
Had Kids Under 18			-0.799***			-0.165**
			(0.081)			(0.065)
Constant	15.668***	16.173***	16.304***	14.032***	14.251***	14.278***
	(0.064)	(0.073)	(0.074)	(0.060)	(0.069)	(0.070)
First Stage F-Stat	[30.76,0.00]	[21.97,0.0]	[19.77,0.0]	[13.65,0.0]	[10.06,0.0]	[10.06,0.0]
$\chi 2$(.)-Stat for Sargan Test	{1.8,0.77}	{1.7,0.78}	{2.1,0.72}	{9.3,0.053}	{8.4,0.08}	{7.2,0.12}
Observations	6026	6026	6026	6026	6026	6026

Notes: Standard errors are in parentheses. ***denotes p-value for two-tailed test is <0.01; **p-value<0.05; *p- value<0.1.

The first number in the brackets is the value of F-stat for joint significance of the instruments in the first stage equation and the second number is the associated p-value. The first figure in the set brackets is the value of the Sargan chi-square statistic for testing over identifying restrictions and the second number is the associated p-value. The excluded dummy for parental religiosity represents the least religious parents with no more than one church visits in 1997. The equation numbers in the heading correspond to the equation numbers in table 2 in the main text.