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MINIMUM DRINKING AGE LAWS AND INFANT HEALTH OUTCOMES

Tara Watson
Angela Fertig

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ABSTRACT

Alcohol policies have potentially far-reaching impacts on risky sexual behavior, prenatal health behaviors, and subsequent outcomes for infants. We examine whether changes in minimum drinking age (MLDA) laws affect the likelihood of poor birth outcomes. Using data from the National Vital Statistics (NVS) for the years 1978-88, we find that a drinking age of 18 is associated with adverse outcomes among births to young mothers -- including higher incidences of low birth weight and premature birth, but not congenital malformations. The effects are largest among black women. We find suggestive evidence from both the NVS and the 1979 National Longitudinal Study of Youth (NLSY) that the MLDA laws alter the composition of births that occur. In states with lenient drinking laws, young black mothers are more likely to have used alcohol 12 months prior to the birth of their child and less likely to report paternal information on the birth certificate. We suspect that lenient drinking laws generate poor birth outcomes because they increase the number of unplanned pregnancies.

Tara Watson
Williams College
Department of Economics
Williamstown, MA 01267
and NBER
tara.watson@williams.edu

Angela Fertig
University of Georgia
College of Public Health and
Carl Vinson Institute of Government
Athens, GA 30602
afertig@uga.edu

1 Introduction

State regulations on the consumption of alcohol by minors are widely credited with reducing teen drinking and alcohol-related traffic fatalities. Much less emphasized is the potential effect of drinking policy on pregnancy and drinking while pregnant, and subsequent outcomes for infants. The existing evidence suggests that alcohol policies affect risky sexual behavior and influence teen birth rates. However, surprisingly little is known about whether, by reducing underage drinking, alcohol regulations also improve birth and infant outcomes. Given the high teen pregnancy rate in the United States and the high incidence of drinking among young adults (47 percent of twelfth graders in the 2005 Monitoring the Future Survey drank in the month prior to the survey), the impact of alcohol regulation on outcomes among births to young mothers is potentially large.

In this paper, we evaluate the consequences of minimum legal drinking age (MLDA) laws on birth outcomes. Despite the fact that all states have had a drinking age of 21 since the late 1980s, policy interest in minimum drinking ages and alcohol policy more generally remains high.[1] There are two channels by which access to alcohol by young adults might affect the health of the next generation. First, by increasing risky sexual behavior, alcohol consumption could change the composition of births towards parents with fewer resources and births resulting from unintended pregnancies. Second, independent of the compositional effect, drinking alcohol during pregnancy may cause poor health outcomes directly.

Using data from the National Vital Statistics (NVS) to analyze increases in state minimum drinking ages over the 1980s, we find that less restrictive drinking laws are associated with higher rates of low birth weight and premature births to young mothers. The results are particularly strong for black mothers. We then use both the NVS and the 1979 National Longitudinal Study of Youth (NLSY) to explore whether these adverse outcomes are due to changes in parental characteristics,

[1] There have been a number of recent studies examining minimum drinking age laws, as discussed in section 2.1.

prenatal health behaviors, or both. Although the findings suggest that black mothers are more likely to drink while pregnant if the drinking age is low, most of the evidence points to a compositional story. In particular, young black mothers are more likely to have used alcohol 12 months prior to the birth of their child and less likely to report paternal information on the birth certificate in states with a drinking age of 18.

Our analysis proceeds in two parts. First, we examine the relationship between drinking laws and low birth weight births, prematurity, and congenital anomalies. Second, we examine parental characteristics and prenatal health behaviors to evaluate how these might contribute to the observed relationship between MLDA laws and infant health.

2 Background and Previous Literature

2.1 Minimum Drinking Age Laws

During the early 1970s, 29 states lowered their minimum legal drinking age from 21 (in most cases) to 18, 19, or 20. Because of a subsequent rise in alcohol-related traffic accidents involving young drivers, the majority of these states increased their MLDA in the late 1970s and early 1980s. In 1984, the federal Uniform Drinking Age Act stipulated that federal highway funds would be withheld from states that did not have a MLDA of 21; as a result, by 1988, the MLDA in all states was 21. Our study focuses on the years 1978 to 1988.[2]

The changes in the MLDA have been widely studied, and there is agreement among most researchers in the field that a higher MLDA reduces driving fatalities and alcohol consumption among young adults. Using cross-sectional variation in state laws, Coase and Grossman (1988) estimate that a uniform drinking age of 21 in all states would reduce the fraction of 16-to-21-year-

[2] We do not examine the effect of legal drinking age reductions in the early 1970s. Vital statistics data do not include consistent reporting for prematurity or congenital anomalies during this time period. Furthermore, it should be noted that these reductions sometimes corresponded with "mature minor" provisions that influenced access to contraception for young women, making it difficult to isolate the effect of the MLDA policy during that time period.

olds who drink more than 4 times a week by 3 percentage points (from a base of 11.5) and the number who drink 1-3 times a week by 2 percentage points (from a base of 27.3). Kaestner (2000) uses several econometric approaches and finds inconsistent estimates of the effect of drinking age laws overall. However, the estimates of these laws on drinking among affected women are fairly robust and suggest a reduction in the weekly frequency of drinking of 0.3 on a base of 1 occasion per week. DiNardo and Lemieux (2001) estimate a structural model using state and time variation in the drinking age; it implies that raising the drinking age from 18 to 21 decreases the fraction of high school seniors in a state who use alcohol by 4.5 percentage points from a base of 67. Carpenter and Dobkin (2007) find a discontinuous jump in alcohol use and associated mortality around age 21. Miron and Tetelbaum (2007), however, argue that increases in the drinking age are not responsible for traffic fatalities. In an overview of the alcohol policy literature, Cook and Moore (2002) conclude that there is "consensus that MPA [minimum purchase age] is effective in controlling alcohol consumption and abuse by those young enough to be affected (p.125)." Wagenaar and Toomey (2002) conduct another review of the literature and find that about half of the studies find evidence of a statistically significant inverse relationship between minimum drinking ages and alcohol use, while most of the remaining studies find no significant relationship.

It is worth noting that several studies of the studies referenced above document effects of drinking age policies on high school seniors or youth under eighteen years of age. When the drinking age is 21, a sixteen-year-old is less likely to have friends or siblings who are legal to purchase alcohol, and is less likely to be able to 'pass' as legal using false identification. Indeed, given the lack of drinking age enforcement on college campuses, it is possible that the effects of the minimum age laws would be concentrated among high school students.

In sum, although the findings are not uniform, the preponderance of evidence suggests that higher legal drinking ages reduce alcohol consumption among young adults, including high school students under 18, to a modest degree.

2.2 Effect of Alcohol Policies on the Composition of Births

Alcohol policies may affect infant outcomes through a change in the composition of births. There is an extensive literature demonstrating the positive relationship between substance use and risky adolescent sexual behavior, including early initiation of sexual intercourse, multiple sexual partners, and engaging in intercourse without contraception (see Rashad and Kaestner (2004) for an extensive list). Thus, teens that drink are more likely to have unprotected sex and to become pregnant (Kaestner & Joyce, 2000; Cooper, 2002; Grossman & Markowitz, 2002; Rees, Argys, & Averett, 2001; Hingson, Strunin, Berlin, & Heeren, 1990; Markowitz, Kaestner, & Grossman, 2005; Rashad & Kaestner, 2004; Sen, 2002).

Previous work has also investigated the relationship between alcohol policy and fertility. Sen (2003) finds that higher beer taxes do not have an effect on aggregate state-level birth rates, but that they reduce teen abortion rates. Using variation in MLDA laws, Dee (2001) reports that alcohol availability and use have large effects on childbearing among black teens, but does not find convincing evidence that this is the case for white teens.

Birth outcomes may suffer if a greater fraction of births are to teen mothers whose pregnancies resulted from alcohol use and were unintended. Unwanted pregnancy is associated with prenatal and postpartum maternal behaviors that adversely affect infant and child health (Brown & Eisenberg, 1995; Joyce, Kaestner, & Korenman, 2000). In sum, it is quite plausible that alcohol control policies alter the composition of teens who give birth and that this compositional change affects average birth outcomes.

2.3 Effect of Alcohol Policies on Prenatal Alcohol Use

Despite a large literature on alcohol policies in general and minimum drinking age laws in particular, there is little evidence on the effect of these policies on drinking while pregnant and on infant outcomes. It is striking to contrast the sizable literature on the effect of tobacco control policies on maternal tobacco use (e.g., Evans & Ringel, 1999; Colman, Grossman, & Joyce, 2003) to the absence of information on the effect of alcohol policies on maternal alcohol use.

Maternal alcohol use is of interest because the potential impact is large. Estimates of drinking alcohol among pregnant women are around 20 percent according to three data sources (CDC, 1995; NIDA, 1994; Serdula, Williamson, Kendrick, Anda, & Byers, 1991) and the rates of drinking and heavy drinking are particularly high for women who are younger, less educated, and single (Leonardson & Loudenburg, 2003). Fetal Alcohol Syndrome (FAS), which is thought to result from high prenatal alcohol exposure, involves growth retardation, characteristic facial features, and anomalies of the central nervous system (O'Leary, 2004). A conservative estimate of the prevalence of Fetal Alcohol Syndrome (FAS) in 1993 is 6.7 cases in 10,000 births, based on the Centers for Disease Control and Prevention birth defects surveillance programs (CDC, 1995). These estimates are expected to be a lower bound since FAS is a complex diagnosis and is not always recognized at birth (Stratton, Howe, & Battaglia, 1996). Higher estimates of FAS and more generally of fetal alcohol effects are found by clinic-based studies - from 1.7 to 3.3 cases in 1,000 births in the U.S. (Stratton et al., 1996). Given that there are 4 million births a year in the U.S., there could be as many as 13,000 babies born with birth defects associated with prenatal alcohol use. The estimated annual cost of care for individuals with FAS in the U.S. was $4 billion in 1998 (Lupton, Burd, & Harwood, 2004).

While there is substantial evidence that heavy drinking is related to preterm delivery (Albertsen, Andersen, Olsen, & Gronbaek, 2004) and low birth weight (Day & Richardson, 2004; Whitehead & Lipscomb, 2003), epidemiologists and other medical researchers argue that the effects of prenatal exposure to alcohol may be significant even for low and moderate drinking (see Russell, 1991, for a review). Day and Richardson (2004) argue that the effects of alcohol exposure on growth are measurable at below one drink per day. Testa, Quigley, and Eiden (2003) find that prenatal alcohol exposure at any level is associated with lower mental development. Day et al. (1991) find that children born to mothers who drank alcohol moderately during pregnancy had significant height and weight deficits at age three. In addition, policies affecting prenatal alcohol consumption in Sweden are linked to adult labor market outcomes (Nilsson, 2008). An Institute of Medicine report on prenatal nutrition suggests that prenatal alcohol use may interfere with the absorption of some minerals, particularly zinc, calcium, and amino acids, and notes that heavy drinkers tend to have poor nutrition (IOM, 1990). However, the report concludes that "the evidence concerning the effects of low levels of alcohol consumption is both limited and inconsistent" (p.395). Indeed, most of the studies in this area are associational in nature and are subject to selection concerns (Nilsson, 2008, is a notable exception). Thus, neither the effect of alcohol policy on prenatal drinking nor the effect of prenatal drinking on infant health is well understood.

3 Data

The primary data used in this study are the National Vital Statistics Natality Detail Files. Publicly available data are available for births in 1968 and subsequent years; these data represent 50 or 100 percent samples of birth certificates for U.S. births, depending on the state and year. By 1979, all but 9 states report information for 100 percent of births.

We use birth years 1978-1989 to create a sample of births conceived in the years 1978-1988 to mothers aged 14 to 24 at the time of conception. In 1978, 37 states and DC permitted alcohol consumption for those under the age of 21; 1988 is the first year where no states permitted drinking under age 21. We include women under age 18 because the literature described above indicates that alcohol consumption among those under 18 is affected by state MLDA policies.

Importantly, the data contain information on mother's age, race, and state of residence. There is also information on birth weight, and, with less completeness, gestation length and congenital anomalies. Maternal and paternal characteristics are also reported. More recently, birth certificate data include questions about smoking and drinking behavior, but this information is unavailable in the years prior to 1989. In addition, there is concern that prenatal alcohol use in particular is underreported in the Natality data (Evans & Ringel, 1999). We therefore use the Vital Statistics data to estimate the reduced form relationship between MLDA laws and birth outcomes, and use another data source, the NLSY, to investigate prenatal health behaviors.

There are well known differences in health outcomes across race and ethnicity groups and between immigrants and non-immigrants. A limitation of the natality data in this period is that Hispanic status is inconsistently measured over time and across states, with a very large fraction of missing values. To investigate heterogeneous effects of alcohol policy, two demographic sub-samples are considered: births to native born white mothers and birth to native born black mothers. A third group, births to immigrant mothers, is included in the full sample, but because results for this group are almost always insignificant, we do not report them separately.[3] In interpreting the results, it is important to keep in mind that all groups include a combination of Hispanic and non-Hispanic mothers.

The sample includes 16.17 million observations on births to mothers aged 14 to 24 at the time of conception. As shown in Table 1, about 7.4 percent of births recorded in Vital Statistics have low birth weight, with a higher rate of 13.0 percent for births to black mothers. The rates of prematurity and congenital anomalies are 10.5 percent and 1.3 percent, respectively, with rates of 18.3 percent and 1.4 percent for black mothers.

Data on MLDA laws come from the Distilled Spirits Council of the U.S. (DISCUS).[4] We use the minimum drinking age in the estimated month of conception as the indicator for the relevant policy regime. We use the date of conception as the relevant date because the effects of prenatal alcohol use are thought to be particularly pronounced in the first trimester. Furthermore, the policy at the date of conception would capture any health effects due to changes in the composition of women

[3]The lack of significance may indicate that these mothers are not affected by the laws or may result from smaller sample sizes.

[4]We are grateful to Thomas Dee for sharing the data with us.

becoming pregnant. We assume the month of conception is nine months prior to the month of birth in cases where gestation length is not reported, and otherwise use the gestation length to calculate the month of conception. Because the vital statistics report maternal age at birth but not birth date, we assume age at conception is one year younger than age at birth if gestation length exceeds six months or is not reported and assume age at conception equals age at birth otherwise. Roughly twenty-five percent of our sample will be classified as younger at conception than their actual age. This could bias the estimated effect of the policy regime, most likely by attenuating the results.[5]

As a supplement to the main analysis, we examine drinking, smoking, and sexual behavior among young women and mothers using the National Longitudinal Survey of Youth 1979. The NLSY follows a cohort aged 14 to 21 in 1979 from 1979 onwards. In 1979, when all individuals in the NLSY were 21 or younger, 37 states and DC permitted alcohol consumption for those under the age of 21. By 1986, when the youngest participants in the NLSY reached age 21, only 7 states permitted drinking under age 21. The restricted version of the dataset includes state identifiers which allow us to match individuals to the relevant alcohol policy regime. The NLSY asks all women who became mothers by 1986 whether they had used alcohol or cigarettes in the twelve months prior to birth or during pregnancy. The NLSY also asks questions about a woman's sexual, fertility, and marital history in 1984 and 1985 and a more limited set of questions in 1986. From these questions, we can discern the month and year in which a woman had sex for the first time and the timing of her births.

Table 2 shows means of variables for two NLSY samples: one of women in the cohort observed monthly between 1979 and 1986 if between the ages of 14 and 24, and one of births that occurred by 1986 to women in the cohort aged 14 to 24. To be consistent with the NVS analysis, we show separate analyses for native born white mothers and native born black mothers, where native born Hispanic mothers are assumed to be white. The cohort sample includes 319,346 observations on

[5]Analysis by year of age shows a minimal effect of MLDA policies on birth outcomes for 20-year-old mothers. We are therefore not concerned that our results are driven by misclassification.

4,164 women, who are between the ages of 14 and 24, observed between the years 1979 and 1986. 71 percent had sex for the first time and 35 percent became pregnant for the first time during this period, with slightly higher rates of 77 percent and 37 percent, respectively, among native black women. 46 percent of all women in the sample had at least one birth (not necessarily their first birth) during this period, with a higher birth rate of 54 percent among native black women. 16 percent had at least one non-marital birth, with a substantially higher non-marital birth rate of 37 percent among native black women. The birth sample includes 3,910 births to 2,750 mothers aged 14 to 24 at the time of birth. 40 percent of these mothers drank 12 months before the birth of their child and 33 percent drank during pregnancy, with higher rates of drinking of 46 percent and 38 percent, respectively, among native white women. These are higher rates of prenatal alcohol use than the 20 percent estimated by the CDC and others (CDC, 1995; NIDA, 1994; Serdula et al., 1991) mentioned above, presumably because this is a young cohort of women.

Several features of the NLSY are important to note. First, the data set is longitudinal, so each woman appears multiple times in the cohort sample and, if a woman has had multiple children, she will appear multiple times in the birth sample. We treat each monthly observation or birth as a separate observation. Standard errors take account of intrastate correlations across observations, so they account for repeated observations of a mother in most cases. Second, the NLSY over-samples blacks and Hispanics. We treat the un-weighted NLSY cohort as our sample, recognizing that it is not representative of the United States. The number of births in each state-age-year cell is small. Furthermore, because of the aging of the cohort, there are no births to 16-year-olds after 1981 and no births to 17-year-olds after 1982, and so on. These limitations lead us to view the NLSY evidence as suggestive rather than definitive, particularly for births to the youngest mothers.

4 Empirical Strategy

Studying the effects of alcohol policy, rather than alcohol use *per se*, has the advantage that it is less subject to concerns about selection. Women who drink prior to pregnancy or while pregnant are likely to be different on a wide range of unobserved dimensions. Potential confounding factors which may be correlated with prenatal drinking include illicit drug use, number of prenatal doctor visits, nutrition, and other health and life-style behaviors. Drinking frequency may be positively related to socioeconomic status.[6] Because drinking is correlated with factors that directly impact infant health, it is difficult to isolate the causal effect of drinking on birth outcomes. For this reason, we focus on the effect of MLDA laws, which are plausibly exogenous to the personal characteristics of young women affected by them. Changes in birth outcomes associated with MLDA laws are likely due to the causal impact of the laws on substance use prior to or during pregnancy.

It is important to keep in mind that alcohol policy may affect the use of drugs other than alcohol. For example, alcohol consumption is a complement to cigarette consumption (Cameron & Williams, 2001; Decker & Schwartz, 2000; Serdula et al., 1991), and maternal smoking is known to be harmful to the fetus (Case & Paxson, 2002). Decker and Schwartz (2000) estimate that a one percent rise in the price of beer decreases smoking by about the same amount as a one percent rise in the price of cigarettes, suggesting that smoking is very responsive to changes in drinking behavior. DiNardo and Lemieux (2001) estimate that raising the minimum drinking age from 18 to 21 increases the prevalence of marijuana use among high school seniors by about 2 percentage points, implying that marijuana and alcohol are substitutes. Thus, the observed relationship between alcohol policy and infant outcomes could be mediated by substances which are complements or substitutes to alcohol. We address this concern in part by investigating whether changes in MLDA laws affect smoking

[6]Casswell, Pledger, and Hooper (2003) find that frequency of drinking is positively influenced by income, but less well-educated young adults drink significantly more during a drinking occasion. Cook and Moore (2002) use the National Household Survey on Drug Abuse for 1996 and find that the self-reported prevalence of drinking increases with education and family income. However, Lowry, Kann, Collins, and Kolbe (1996) report that lower family income is associated with episodic heavy drinking among adolescents.

behavior.

To estimate the effect of MLDA laws on birth outcomes, we use a difference-in-differences model with women aged 21 to 24 at the time of conception as a control group to account for unobserved time-varying state-level factors which could affect infant health. In doing so, we implicitly assume drinking laws have a negligible effect on the behavior of those 21 and older.[7] We view the increase in the drinking age as an increase in the cost of obtaining alcohol for young women.

In an analysis of drinking habits among high school seniors, Dee (2001) finds that an indicator for an MLDA of 18 captures the relevant variation in drinking behavior. We follow this standard in our analysis.[8] Thus, the baseline specification for the least squares birth outcome analysis is as follows:

$$\begin{aligned} outcome_{iasm} &= B_1 MLDA18_{sm} \\ &+ B_2 MLDA18_{sm} age14to17_{iasm} \\ &+ B_3 MLDA18_{sm} age18to21_{iasm} \\ &+ \delta_s + \theta_y + \alpha_a + u_{iasm} \end{aligned} \tag{1}$$

where $MLDA18$ indicates whether the drinking age in the state was 18 in the month of conception, $age14to17$ indicates mothers who were between the ages of 14 and 17 at the time of conception, and $age18to20$ indicates mothers who were between the ages of 18 and 20 at the time of conception. The $MLDA18$ variable controls for any unobserved state characteristics affecting birth outcomes across

[7]Because 21-to-24-year-olds in a low MLDA state were themselves more likely to have been legal to drink at eighteen, they may be more likely to drink as adults. If that is the case, the effect of MLDA laws on women under twenty-one could be understated.

[8]We have also tried tracking the legality of each cohort to drink. This approach generates results that are less robust, in part because teenagers under eighteen may be indirectly affected by changes to the legal drinking age. Furthermore, we have replicated the analysis using an indicator for a drinking age of 21. The results are largely consistent with those presented here for the NVS analysis, but the NLSY results become insignificant.

all ages in a given month. The subscript i indicates each individual birth, a indicates the estimated age at conception, s indicates the state of residence, m indicates the month of conception, and y indicates the year of conception. We include state fixed effects, year fixed effects, and maternal age fixed effects in all specifications. The birth outcomes we examine in this analysis are low birth weight status, preterm birth status, and whether the baby has any congenital anomalies. Because the NLSY samples are too small to detect changes in these relatively rare birth events, we only use the NVS for the birth outcomes regressions.

To augment the baseline model, we include various sets of controls. We include controls for birth characteristics - whether the infant is male and the plurality of the birth - which are unlikely to be endogenous to the policy regime. These controls do not affect our estimates very much. In some specifications, we also add controls for maternal characteristics including race/ethnicity/nativity status, education, and number of children. These factors may reflect underlying state-level population changes, or may stem from compositional effects associated with the policy change. Paternal characteristics such as age, race/ethnicity, and education, are also included in some models.[9] In the birth weight analysis, additional controls for preterm birth are included in some models to assess the extent to which low birth weight is due to prematurity. In addition, in some specifications, we control for state-specific time trends and age-specific time trends. In the appendix, we also consider the effects of other time-varying factors that could influence birth outcomes, such as beer and cigarette taxes, parental notification and consent abortion laws and aggregate birth rates.

All reported results are for linear probability models.[10]

[9]We experimented with including mother's marital status as a proxy for the father's relationship to the mother. However, states had different policies for determining marital status during this time. Some states used last names to impute marital status, and others assumed the mother was married unless she specifically indicated otherwise. The results of models including the marital status variables are often counterintuitive. Because this variable seems to be unreliable, we exclude it from the specifications we present here. We view the presence or absence of paternal information on the birth certificate as a more reliable indicator of the relationship between the parents at the time of birth.

[10]As noted by Ai and Norton (2003), coefficients on interaction terms in non-linear models cannot be readily interpreted.

5 Effect of MLDA Laws on Birth Outcomes

5.1 Birth Weight

Birth weight is a widely used and accurately measured indicator of infant health at birth. The medical literature suggests that prenatal alcohol use may stunt fetal growth, which could lead to low birth weight. In addition, if alcohol use leads to an increased number of unintended pregnancies, the resulting births could have an increased incidence of low birth weight because of prenatal behaviors or parental characteristics associated with low birth weight. Births under 2500g are considered low birth weight.

Table 3 shows the results of the low birth weight analysis for all women. The first column includes state fixed effects, year of conception fixed effects, and maternal age fixed effects. Columns II through V add additional sets of controls.

In the first column of Table 3, there is a small but statistically significant effect of the MLDA of 18 on low birth weight for both women younger than 18 and women between the ages of 18 and 20. Women conceiving under age 21 are 0.27 to 0.50 percentage points more likely to conceive a low birth weight birth in months and states with a drinking age of 18 (on a base of 7.4 percentage points.) The effects are larger for younger mothers. However, even among the youngest group, the estimated effect is small in magnitude; moving to an MLDA of 18 increases the probability of low birth weight by less than 10 percent. Controlling for birth characteristics (gender of baby, twin, triplets or higher order status) has little effect on the estimates, as shown in column II.

The model including state-specific time trends in Column III of Table 3 has no effect on the coefficients of interest. Controlling for preterm birth (<37 weeks gestation) and whether the gestational length information was missing reduces coefficients by about a quarter, suggesting that part of the observed effect on birth weight is due to prematurity. We explore the relationship between drinking age laws and prematurity in section 5.2.

When age-specific time trends are included in Column V of Table III, the size of the coefficients falls by about a third and the estimates become statistically insignificant. We discuss this issue below.

Because birth outcomes are known to differ substantially by race/ethnicity and immigrant status, we divide our sample into native-born white mothers, native-born black mothers, and immigrant mothers.[11] Results for immigrant mothers are almost always insignificant and we do not report them here. Table 4 presents the effect of MLDA laws on birth weight for the other two demographic sub-groups. The results for native born white mothers are significant but smaller in magnitude, ranging from 0.12 to 0.23 percentage points. The estimated effects for native born black mothers are much larger, ranging from 0.59 to 0.99 percentage points. For both sub-groups, the effects are robust to the inclusion of state-specific time trends.[12]

In the third and seventh columns of Table 4, we include an indicator for whether the infant was born prematurely (<37 weeks gestation) and whether the gestation length information was missing. The inclusion of premature status reduces the estimated effect of MLDA laws on birth weight by about a quarter to a third for native black mothers and somewhat less for white mothers. This suggests that MLDA laws are associated with prematurity for black mothers, but prematurity cannot fully account for the relationship between MLDA laws and birth weight.[13] Below we examine the association between MLDA laws and preterm birth directly.

For white mothers 18-to-20 years old, the results in Table 4 are also robust to the inclusion of age-specific time trends. However, for black mothers and for younger white mothers this is not the

[11] As noted above, Hispanic status is not reliably reported during this period. All groups include both Hispanics and non-Hispanics.

[12] If we separate by metropolitan status, the results are statistically significant for rural white mothers, rural black mothers, and urban black mothers. Also, it should be noted that the size of the coefficients for the youngest black mothers are reduced by about half (but remain statistically significant) when controls for beer taxes are included in the model. However, as discussed in the appendix, we suspect that the beer tax variables may not capture meaningful policy variation and we exclude them from our preferred model.

[13] Of course, there could be more subtle changes in gestational age that are not fully captured by the preterm birth indicator and could affect birth weight.

case. There are two explanations for this phenomenon. First, policy or other changes over time may differentially affect the health of infants born to some age groups. The observed pattern is consistent with the secular improvement in birth outcomes for births to younger mothers relative to older mothers. In the appendix, we try controlling for a number of factors that might be related to birth outcomes. However, none of these factors explain the observed pattern (see Appendix Tables A and B). A second possibility is that the age-specific trends absorb useful variation in MLDA laws and make identification of their effects difficult. Given this possibility, in the analysis that follows, we treat the specification with state-specific time trends (but not age-specific time trends) as our preferred specification, but report results with and without age-specific time trends where space allows.

As a supplement to the birth weight analysis, we examine the effect of drinking age policy on a continuous variable, birth weight in grams. The results (not shown) suggest an MLDA of 18 is associated with a significant 16-22 gram decrease among black women and a small and insignificant decrease among white women.

5.2 Prematurity

A similar analysis is performed to examine the relationship between MLDA laws and premature birth, defined as gestation length under 37 weeks. We show results for the two demographic subgroups in Table 5. The results indicate that a drinking age of 18 is associated with an increased likelihood of premature birth by 0.39 percentage points for native white women (on a base of 8.4 percent) among mothers under age 18 at conception. For native black mothers, the estimated coefficient is much larger for mothers under age 18 and mothers between the age of 18 and 20. A drinking age of 18 is associated with an increased likelihood of premature birth by 1.28 percentage points for native black mothers under age 18 at conception and 0.65 percentage points for native black mothers between the ages of 18 and 20 at conception (on a base of 18 percent).[14] This is consistent with the findings from Table 4 which suggested that prematurity played a role in the relationship between the MLDA laws and low birth weight among native black women, but less so for native white women. For both groups, the findings are robust to the inclusion of state-specific time trends. The inclusion of age-specific time trends substantially reduces most of the estimated coefficients, though coefficients for the youngest black women remain statistically significant at the 10 percent level.

Estimation of the model with gestation in weeks as the dependent variable indicates reductions in gestation length of 0-0.04 weeks for white women (with only the youngest group showing a significant relationship) and 0.07-0.11 weeks for black women (results not shown).

5.3 Congenital Anomalies

Of the three outcome measures, the measure of congenital anomalies is the least well measured. Definitions of congenital anomalies differ across states and the variable is not reported by every state in every year. Furthermore, reported anomalies are rare (occurring in about one percent of births) and so policy impacts are likely to be difficult to detect. Nevertheless, because the medical literature suggests a relationship between heavy prenatal alcohol use and Fetal Alcohol Syndrome, it is important to consider the effect of drinking laws on this outcome.

The results in Table 6 are small, wrong-signed, and insignificant, suggesting no relationship between MLDA laws and congenital anomalies. That we find no persuasive effects on congenital anomalies is somewhat surprising, given the apparently strong link between heavy drinking during pregnancy and Fetal Alcohol Syndrome. We believe there are at least two potential explanations.[15] First, given the caveats described above, we cannot rule out the possibility that measurement error

[14] As in the birth weight analysis, the magnitudes of the coefficients for black women are diminished when beer taxes are included in the model.

[15] It is also possible that the relationship between prenatal alcohol use and congenital anomalies has been overstated.

is driving the null result. Second, it is possible that alcohol policy has little impact on heavy prenatal drinking. The observed effects of MLDA laws on birth weight and prematurity might relate not to adverse impacts of prenatal drinking, but rather to the selection into birth. In the next section, we investigate how MLDA laws affect the composition of births.

6 Effect of MLDA Laws on the Composition of Births

6.1 Evidence from NVS

We find significant effects of MLDA laws on birth weight and prematurity, and no relationship between the laws and congenital anomalies. The interpretation of the observed relationship between alcohol policy and birth outcomes hinges on whether MLDA laws affect the composition of births, the health status of any given birth, or both. In this section, we examine the effects of MLDA laws on the composition of births. We use the NVS to investigate changes in the composition of maternal and paternal characteristics and we use the NLSY to examine changes in drinking and sexual behavior associated with MLDA laws.

First, we investigate the role of MLDA in shifting the composition of births across demographic subgroups. Point estimates (not shown) suggest a 0.8-2.2 percentage point increase in an infant's probability of an infant having a native black mother (on a base of 18.6 percentage points). These findings are consistent with Dee (2001), who finds six percent reductions in childbearing among 15-to-19 year old black women associated with a higher drinking age. However, the results of our analysis are statistically insignificant, so we focus on compositional changes within demographic sub-groups.

In Table 7, we examine whether adding controls for parental characteristics changes the estimated effects of MLDA laws. We focus on low birth weight in this table, but the pattern in the similar for prematurity (not shown). In the first and fourth columns, we present our preferred specification for native white women and native black women.[16] In the column to the right, we add maternal controls, such as race/ethnicity/nativity status, age at conception, parity, and maternal education. We then add paternal controls, such as race/ethnicity/nativity status, age at conception, and education. For each set of controls we also include indicators for missing information. Missing paternal information, in particular, proves to be an important predictor of poor health outcomes.

The inclusion of maternal controls reduces the size of the estimated coefficients on MLDA laws for native white women. Further analysis (not shown) shows that less restrictive minimum age laws are negatively associated with the educational distribution of women who give birth. After controlling for maternal characteristics, there is no significant relationship between MLDA laws and infant health among white mothers.

In contrast, column V of Table 7 suggests that including maternal information does not reduce the estimated effect of MLDA substantially for black mothers. This suggests that the observable characteristics of black mothers do not change very much as the result of drinking age laws. Rather, it is the inclusion of paternal characteristics that affects the coefficients. A drinking age of 18 is associated with undesirable (from an infant health perspective) paternal characteristics. Further analysis suggests that controlling for any one set of paternal controls - age, education, or race/ethnicity/nativity - weakens the relationship between the policy and infant health. This leads us to explore the role of missing paternal information.

Given the link between alcohol policy and risky sexual behavior, we are particularly interested in births that might arise as the result of unintended or unplanned pregnancies. Though the birth certificate data do little to shed light on this question directly, one proxy for the involvement of the father is the presence of his information on the birth certificate.[17] We focus on whether or not his

[16]These models are the same as those presented in Columns II and VI of Table 4.

[17]As noted in a footnote 9, we have concerns about the marital status variables and we do not use them here.

age is reported.[18] Births with missing paternal information may be more likely to be the result of unintended pregnancies or may otherwise reflect unobserved maternal or paternal characteristics associated with poor infant health outcomes.[19]

Table 8 shows that lower minimum drinking ages are significantly associated with higher rates of missing paternal age for native black women, but not for white women. The results for black women are significant even when controlling for age-specific time trends. To investigate whether these results do suggest a link between MLDA laws and unintended pregnancies, we divide the sample into states with and without parental notification (or consent) abortion laws. If abortions are harder for young women to obtain, then we expect the compositional birth effects of MLDA laws to be greater. We find that, for native born black women, the effect of MLDA laws on missing paternal information is sizable in states with restrictive abortion laws but not other states. In parental notification states, for the native black group, a drinking age of 18 is associated with an 8.8-19.5 percentage point increase in the probability of a birth with missing father information (on a base of 50 percentage points). Though there may be other differences between notification and non-notification states, these results are consistent with the notion that missing paternal information is serving as a proxy for unintended pregnancies.

In sum, the evidence from the NVS suggests that composition plays an important role in the relationship between MLDA laws and birth outcomes. However, the NVS cannot be used to look at the relationship between MLDA laws and drinking prior to or during pregnancy. In addition, the NVS does not include any women who did not have births. Thus, we turn to the NLSY to examine the effect of MLDA laws on drinking prior to pregnancy and sexual behavior, keeping in

[18]Paternal age is almost always reported if any paternal information is reported. One exception is that paternal race is sometimes included even when other information is missing. This may be the result of imputation.

[19]For instance, the probability of a low birth weight birth is estimated to be 0.3 to 1.8 percentage points lower for any reported age category relative to the missing age category, based on the analysis shown in Table 7. The link between missing paternal age and birth weight is stronger for black women.

mind the limitations of the NLSY discussed previously.

6.2 Evidence from NLSY

First, we use the birth sample to examine drinking in the 12 months prior to pregnancy.[20] We examine the relationship between MLDA laws in effect one year prior to the birth and drinking behavior, as shown in Table 9. For white women, the key coefficients are sizeable but statistically insignificant. However, a drinking age of 18 is significantly associated with a marginally significant increased probability of drinking among 18-to-20 year old native black women.[21] The point estimates indicate a 9 to 11 percentage point higher likelihood of drinking in the 12 months prior to birth, representing approximately a 30 percent increase. The estimated effects of the laws on alcohol consumption among black women are large.[22] This association is robust to the inclusion of controls for individual characteristics, including Hispanic origin, education of the mother's parents, and whether she lived with both parents until age 18. We also test models which account for age-specific time trends and find that, while the coefficient size remains large, it is not statistically significant (results not shown).

In Table 10, we examine the relationship between MLDA laws and the timing of a woman's sexual initiation using the female cohort sample.[23] Among women who had never had sex at the beginning of 1979, this outcome variable is coded 0 for every month until she had sex for the first

[20]Each birth is treated as a separate observation, but standard errors are clustered to account for within-state correlations. We have a small sample of births to women under 18, so these results should be interpreted with caution.

[21]The lack of significant impact on the younger ages may be due to the relatively few observations for the youngest groups resulting from the aging of the NLSY cohort.

[22]We expect an imperfect correlation between the policy regime and behavior. Drinking laws are widely evaded, grandfathering of cohorts implies that not all 18-to-20 year old women are affected when the law is changed, and individuals may live near a state with a lower drinking age than their own. Coase and Grossman (1988) report small effects of the drinking age in bordering states in some models.

[23]Each month between 1979 and 1986 is treated as a separate observation, but standard errors are clustered to account for within-state correlations.

time (such that her last observation is coded 1), or when the latest interview question was asked (in 1984 or 1985).[24] We match the drinking age law to the observation month. The results suggest that a lower drinking age is associated with an increased probability of having sex for the first time in a given month for all women. The estimated effects are large for both white and black women (effects of 0.1 to 0.4 percentage points on a base of 0.5 percentage points), but only statistically significant for 18-to-20-year-old black women. The results are robust to the inclusion of controls for individual characteristics but not age-specific time trends.

Finally, although we do not show the results here, we also examine the relationships between MLDA laws and becoming pregnant for the first time, having a birth, and having a non-marital birth, all using the female cohort sample. For all three outcomes and both demographic groups, the coefficients are insignificant. It may be that the laws do not affect these outcomes, but it may also be the case that the NLSY sample is not large enough to detect modest effects.[25]

In sum, the evidence reported in this section suggests that drinking laws may affect the composition of births, particularly among native black women. The inclusion of maternal and paternal controls dampens the effect of MLDA laws on the probability of low birth weight, suggesting an increase in births to parents with less healthy characteristics in states with lower drinking ages. Among white women, maternal characteristics change substantially in association with MLDA laws. Among black women, there is a substantial increase in the fraction of births with absent fathers, representing up to a 25 percent increase. These are most pronounced in states with restrictive abortion laws. Evidence from the NLSY indicates that black women are more likely to drink 12 months prior to a birth and have their first sexual intercourse when the drinking age is 18. Overall, we believe the findings point to an association between a low drinking age and the likelihood of

[24]In months when women were no longer at risk for sexual initiation, they are excluded from the analysis.

[25]The NLSY analysis is based on a fairly small number of births in each age-year cell. Furthermore, as noted above, there are no births to 16-year-olds after 1981, no births to 17-year-olds after 1982, and so on, due to the aging of the sample.

birth stemming from unintentional pregnancy.

7 Effect of MLDA Laws on Prenatal Behaviors

Observable characteristics of parents do not explain all of the differences in birth outcomes associated with MLDA laws, particularly among black women. In this section we examine whether the drinking age is associated with prenatal health behaviors as well.

In Table 11, we investigate the relationship between MLDA laws and drinking during pregnancy using the birth sample from the NLSY. We match the drinking age law to six months prior to the birth month.[26] Black women between the age of 18 and 20 are more likely to report prenatal drinking when the drinking age is 18. We observe no evidence of an increase in prenatal drinking among white women in either age group when the drinking age is 18.

Because smoking is a complement to drinking, and the effects of prenatal smoking are believed to be quite detrimental, we also examine whether MLDA laws affect prenatal smoking. We do not show the results because, regardless of specification or demographic group, the coefficients are never significant and often wrong-signed.

In conclusion, we do find a relationship between the drinking age and prenatal drinking. However, the changing composition of observed parental characteristics leads us to suspect that unobserved characteristics are also influenced by the policy regime. Therefore, we cannot isolate the causal impact of prenatal drinking on birth outcomes.

8 Conclusions

This paper examines the effect of minimum age drinking laws on birth outcomes. Minimum drinking age laws are related to the incidence of prematurity and low birth weight births among young women, particularly among black women. We present evidence that a lower drinking age is associ-

[26]The results do not change if we match the drinking age law to 9 months prior to the birth month.

ated with drinking in the 12 months prior to a birth and prenatally, sexual initiation, and absence of paternal information on the birth certificate. Taken together, these findings lead us to suspect that a lower drinking age raises the proportion of births resulting from unintentional teen pregnancy, thereby generating adverse health outcomes for infants.

The infant health effects associated with an MLDA of 18 are small, representing far less than a ten percent change in rates of prematurity or low birth weight for blacks, and smaller changes for other groups. However, the effects of minimum legal drinking ages on drinking are also modest. Alcohol policy that more effectively curtailed drinking, or the risky behaviors associated with it, might hold greater promise for infant health. Our results suggest that alcohol policies may have positive unintended consequences - benefits for the well-being of a generation beyond those directly targeted.

APPENDIX

Exploring Sensitivity to Age Specific Linear Time Trends

In this appendix we examine the reasons for the sensitivity of our results to the inclusion of age-specific time trends. A number of our results are rendered statistically insignificant by the inclusion of such trends as controls. Notable exceptions include results for 18-to-20 year old whites in Table 4 (low birth weight analysis), results for the youngest blacks in Table 5 (prematurity analysis) and all results for black mothers in Table 8 (missing paternal information).

Because the minimum drinking age is increasing over time in our study period, the sensitivity is consistent with younger age groups experiencing better relative health outcomes over time relative to older age groups or, equivalently, more recent cohorts experiencing better birth outcomes at any given maternal age. We try to add a number of sets of control variables to determine if any might be associated with these trends: beer and cigarette taxes, parental notification and consent abortion laws, the group-state-age specific birth rate, and the log of the birth rate. Tax data come from the World Tax Database at the University of Michigan (http://www.bus.umich.edu/OTPR/otpr). Abortion law information comes from Haas-Wilson (1996) and Greenberger and Connor (1991). Birth rates are estimated by the authors using the Census Public Use Microdata Series to generate age-state-group-specific denominators. Linear interpolation is used between Census years.

The results of our analysis are shown in Tables A and B for whites and blacks respectively. Column I of each table shows our preferred specification which includes state-specific time trends but not age-specific time trends. In column II, we include the real beer tax interacted with the age groups and an indicator for missing data. These variables do reduce the coefficients slightly in Table A and more substantially in Table B, though in neither case do they render the coefficients statistically insignificant. Further investigation reveals that nominal beer taxes changed infrequently during the time period, so changes are likely to reflect age-specific responses to inflation (or another time-varying factor) in states with high initial taxes rather than a genuine policy response.

Next, we investigate the role of cigarette taxes in column III. We include real cigarette taxes interacted with the age groups and an indicator for missing data. The results are largely unchanged relative to the first specification.

In columns IV and V, we explore the role of abortion laws. Though our sample period follows the *Roe* decision legalizing abortion, states differed on requirements for minors seeking access to abortion. We control for the existence of parental notification (or consent) laws, interacted with age groups, in column IV, and control for the more restrictive parental consent laws only in column V. These controls do little to change the coefficients, suggesting they do not explain the sensitivity of our results to age-specific time trends.

Finally, we consider the possibility that increasing teen birth rates might explain the age-specific time trends. It is possible that healthier teens were entering into the population of mothers over the time period. To test this hypothesis, we estimate age and state specific birth rates for native whites and native blacks. Controlling for the birth rate does little to change the estimated coefficients, as shown in column VI. We try controlling for the log of the birth rate in Column VII, with similar results.

In sum, we are unable to explain the sensitivity of our results to age-specific time trends. It is possible that these trends reflect secular trends driven by factors for which we are unable to account, or that controlling for age-specific trends eliminates useful variation in drinking age laws. We present both sets of results so the reader can assess the strength of the evidence.

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Table 1: Summary Statistics for Vital Statistics Data

	Native White	Native Black	All Women
N	11,426,203	3,032,108	16,165,747
Birth Outcomes			
Low Birthweight	0.061	0.130	0.074
Birthweight in grams (if avail.)	3356.365	3074.426	3297.001
Exact Birthweight Missing	0.001	0.002	0.002
Preterm Birth (if avail.)	0.084	0.183	0.105
Weeks Gestation (if avail.)	39.628	38.539	39.391
Preterm Birth/Gestation Length Missing	0.100	0.117	0.105
Congenital Anomoly (if avail.)	0.013	0.014	0.013
Congenital Anomoly Missing	0.178	0.162	0.195
Birth Characteristics			
Baby Male	0.514	0.508	0.512
Twin Birth	0.016	0.021	0.017
Triplets or Higher Order Birth	0.000	0.000	0.000
Maternal Characteristics			
Mother Native White	1.000	0.000	0.701
Mother Native Black	0.000	1.000	0.186
Mother Foreign Born	0.000	0.000	0.096
Mother Hispanic (if avail.)	0.126	0.007	0.174
Mother Hispanic Missing	0.454	0.434	0.427
Estimated Mother Age at Conception	20.517	19.512	20.340
Second Birth	0.315	0.296	0.310
Third Birth	0.124	0.158	0.131
Fourth or Higher Order Birth	0.056	0.111	0.069
Mother Education High School (if avail.)	0.506	0.436	0.481
Mother Education Some College (if avail.)	0.160	0.134	0.153
Mother Education College Grad or More (if avail.)	0.048	0.022	0.043
Mother Education Missing	0.203	0.145	0.217
Paternal Characteristics			
Father Race Black	0.009	0.545	0.115
Father Race Native American	0.004	0.000	0.007
Father Race Asian	0.003	0.001	0.013
Father Race Other/Missing	0.109	0.445	0.176
Father Hispanic	0.065	0.006	0.091
Father Hispanic Missing	0.513	0.673	0.522
Mother Married (if avail.)	0.803	0.283	0.694

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	Native White	Native Black	All Women
N	11,426,203	3,032,108	16,165,747
Mother Married Missing	0.060	0.057	0.061
Estimated Father Age at Conception (if avail.)	23.834	23.469	23.915
Father Age Missing	0.121	0.490	0.193
Father Education High School (if avail.)	0.510	0.565	0.507
Father Education Some College (if avail.)	0.171	0.152	0.167
Father Education College Grad+ (if avail.)	0.099	0.048	0.094
Father Education Missing	0.304	0.599	0.385
State Characteristics			
Real Beer Tax (if avail.)	0.178	0.246	0.185
Real Cigarette Tax (if avail.)	0.162	0.153	0.160
Beer/Cigarette Tax Missing	0.002	0.001	0.005
Parental Notification (or Consent) Law (if avail.)	0.433	0.422	0.417
Parental Consent Law (if avail.)	0.269	0.304	0.270
Parental Notification/Consent Law Missing	0.021	0.004	0.018
Age-Group Birth Rate (if avail.)	90.336	117.268	99.305
Birth Rate Missing	0.000	0.000	0.017
MLDA is 18	0.272	0.343	0.279
MLDA is 21	0.480	0.422	0.480

Table 2: Means of Variables in NLSY Data

	1979 Cohort Sample			Birth Sample		
	Native White	Native Black	All Women	Native White	Native Black	All Births
N	232,256	72,301	319,346	2,536	1,167	3,910
Average number of monthly observation	76	79	77	–	–	–
Average number of births	–	–	–	1.4	1.5	1.4
Number of unique women/mothers	3,046	918	4,164	1,798	803	2,750
Behavioral Outcomes						
Had Sex for First Time	0.699	0.771	0.709	–	–	–
Became Pregnant For the First Time	0.348	0.371	0.354	–	–	–
Had At Least One Birth	0.433	0.541	0.463	–	–	–
Had At Least One Non-Marital Birth	0.099	0.370	0.160	–	–	–
Drank 12 Months Before Birth	–	–	–	0.461	0.314	0.404
Drank During Pregnancy	–	–	–	0.376	0.254	0.329
Smoked During Pregnancy	–	–	–	0.398	0.277	0.348
Individual Characteristics						
Native Born White	1.000	0.000	0.728	1.000	0.000	0.650
Native Born Black	0.000	1.000	0.226	0.000	1.000	0.299
Immigrant	0.000	0.000	0.046	0.000	0.000	0.050
Hispanic	0.191	0.000	0.170	0.238	0.000	0.191
Race/Ethnicity/Nativity Status Missing	0.000	0.000	0.000	0.000	0.000	0.003
Maternal Age This Month	20.941	20.822	20.920	–	–	–
Maternal Age at Birth	–	–	–	21.563	21.124	21.439
Age-adjusted AFQT score	33.414	17.173	28.867	23.758	12.668	19.709
Mother's Education (of resp., if avail.)	11.065	10.857	10.833	10.090	10.287	9.956
Mother's Education Missing	0.039	0.067	0.048	0.061	0.081	0.069
Father's Education (of resp., if avail.)	11.327	10.392	10.948	10.035	9.581	9.713
Father's Education Missing	0.095	0.236	0.131	0.147	0.305	0.197
Lived With Both Parents at 18 (if avail.)	0.636	0.464	0.597	0.513	0.410	0.484
Both Parents at 18 Missing	0.074	0.069	0.076	0.123	0.081	0.114

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	1979 Cohort Sample			Birth Sample		
	Native White	Native Black	All Women	Native White	Native Black	All Births
N	232,256	72,301	319,346	2,536	1,167	3,910
State Characteristics						
MLDA is 18	0.357	0.414	0.366	0.369	0.419	0.380
MLDA is 21	0.355	0.244	0.334	0.351	0.264	0.329

Table 3: Relationship Between MLDA and Low Birth Weight

Births Conceived 1978-1988 Among Women Aged 14-24, All Women

	I	II	III	IV	V
Dependent Variable: Low Birth Weight (mean=0.074)					
MLDA is 18	-0.0012	-0.0011	-0.0014*	-0.0018**	-0.0009
	(0.0007)	(0.0007)	(0.0007)	(0.0006)	(0.0008)
MLDA is 18*Mother is $\leq$17	0.0050**	0.0048*	0.0048*	0.0037**	0.0028
	(0.0017)	(0.0018)	(0.0018)	(0.0012)	(0.0022)
MLDA is 18*Mother is 18-20	0.0027**	0.0025*	0.0025*	0.0021**	0.0019
	(0.0009)	(0.0010)	(0.0010)	(0.0007)	(0.0011)
State of Residence Fixed Effects	yes	yes	yes	yes	yes
Year of Conception Fixed Effects	yes	yes	yes	yes	yes
Maternal Age at Conception Fixed Effects	yes	yes	yes	yes	yes
Birth Characteristic Controls		yes	yes	yes	yes
State-Specific Linear Time Trends			yes	yes	yes
Age-Specific Linear Time Trends					yes
Preterm Birth				yes	
Number of Observations	16,165,747	16,165,747	16,165,747	16,165,747	16,165,747
R-squared	0.00	0.07	0.07	0.19	0.07

Note: Linear probability model. Standard errors are clustered by state of residence and reported in parentheses. +,*, and ** represent statistical significance at the 10,5, and 1% levels respectively. Maternal Age at Conception dummies included for each year of age (age 14 omitted). Birth controls include male infant and four plurality categories (twins, triplets or more, and plural birth information missing, with singleton omitted). Preterm birth indicates less than 37 weeks gestation.

Table 4: Relationship Between MLDA, Low Birth Weight and Race

Births Conceived 1978-1988 Among Women Aged 14-24, Native White and Native Black Women

	I	II	III	IV	V	VI	VII	VIII
		Native White Women				Native Black Women		
Dependent Variable: Low Birth Weight		*(mean=0.061)*				*(mean=0.130)*		
MLDA is 18	-0.0002	-0.0007	-0.0011*	-0.0006	-0.0047**	-0.0041*	-0.0045*	-0.0014
	(0.0006)	(0.0005)	(0.0005)	(0.0005)	(0.0017)	(0.0018)	(0.0019)	(0.0021)
MLDA is 18*Mother is ≤17	0.0022+	0.0023+	0.0020+	0.0008	0.0098**	0.0099**	0.0071**	0.0057
	(0.0013)	(0.0013)	(0.0010)	(0.0015)	(0.0025)	(0.0025)	(0.0020)	(0.0035)
MLDA is 18*Mother is 18-20	0.0012+	0.0012+	0.0013*	0.0012+	0.0059**	0.0059**	0.0042**	0.0010
	(0.0006)	(0.0006)	(0.0006)	(0.0007)	(0.0015)	(0.0015)	(0.0012)	(0.0021)
State of Residence Fixed Effects	yes	yes	yes	yes	yes	yes	yes	yes
Year of Conception Fixed Effects	yes	yes	yes	yes	yes	yes	yes	yes
Age at Conception Fixed Effects	yes	yes	yes	yes	yes	yes	yes	yes
Birth Characteristic Controls	yes	yes	yes	yes	yes	yes	yes	yes
State-Specific Linear Time Trends		yes	yes	yes		yes	yes	yes
Age-Specific Linear Time Trends				yes				yes
Preterm Birth			yes				yes	
Number of Observations	11,426,203	11,426,203	11,426,203	11,426,203	3,032,108	3,032,108	3,032,108	3,032,108
R-squared	0.07	0.07	0.20	0.07	0.06	0.06	0.18	0.06

Note: Linear probability model. Standard errors are clustered by state of residence and reported in parentheses. +,*, and ** represent statistical significance at the 10,5, and 1% levels respectively. Maternal Age at Conception dummies included for each year of age (age 14 omitted). Birth controls include male infant and four plurality categories (twins, triplets or more, and plural birth information missing, with singleton omitted). Preterm birth indicates less than 37 weeks gestation.

Table 5: Relationship Between MLDA and Preterm Birth

Births Conceived 1978-1988 Among Women Aged 14-24, Native White and Native Black Women

	I	II	III	IV	V	VI
	Native White Women (*mean=0.084*)			Native Black Women (*mean=0.183*)		
Dependent Variable: Preterm Birth						
MLDA is 18	-0.0010	-0.0023**	-0.0020*	-0.0053**	-0.0084**	-0.0053*
	(0.0008)	(0.0008)	(0.0008)	(0.0018)	(0.0021)	(0.0025)
MLDA is 18*Mother is ≤ 17	0.0039*	0.0039*	0.0012	0.0127**	0.0128**	0.0066+
	(0.0015)	(0.0015)	(0.0017)	(0.0029)	(0.0029)	(0.0039)
MLDA is 18*Mother is 18-20	0.0005	0.0005	0.0008	0.0064**	0.0065**	0.0022
	(0.0008)	(0.0008)	(0.0009)	(0.0014)	(0.0014)	(0.0021)
State of Residence Fixed Effects	yes	yes	yes	yes	yes	yes
Year of Conception Fixed Effects	yes	yes	yes	yes	yes	yes
Maternal Age at Conception Fixed Effects	yes	yes	yes	yes	yes	yes
Birth Characteristic Controls	yes	yes	yes	yes	yes	yes
State-Specific Linear Time Trends		yes	yes		yes	yes
Age-Specific Linear Time Trends			yes			yes
Number of Observations	10,312,349	10,312,349	10,312,349	2,686,093	2,686,093	2,686,093
R-squared	0.03	0.03	0.03	0.02	0.02	0.02

Note: Linear probability model. Standard errors are clustered by state of residence and reported in parentheses. +,*, and ** represent statistical significance at the 10,5, and 1% levels respectively. Maternal Age at Conception dummies included for each year of age (age 14 omitted). Birth controls include male infant and four plurality categories (twins, triplets or more, and plural birth information missing, with singleton omitted). Preterm birth indicates less than 37 weeks gestation.

Table 6: Relationship Between MLDA and Congenital Anomalies

Births Conceived 1978-1988 Among Women Aged 14-24, Native White and Native Black Women

	I	II	III	IV	V	VI
	Native White Women			Native Black Women		
Dependent Variable: Congenital Anomaly	*(mean=0.084)*			*(mean=0.183)*		
MLDA is 18	0.0006	-0.0007	-0.0008	-0.0015	-0.0038	-0.0036
	(0.0008)	(0.0007)	(0.0007)	(0.0021)	(0.0027)	(0.0026)
MLDA is 18*Mother is $\leq$17	-0.0002	-0.0003	-0.0002	-0.0004	-0.0003	-0.0006
	(0.0004)	(0.0004)	(0.0005)	(0.0007)	(0.0007)	(0.0009)
MLDA is 18*Mother is 18-20	-0.0001	-0.0002	0.0001	-0.0005	-0.0004	-0.0006
	(0.0002)	(0.0002)	(0.0002)	(0.0003)	(0.0003)	(0.0005)
State of Residence Fixed Effects	yes	yes	yes	yes	yes	yes
Year of Conception Fixed Effects	yes	yes	yes	yes	yes	yes
Maternal Age at Conception Fixed Effects	yes	yes	yes	yes	yes	yes
Birth Characteristic Controls	yes	yes	yes	yes	yes	yes
State-Specific Linear Time Trends		yes	yes		yes	yes
Age-Specific Linear Time Trends			yes			yes
Number of Observations	9,748,369	9,748,369	9,748,369	2,617,711	2,617,711	2,617,711
R-squared	0.00	0.00	0.00	0.00	0.01	0.01

Note: Linear probability model. Standard errors are clustered by state of residence and reported in parentheses. +,*, and ** represent statistical significance at the 10,5, and 1% levels respectively. Maternal Age at Conception dummies included for each year of age (age 14 omitted). Birth controls include male infant and four plurality categories (twins, triplets or more, and plural birth information missing, with singleton omitted).

Table 7: Compositional Effects and Low Birth Weight

Births Conceived 1978-1988 Among Women Aged 14-24, Native White and Native Black Women

	I	II	III	IV	V	VI
	Native White Women (*mean=0.061*)			Native Black Women (*mean=0.130*)		
Dependent Variable: Low Birth Weight						
MLDA is 18	-0.0007	-0.0008	-0.0006	-0.0041*	-0.0050*	-0.0041*
	(0.0005)	(0.0006)	(0.0007)	(0.0018)	(0.0021)	(0.0020)
MLDA is 18*Mother is $\leq$17	0.0023+	0.0008	0.0005	0.0099**	0.0094**	0.0070**
	(0.0013)	(0.0011)	(0.0015)	(0.0025)	(0.0025)	(0.0021)
MLDA is 18*Mother is 18-20	0.0012+	0.0005	0.0003	0.0059**	0.0057**	0.0045**
	(0.0006)	(0.0006)	(0.0007)	(0.0015)	(0.0014)	(0.0013)
Birth Characteristics	yes	yes	yes	yes	yes	yes
Maternal Controls		yes	yes		yes	yes
Paternal Controls			yes			yes
State of Residence Fixed Effects	yes	yes	yes	yes	yes	yes
Year of Conception Fixed Effects	yes	yes	yes	yes	yes	yes
Maternal Age at Conception Fixed Effects	yes	yes	yes	yes	yes	yes
State-Specific Linear Time Trends	yes	yes	yes	yes	yes	yes
Number of Observations	11,426,203	11,426,203	11,426,203	3,032,108	3,032,108	3,032,108
R-squared	0.07	0.07	0.07	0.06	0.06	0.06

Note: Linear probability model. Standard errors are clustered by state of residence and reported in parentheses. +,*, and ** represent statistical significance at the 10,5, and 1% levels respectively. Maternal controls include indicators for Hispanic and Hispanic status missing (non-Hispanic omitted), indicators for less than high school graduate, high school graduate, some college, and college graduate or more (missing education status omitted), and second birth, third birth, and fourth or greater birth (first birth omitted) Paternal controls include age 14 or under, 15, 16, 17, 18, 19, 20, 21-24, 25-29, and 30 or higher (missing age omitted), indicators for father black, father Asian, father Indian, father other/missing race, father Hispanic, and father Hispanic status missing (white Non-Hispanic omitted) and indicators for high school graduate, some college, college graduate or more, and missing education status (less than high school graduate omitted).

Table 8: Relationship Between MLDA and Missing Paternal Age

Births Conceived 1978-1988 Among Women Aged 14-24, Native White and Native Black Women

	I	II	III	IV	V	VI	VII	VIII
	Native White Women (*mean=0.121*)				Native Black Women (*mean=0.490*)			
Dependent Variable: Missing Paternal Age on Birth Certificate			Parental Notification?				Parental Notification?	
			No	Yes			No	Yes
MLDA is 18	-0.0016	-0.0095	-0.0017	-0.0053	-0.0467*	-0.0472+	-0.0303	-0.0754*
	(0.0083)	(0.0085)	(0.0119)	(0.0098)	(0.0204)	(0.0261)	(0.0252)	(0.0327)
MLDA is 18*Mother is ≤17	-0.0011	0.0221	-0.0011	0.0145	0.1229**	0.1211*	0.0674	0.1954**
	(0.0299)	(0.0319)	(0.0441)	(0.0336)	(0.0414)	(0.0560)	(0.0538)	(0.0560)
MLDA is 18*Mother is 18-20	-0.0044	0.0095	-0.0041	-0.0006	0.0522*	0.0552+	0.0275	0.0877**
	(0.0098)	(0.0099)	(0.0148)	(0.0111)	(0.0212)	(0.0276)	(0.0291)	(0.0276)
State of Residence Fixed Effects	yes	yes	yes	yes	yes	yes	yes	yes
Year of Conception Fixed Effects	yes	yes	yes	yes	yes	yes	yes	yes
Age at Conception Fixed Effects	yes	yes	yes	yes	yes	yes	yes	yes
Birth Characteristic Controls	yes	yes	yes	yes	yes	yes	yes	yes
State-Specific Linear Time Trends	yes	yes	yes	yes	yes	yes	yes	yes
Age-Specific Linear Time Trends		yes				yes		
Number of Observations	11,426,203	11,426,203	6,116,456	5,050,375	3,032,108	3,032,108	1,678,628	1,340,828
R-squared	0.10	0.10	0.09	0.10	0.26	0.26	0.24	0.28

Note: Linear probability model. Standard errors are clustered by state of residence and reported in parentheses. +,*, and ** represent statistical significance at the 10,5, and 1% levels respectively. Maternal Age at Conception dummies included for each year of age (age 14 omitted). Birth controls include male infant and four plurality categories (twins, triplets or more, and plural birth information missing, with singleton omitted). Notification refers to the requirement that young women obtain parental notification or parental consent to undergo an abortion in the state of residence and year of conception.

Table 9: Relationship between MLDA and Maternal Drinking Before Birth

Births Conceived 1978-1987 Among Women Aged 14-24, Native White and Native Black Women

	I	II	III	IV	V	VI
	All Women		Native White Women		Native Black Women	
Dependent Variable: Drank 12 Months Prior to Birth	*(mean=0.40)*		*(mean=0.46)*		*(mean=0.31)*	
MLDA 18	-0.072*	-0.076*	-0.086*	-0.083+	-0.086	-0.080
	(0.034)	(0.034)	(0.042)	(0.043)	(0.063)	(0.065)
MLDA is 18*Mother is ≤ 17	-0.002	0.003	-0.004	-0.010	0.064	0.053
	(0.037)	(0.036)	(0.054)	(0.047)	(0.072)	(0.071)
MLDA is 18*Mother is 18-20	0.063*	0.052+	0.050	0.045	0.105+	0.091+
	(0.031)	(0.029)	(0.047)	(0.042)	(0.053)	(0.053)
State of Residence Fixed Effects	yes	yes	yes	yes	yes	yes
Year Prior to Birth Fixed Effects	yes	yes	yes	yes	yes	yes
Age 12 Months Prior to Birth Fixed Effects	yes	yes	yes	yes	yes	yes
Individual Controls		yes		yes		yes
State-Specific Linear Time Trends	yes	yes	yes	yes	yes	yes
Number of Observations	3,910	3,910	2,536	2,536	1,167	1,167
R-squared	0.08	0.13	0.10	0.15	0.11	0.12

Note: Linear probability model. Standard errors are clustered by state of residence and reported in parentheses. +, *, ** represent statistical significance at the 10, 5, and 1% levels respectively. Each birth represents a separate observation. Samples include Hispanic and non-Hispanic women. Maternal Age 12 Months Prior to Birth dummies included for each year of age (age 14 omitted). Individual controls include three race/ethnicity/nativity categories (Native Born Black, Immigrant, Hispanic, with Native Born White omitted), Age-adjusted AFQT Score, Respondents' Mothers' and Fathers' Education, Respondent Lived With Both Parents at 18, and missing indicators for all controls.

Table 10: Relationship between MLDA and Timing of First Sex

Births Conceived 1978-1987 Among Women Aged 14-24, Native White and Native Black Women

	I	II	III	IV	V	VI
	All Women		Native White Women		Native Black Women	
Dependent Variable: First Sex This Month	*(mean=0.00514)*		*(mean=0.00518)*		*(mean=0.00499)*	
MLDA 18	-0.002+	-0.002+	-0.002*	-0.002*	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
MLDA is 18*Mother is $\leq$17	0.003+	0.003+	0.001	0.001	0.004	0.004
	(0.002)	(0.002)	(0.001)	(0.001)	(0.003)	(0.003)
MLDA is 18*Mother is 18-20	0.002*	0.002*	0.002	0.002	0.003+	0.003+
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
State of Residence Fixed Effects	yes	yes	yes	yes	yes	yes
Year Fixed Effects	yes	yes	yes	yes	yes	yes
Age Fixed Effects	yes	yes	yes	yes	yes	yes
Individual Controls		yes		yes		yes
State-Specific Linear Time Trends	yes	yes	yes	yes	yes	yes
Number of Observations	285,709	285,709	208,104	208,104	64,301	64,301
R-squared	0.01	0.01	0.01	0.01	0.01	0.01

Note: Linear probability model. Standard errors are clustered by state of residence and reported in parentheses. +, *, ** represent statistical significance at the 10, 5, and 1% levels respectively. Each birth represents a separate observation. Samples include Hispanic and non-Hispanic women. Age of Woman This Month dummies included for each year of age (age 14 omitted). Individual controls include three race/ethnicity/nativity categories (Native Born Black, Immigrant, Hispanic, with Native Born White omitted), Age-adjusted AFQT Score, Respondents' Mothers' and Fathers' Education, Respondent Lived With Both Parents at 18, and missing indicators for parents' education, both parents at 18, race/ethnicity/nativity status.

Table 11: Relationship between MLDA and Prenatal Drinking Behavior

Births Conceived 1978-1987 Among Women Aged 14-24, Native White and Native Black Women

	I	II	III	IV	V	VI
	All Women		Native White Women		Native Black Women	
Dependent Variable: Drank during Pregnancy	*(mean=0.33)*		*(mean=0.38)*		*(mean=0.25)*	
MLDA 18	-0.022	-0.025	-0.057	-0.065	-0.005	-0.007
	(0.026)	(0.027)	(0.036)	(0.039)	(0.042)	(0.042)
MLDA is 18*Mother is ≤17	-0.045	-0.037	-0.083	-0.082	0.046	0.040
	(0.048)	(0.045)	(0.064)	(0.063)	(0.054)	(0.052)
MLDA is 18*Mother is 18-20	0.064	0.066+	0.026	0.037	0.143+	0.141*
	(0.039)	(0.039)	(0.050)	(0.049)	(0.072)	(0.068)
State of Residence Fixed Effects	yes	yes	yes	yes	yes	yes
Year Six Months Prior to Birth Fixed Effects	yes	yes	yes	yes	yes	yes
Age Six Months Prior to Birth Fixed Effects	yes	yes	yes	yes	yes	yes
Individual Controls		yes		yes		yes
State-Specific Linear Time Trends	yes	yes	yes	yes	yes	yes
Number of Observations	3,910	3,910	2,536	2,536	1,167	1,167
R-squared	0.08	0.11	0.10	0.14	0.11	0.11

Note: Linear probability model. Standard errors are clustered by state of residence and reported in parentheses. +, *, ** represent statistical significance at the 10, 5, and 1% levels respectively. Each birth represents a separate observation. Samples include Hispanic and non-Hispanic women. Maternal Age Six Months Prior To Birth dummies included for each year of age (age 14 omitted). Individual controls include three race/ethnicity/nativity categories (Native Born Black, Immigrant, Hispanic, with Native Born White omitted), Age-adjusted AFQT Score, Respondents' Mothers' and Fathers' Education, Respondent Lived With Both Parents at 18, and missing indicators for parents' education, both parents at 18, race/ethnicity/nativity status.

Table A: Understanding Age Specific Time Trends

Births Conceived 1978-1988 Among Women Aged 14-24, Native White Women							
	I	II	III	IV	V	VI	VII
				Native White Women			
Dependent Variable: Low Birth Weight				*(mean=0.061)*			
MLDA is 18	-0.0007	-0.0007+	-0.0007	-0.0008+	-0.0008	-0.0007	-0.0008
	(0.0005)	(0.0004)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
MLDA is 18*Mother is $\leq$17	0.0023+	0.0019+	0.0021+	0.0025+	0.0023+	0.0022+	0.0025*
	(0.0013)	(0.0011)	(0.0012)	(0.0013)	(0.0013)	(0.0012)	(0.0012)
MLDA is 18*Mother is 18-20	0.0012+	0.0012*	0.0011+	0.0014*	0.0012+	0.0014*	0.0015*
	(0.0006)	(0.0005)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)
Birth Characteristics	yes	yes	yes	yes	yes	yes	yes
Beer Taxes *Age Categories		yes					
Cigarette Taxes *Age Categories			yes				
Parental Notification*Age Categories				yes			
Parental Consent*Age Categories					yes		
Age-Group Specific Birth Rate						yes	
Log (Age-Group Specific Birth Rate)							yes
State of Residence Fixed Effects	yes	yes	yes	yes	yes	yes	yes
Year of Conception Fixed Effects	yes	yes	yes	yes	yes	yes	yes
Age at Conception Fixed Effects	yes	yes	yes	yes	yes	yes	yes
State-Specific Linear Time Trends	yes	yes	yes	yes	yes	yes	yes
Number of Observations	11,426,203	11,426,203	11,426,203	11,426,203	11,426,203	11,426,203	11,426,203
R-squared	0.07	0.07	0.07	0.07	0.07	0.07	0.07

Linear probability model. Standard errors are clustered by state of residence and reported in parentheses. +,*, and ** represent statistical significance at the 10,5, and 1% levels respectively. Maternal Age at Conception dummies included for each year of age (age 14 omitted). Birth controls include male infant and four plurality categories (twins, triplets or more, and plural birth information missing, with singleton omitted). Beer tax variables include real beer taxes and an indicator for missing beer tax data. Cigarette tax variables include real cigarette taxes and an indicator for missing cigarette tax data. Parental notification includes an indicator for the presence of a parental notification or consent law and an indicator for missing data. Parental consent includes an indicator for the presence of a parental consent law an an indicator for missing data. Age-group specific birth rate is specific to age in years at conception and estimated separately for native white women and native black women.

Table B: Understanding Age Specific Time Trends

Births Conceived 1978-1988 Among Women Aged 14-24, Native Black Women

	I	II	III	IV	V	VI	VII
				Native Black Women			
Dependent Variable: Low Birth Weight				*(mean=0.130)*			
MLDA is 18	-0.0041*	-0.0020	-0.0041*	-0.0042*	-0.0043*	-0.0042*	-0.0042*
	(0.0018)	(0.0016)	(0.0018)	(0.0017)	(0.0018)	(0.0018)	(0.0018)
MLDA is 18*Mother is $\leq$17	0.0099**	0.0049**	0.0100**	0.0101**	0.0102**	0.0099**	0.0099**
	(0.0025)	(0.0018)	(0.0024)	(0.0024)	(0.0024)	(0.0025)	(0.0025)
MLDA is 18*Mother is 18-20	0.0059**	0.0031*	0.0059**	0.0060**	0.0060**	0.0059**	0.0058**
	(0.0015)	(0.0014)	(0.0014)	(0.0015)	(0.0015)	(0.0015)	(0.0015)
Birth Characteristics	yes	yes	yes	yes	yes	yes	yes
Beer Taxes *Age Categories		yes					
Cigarette Taxes *Age Categories			yes				
Parental Notification*Age Categories				yes			
Parental Consent*Age Categories					yes		
Age-Group Specific Birth Rate						yes	
Log (Age-Group Specific Birth Rate)							yes
State of Residence Fixed Effects	yes	yes	yes	yes	yes	yes	yes
Year of Conception Fixed Effects	yes	yes	yes	yes	yes	yes	yes
Age at Conception Fixed Effects	yes	yes	yes	yes	yes	yes	yes
State-Specific Linear Time Trends	yes	yes	yes	yes	yes	yes	yes
Number of Observations	3,032,108	3,032,108	3,032,108	3,032,108	3,032,108	3,031,736	3,031,736
R-squared	0.06	0.06	0.06	0.06	0.06	0.06	0.06

Linear probability model. Standard errors are clustered by state of residence and reported in parentheses. +,*, and ** represent statistical significance at the 10,5, and 1% levels respectively. Maternal Age at Conception dummies included for each year of age (age 14 omitted). Birth controls include male infant and four plurality categories (twins, triplets or more, and plural birth information missing, with singleton omitted). Beer tax variables include real beer taxes and an indicator for missing beer tax data. Cigarette tax variables include real cigarette taxes and an indicator for missing cigarette tax data. Parental notification includes an indicator for the presence of a parental notification or consent law and an indicator for missing data. Parental consent includes an indicator for the presence of a parental consent law an an indicator for missing data. Age-group specific birth rate is specific to age in years at conception and estimated separately for native white women and native black women.