Graduated Driver Licensing and Teen Fertility

Monica Deza[1]

Abstract

This paper evaluates the effect of implementing nighttime driving curfews and passenger restrictions mandated by graduated driver licensing (GDL) on teen fertility. Both components of GDL potentially restrict the freedom and mobility of minor drivers by requiring adult supervision. Using birth data from the National Vital Statistics NVSS and a triple differences estimation, I find that the implementation of GDL decreased fertility by 4% among mothers between the ages of 16 and 18, relative to women who were not affected by GDL at the time of conception. This effect is driven by the states that require driving curfews for at least a year before teenagers can obtain their unrestricted drivers license.

JEL: J1 J13 J18 R00

Keywords: teen pregnancy, fertility, risky sex, graduated driver licensing

[1] University of Texas at Dallas. Corresponding author: monica.deza@utdallas.edu

I.INTRODUCTION

Unintended pregnancies have high social costs and are associated with negative outcomes for both the mother and the children. In particular, children that result from unintended pregnancies are less likely to receive prenatal care, less likely to be breastfed and are more likely to engage in delinquent behavior (Thomas, 2012).

In addition to presenting these correlations, previous literature has also provided vast evidence of the negative consequences of teen motherhood by exploiting exogenous changes in policies that either change the cost of prevention (e.g. access to birth control) or change the cost of termination (e.g. access to abortion). In particular, decreasing unintended pregnancies through these policies leads to positive maternal outcomes such as higher educational attainment and higher attachment to the labor force (Ananat and Hungerman, 2012; Goldin and Katz, 2002; Bailey, 2006) and results in a birth cohort which is less likely to live in poverty, less likely to die as an infant (Gruber, Levine and Staiger, 1999) and is less likely to be be a welfare participant (Ananat et al, 2009; Gruber, Levine and Staiger, 1999).

Relying on the assumption that miscarriage is exogenous, previous literature argues that teen mothers have higher levels of employment and earnings than women whose childbearing was delayed through miscarriage (Hotz et al, 2005; Hotz et al, 1997). Given that teenagers who face a higher cost of unintended pregnancies are more likely to have an abortion, teens who continue the pregnancy and hence are at risk for miscarriage are unfavorably selected from the set of pregnant teens, which indicates that miscarriage is indeed endogenous (Ascraft et al., 2013; Fletcher, 2012; Fletcher and Wolfe, 2009; Lang and Weinstein, 2013). Research that takes into account the non-randomness of miscarriage in the presence of abortion finds that teen fertility in fact had negative effects on educational attainment (Fletcher and Wolfe, 2009; Ashcraft et al, 2013; Lang and Weinstein, 2013) and earnings (Fletcher and Wolfe, 2009). Since miscarriage is more likely to be random in the absence of abortions (Ashcraft et at. 2013), Lang and Weisman (2013) finds particularly large adverse effects of teen pregnancies on education when studying a period when most abortions were illegal and birth control access was limited.

Because approximately 75% of all teen births are unintended (Finer and Henshaw, 2006), policy makers are concerned with understanding the determinants of teen fertility. Despite teen birth rates reaching a historic low in 2015 at 22 births per 1000 women after a 60% decline since 1990[2], the United States still has a higher teen fertility rate than other industrialized countries.

Given the little evidence that abstinence only sex education programs influence teen sex behavior (Kirby, 2001; Threhold et. Al, 2008; Sabia, 2006), policy makers need to contemplate policies beyond these traditional school-based programs. While only atypical programs such as such as long-term repeated intensive abstinence-only or comprehensive based sex education courses may have an effect on teen fertility, the typical school-based sex education program has no effects (Sabia, 2006).

Unlike sex education programs, policies that increase access to birth control have a modest-sized effect on teen fertility. In particular, changes in Medicaid policy that expanded access and provided waivers for family planning reduced teen births by 4% by increasing contraceptive use (Kearney and Levine, 2009). Unlike Medicaid expansion

---

[2] http://www.cdc.gov/teenpregnancy/about/index.htm,
http://thenationalcampaign.org/data/landing

policies, providing over-the-counter access to emergency contraception increased single motherhood rates, increased STD rates, increased the number of lifetime sexual partners and decreased cohort marriage rates (Zuppann, 2012). These negative consequences were only accompanied by a modest-sized decreased in teen fertility not larger than 2%, as these laws only changed the venue from obtaining emergency birth control from emergency rooms to obtaining them over the counter (Gross, Lafortune and Low, 2014). In addition, this change in venue results in a lower probability of reporting rape (Gross, Lafortune and Low, 2014),

A particularly effective policy that was aimed at increasing the cost of teen motherhood is the 1996 changes in welfare programs that require teen mothers to live with a parent or guardian and enroll in high school to receive welfare benefits. Such increase in the cost of teen motherhood resulted in a 22% decrease in teen fertility rate (DeLeire and Lopoo, 2006)

Another way to combat unwanted births is by providing access to abortion. Haas-Wilson (1993) presents descriptive analysis that compares states with and without three state abortion laws that were implemented by 1988 and concludes that abortion rates are lower in states that restrict Medicaid funding relative to states that do not. While the recent implementation of parental involvement laws (PIL)[3] increase the cost of abortion, Sabia and Anderson (2016) find that parental involvement laws (PIL) that require parental permission before a minor obtains an abortion increase the probability that sexually active teen females use birth control with no effect on abstinence decisions.

---

[3]Parental involvement laws require parental permission before a minor obtains an abortion

While the previous literature has been interested in determining the potential determinants of teen births, the role of adult and parental supervision has been ignored. A potential determinant of teen fertility could be changes in the amount of parental or adult supervision as well as changes in nighttime mobility. In 1996, Florida was the first state to implement Graduated Driver Licensing (GDL) laws, which impose an intermediate driving phase prior to transitioning into an unrestricted driver license for teenagers who obtain their license for the first time. As of today, all 50 states and the District of Columbia had implemented GDL. The intermediate phase imposes two restrictions. First, it imposes a nighttime driving curfew and only allows teenagers to drive at night with adult supervision. Second, it imposes restrictions on the number of minor passengers, hence decreasing the probability of teenagers being unsupervised in a car.

This study evaluates the extent to which imposing limitations on the amount of unsupervised driving among teenagers affects teen fertility[4]. Using data from the National Vital Statistics and using a triple differences approach, this study finds that the implementation of graduated driver licensing decreased teen fertility by 4% among teenagers relative to young adults[5]. The findings can be summarized as follows. First, GDL only reduced teen fertility in states that required the intermediate phase for longer before obtaining the unrestricted driver license. Second, 16-year old females experienced the largest decrease in fertility in response to GDL. Third, the curfew component of GDL was more effective at decreasing teen fertility than the passenger restrictions. Finally, these results remain robust across specifications and definitions of treatment and control

[4] Deza and Litwok (2016) find that the implementation of GDL decreased juvenile crime by six percent among 16 and 17 year old teenagers.
[5] I also present evidence that this decrease in teen fertility was not driven by an increase in teen abortion rates using data from the CDC in Table A8.

groups. I also estimate an event study, which indicates that GDL implementation was not preceded by a particular trend in teen fertility.

Relative to the existing literature, this paper makes the following contributions. First, to the best of my knowledge, this is the first study to consider the effects of graduated driver licensing on teen fertility. Second, this paper evaluates whether the effects were heterogeneous by age and also by how strict GDL laws were in a particular state. Third, this paper exploits the variation in the timing of adoption of each component of GDL (curfews versus passenger restrictions) to compare the effectiveness of each component. Most importantly, this study contributes to the literature by identifying GDL as a new tool to fight teen fertility.

GDL provides an interesting quasi-experiment of a policy that was not aimed at affecting fertility, and yet resulted in effects comparable to more controversial and more costly policies that were originally aimed at decreasing teen fertility. The effects of GDL of approximately 4%-6% reduction in teen fertility are large relative to the 4% decrease in teen fertility that resulted from expanded access to waivers for family planning services trough Medicaid (Kearney and Levine, 2009) and also large relative to the 2% decrease in teen fertility that resulted from expanded over-the-counter access to emergency birth control (Gross, Lafortune and Low, 2014). If teenagers are less likely to become teen mothers while subject to GDL, previous cost-benefit analyses of GDL implementation underestimate the full benefits of GDL.

The remainder of the paper is organized as follows. I describe the data in Section 2 and discuss the methodology in Section 3. I discuss the results and robustness checks in section 4. Section 5 summarizes and concludes.

II.DATA

I obtain the dates of GDL implementation from the Insurance Institute for Highway Safety (IIHS) which reports the dates of implementation of the nighttime driving curfews, the dates of implementation of the restrictions on the number of minor passengers, as well as specific features of the policies such as the time at which the curfews start or the specific number of passengers that one can have in a car at the time.

Table 1 presents a summary of the GDL implementation dates and corresponds to Table 1 from Deza and Litwok (2016). The second column presents the date of GDL enactment corresponding to Table 1 of Dee, Grabowski and Morrisey (2005). GDL enacted both a nighttime driving curfew and a restriction on the number of minor passengers, which dates of implementation are reported in the third and fourth column respectively. The third column reports the date of GDL driving curfew implementation only for states that did not have a driving curfew prior to GDL enactment. While Florida was the first state to implement GDL in 1996, there were a few states such as Massachusetts that had unrelated nighttime driving restrictions prior to GDL implementation. While most states implemented both components of GDL (driving curfews and passenger restrictions) simultaneously, the following thirteen states implemented them both as part of the GDL program but implemented them at different times: Colorado, Connecticut, Maine, Michigan, Missouri, Nebraska, Nevada, New Hampshire, North Carolina, Ohio, Rhode Island, Utah and Virginia[6].

---

[6] For instance, Maryland implemented driving curfews before 1995 and implemented passenger restrictions in 2005. Even though curfews and passenger restrictions were implemented at different times, I do not count Maryland as one of the 13 states that implemented both components at different times because these driving curfews were not implemented as part of GDL.

With the exception of six states, the minimum age in which teenagers can enter the intermediate phase of GDL is age 16.[7] Because GDL only mandates the amount of time one must be in the intermediate phase before obtaining an unrestricted driver license without requiring teens to enter the intermediate phase at a particular age, there is substantial variation in the minimum age in which the nighttime driving restrictions may be lifted. Let us focus on Alaska as an example. In Alaska, one must be at least 16 years old to enter the intermediate phase and must be in the intermediate phase for at least 6 months prior to obtaining an unrestricted driver license. Therefore, in Alaska, teens can obtain a driver license at age 16 years and 6 months at the youngest. However, nothing stops them from delaying their application for a driver license. If a teen in Alaska was to obtain a driver license at age 17, he or she still has to abide by the intermediate phase for 6 months prior to obtaining their unrestricted driver license and hence would obtain their unrestricted driver license at age 17 years and 6 months. For the remaining of the paper, I define "tough GDL" laws as states that require the intermediate phase for at least a year. In most states where the minimum age in which an individual can enter the intermediate phase is 16, the minimum age in which they can obtain an unrestricted license in a "tough GDL" stat is at age 17. I define "non-tough" GDL as states that only require the intermediate phase for less than 12 months.

[7] GDL implementation does not affect the age in which teenagers are able to obtain a driver license. GDL only replaces the unrestricted driver license that teenagers were able to obtain (mostly) at age 16 with the restricted or intermediate stage driver license. As of today, only five states allow teenagers to begin the intermediate stage of GDL prior to age 16 (i.e. Idaho, Montana, New Mexico, South Carolina, and South Dakota) and only one state (i.e. New Jersey) does not allow them to begin the intermediate stage of GDL until age 17. For more information, see the following link http://www.iihs.org/iihs/topics/laws/graduatedlicenseintro?topicName=teenagers

For this analysis, I use birth counts by state and age for all women from the National Vital Statistics System (NVSS). The National Vital Statistics System (NVSS) reports registered births at the state level, which is collected and disseminated by the National Center for Health Statistics (NCHS). For this study, I use NVSS data over the 1995-2013[8] period. The advantage of the NVSS is that it represents the universe of women who give birth. A limitation of this data is that it does not provide birth rates, for which we would need information on the number of women in fertile age by state and year. The National Center for Health Statistics (NCHS) collaborates with states to complete a Federal compilation of state level compilation of all births from the birth certificates. The NVSS obtains data from birth certificates such as the age of the mother, state of birth of the newborn, and some health indicators at birth such as birth weight, birth complications, labor complications and some prenatal measures. I obtain population counts by gender, age, state and year from the bridged-race population estimates[9], which is produced by the U.S. Census Bureau in collaboration with the National Center for health Statistics (NCHS).

Figure 1 shows the number of births per thousand women between 1995 and 2014 for women between the ages of 16 and 20. Interestingly, teen fertility rates decreased slightly more than the fertility rate among young adult women between 1995 and 2013. For instance, the number of births per thousand women decreased from 31.8 in 1995 to 10.8 in 2013 among 16 year olds (66% decrease), decreased from 53 in 1995 to 20 in 2013 among 17 year olds (62% decrease), and from 74 in 1995 to 37 in 2013 among 18

[8] I use the restricted version of the data for years 2005 and after because geographic identifiers were only available in the public data until year 2004.
[9] https://wonder.cdc.gov/controller/datarequest/D9

year olds (50% decrease). The decrease was not as drastic for young adult females. For instance, the number of births per thousand women decreased from 92.3 in 1995 to 58 in 2013 among 19-year olds (37% decrease), decreased from 99 in 1995 to 71 in 2013 among 20 year olds (28% decrease), decreased from 104 to 77 among 21 year olds (25% decrease), decreased from 111 to 84 among 22 year olds (24% decrease), from 110 to 89 among 23 year olds (19% decrease) and from 110 to 96 among 24 year olds (12% decrease). This study explores the role that GDL played in decreasing teen fertility during this period.

Panel A provides a description of maternal characteristics for three different age groups: 16-18, 19-20, and 21-24 for every state from 1995 to 2013 and results in 969 state-year cells[10]. The summary statistics can be summarized as follows: First, the number of births per 1000 women increases with age from 38 for 16-18 year-old mothers to 104 for 21-24 year-old mothers. Second, the number of prenatal visits increases slightly with age from 10.3 among 16-18 year-old mothers to 11.08 among 21-24 year-old mothers. Third, birth weight increases with age as well from 3167 grams among children of 16-18 year-old mothers to 3262 grams among children of 21-24 year-old mothers. Finally, weight gain during pregnancy decreases with age from 32.9 lbs among 16-18 year-old mothers to 30.9 among 21-24 year-old mothers.

Because several laws aimed at decreasing unplanned pregnancies were implemented during the period of study, I control for whether the following six policies were in place for at least four months in a particular state and year: (1) Zero Tolerance

---

[10] 19 years and 51 states

Laws[11], (2) Parental Involvement Laws[12], (3) Medicaid subsidized contraception[13], (4) Over the counter access to emergency birth control[14], (5) AFDC waivers and (6)TANF waivers[15]. Panel B indicates the share of state-year cells that are affected by each of these laws.

If teenagers are more likely to engage in sexual activities at night or outside the parents' home, we would expect curfews that keep them at home in the evenings to be effective at decreasing teen sex. Similarly, if female teenagers are more likely to engage in sexual activity with males older than 18 and also if these men are the only drivers while the women are affected by the curfews, we would expect curfews to not be so

[11] Zero Tolerance laws set low legal blood alcohol limits for individuals under the age of 21 and they were implemented between 1990 and 1998. The author is grateful to Christopher Carpenter for providing the exact dates of ZT laws implementation

[12] Parental Involvement Laws (PIL) require parental permission in a minor's decision to abort a pregnancy. I use the dates of PIL implementation presented in Table 1 of Levine (2003), which indicates that they were implemented between 1979 and 2001.

[13] Table 1 of Kearney and Levine (2009) report the dates of implementation for Medicaid subsidized contraception (i.e. family planning waivers), which indicates that they were implemented between 1994 and 2007. Because some of these states restrict the waivers to individuals age 19 or older, I only use the implementation dates for states where the waivers affect teenagers.

[14] I obtain the dates corresponding to over-the-counter pharmacy access laws for emergency contraception from Table 1 in Zuppann (2011). These laws enabled individuals to purchase emergency contraception from over-the-counter in pharmacies without prescription or without obtaining them from an emergency care center. Zuppann (2011) provides implementation dates for nine states only between years 1998 and 2006. These implementation dates correspond to "Pharmacy-access law" stated in Table 1 from Gross, Lafortune and Low (2014).

[15] Following DeLeire and Lopoo (2006), I obtain the implementation dates of AFC and TANF from http://aspe.hhs.gov/hsp/Waiver-Policies99/Table_A.PDF. The AFDC waivers were implemented between 1992 and 1997 while TANF was implemented between 1996 and 1998. States made changes in their welfare programs to reduce teen childbearing by restricting access to TANF and AFDC unless teen mothers lived with a guardian and were enrolled in school. Both TANF and AFDC are welfare programs and their main difference is that TANF includes strict work requirements for recipients, unlike AFDC which is more of an entitlement (Lopoo, Deleire, 2006)

effective at decreasing teen sex. Unfortunately, we do not have data on location and time of most recent sexual experience or driving patterns. Fortunately, the National Longitudinal Survey of Youth 1997 (NLSY97), which collects self-reported longitudinal information regarding sexual activity for a sample of 8984 adolescents between the ages of 12 to 18 in 1997, asks respondents to report details about their first sexual experience such as the age, location and time of day in which the event occurred. Even though this only applies to their first sexual encounter, these summary statistics shed some light about patterns that could potentially apply sexual behavior overall.

The summary statistics presented in Table 3 indicate that 44% of teenagers had their first sexual experience after 10pm and this probability remains similar for boys and girls. On the other hand, only 5% of teenagers had their first sexual experience before noon, 9% between 12pm and 3pm, 14% between 3pm and 6pm, and 26% between 6pm and 10pm. Panel B of Table 3 indicates that having sex in their family home is unlikely for females. Only 17% of females that los their virginity between ages 16 and 17 had sex for the first time in their family home, which indicates that sexual intercourse is more likely to occur outside the family home (e.g. partner's home, friend's home, car, hotel, motel, outdoor place). It is also more likely for 16-17 year old female teenagers to have sex at their partner's family home (35%) than it is to have sex at their own family home, which is consistent with females being more supervised at home than males.

A potential mechanism for GDL to decrease teen pregnancies is if the nighttime curfews keeps girls between the ages of 16 and 17 at their parents' home during the hours in which they are likely to engage in sexual activity. While GDL could potentially affect the probability of having a child for 16-17 year old boys, the age of the father is often missing in teen births, and hence this study focuses on how being subject to the GDL-related nighttime curfews affects the fertility of 16-17 year old girls who are subject to GDL.

Panel C of Table 3 indicates that the among teenagers that had sex for the first time under age 16, 86% of them had a partner of age 18 or younger, while 79% of teenagers that had sex for the first time between the ages of 16 and 17 had a partner of age 18 or younger. These shares are higher for men and lower for women, since men are more likely to have their first sexual experience with a younger partner than females. In particular, 90% of males who had sex for the first time between the ages if 16 and 17 had a partner of age 18 or younger while 70% of females who had sex for the first time between the ages of 16 and 17 had a partner of age 18 or younger. The average age of the sexual partner of females that have their first sexual experience prior to age 16 (and hence are already sexually active when affected by GDL) is 17 years of age. However, the age of the sexual partner is only relevant to the extent that the partner drives the female to and from home while she is under the GDL curfews, which may not be as prevalent.

III.METHODS

Triple Differences, Homogeneous Effects

Because GDL only affects individuals between the ages of 16-17 without imposing any restriction on individuals of age 18 or older, GDL allows researchers to evaluate the effect of the implementation on teenagers relative to young adults in the same state. Being able to compare young adults with teenagers in the same state and year enables me to control for unobserved state-year changes that may be correlated with

GDL, which is particularly important during a period were several state-level policies were implemented to decrease teen pregnancies. Given that the treatment and control groups are clearly defined and there was heterogeneity in the timing of implementation across states, I follow Dee, Grabowski and Morrisey (2005) and Deza and Litwok (2015) and use a triple differences estimation strategy.

The nighttime driving curfews apply to teenagers who obtain their license for the first time between ages 16 and 18, but depending on the state, one may transition into a full privileges driver license as early as 16 years and 6 months or as long as 18 years of age. Because conceptions that occur while the mother is in the intermediate phase of GDL (i.e. ages 16-17) result in births between ages 16 to 18, I define the treatment group in the main specification as mothers between the ages of 16 and 18.

The control group in the main specification is composed of individual between the ages of 19 and 24[16]. As an alternative specification, I exclude 16 year-old mothers because some of those pregnancies occurred at age 15 or 18-year old mothers because some of those conceptions occurred at age 18, and the results remain robust. More formally, I estimate the following triple differences model.

$$\ln(Y_{ast}) = \alpha_0 + \beta_1 Treat_a + \beta_2 Post_{st} + \beta_3 Treat_a Post_{st} + \beta_4 X_{st} + \gamma_t + +\gamma_{as} + \gamma_a * t + \gamma_s * t + \varepsilon_{ast} \quad (1)$$

The dependent variable is the natural logarithm of the counts of births per 1000 mothers of age a in state s in year t. I define $Treat_a$ as an indicator for whether age a is between ages 16 and 18, $Post_{st}$ is an indicator for whether GDL has been implemented

16 Table A1 and Table A2 show estimates where the control groups are composed of individuals of ages 19-20 and ages 19-21, respectively. The fact that the results remain robust to the inclusion of 21-year old mothers indicates there the effects are not being driven only by women older than 21.

in state s for at least 4 months in year t. The vector X_{st} is composed of indicators for whether Zero Tolerance (ZT), Parental Involvement Laws (PIL), Medicaid subsidized contraception , over-the-counter access to emergency birth control, AFDC waivers, and TANF waivers[17] were implemented in state s for at least 4 months in year t. I also control for state level unemployment rate ($Urate_{st}$).

The parameter of interest is β_3 , which measures the change in fertility among mothers between the ages of 16-18 relative to mothers in the control group following the passage of GDL. The parameter β_1 measures the difference in fertility between mothers in the treatment and control group, regardless of whether GDL is implemented. Finally, β_2 measures whether fertility is different after the implementation of GDL for mothers regardless of their age.

Following Dee, Grabowski and Morrisey (2005), Deza and Litwok (2015) and (Barreca & Page, 2015), I include state-specific age effects (γ_{as}), age-specific linear trends ($\gamma_a * t$), and state-specific linear trends ($\gamma_s * t$). The age-specific linear trends ($\gamma_a * t$) are crucial to the identification of β_3 as it controls for potential convergence in birth rates among mothers of different ages over time (Barreca, Page, 2015)[18]. In addition, including age by state fixed effects (γ_{as}) controls for potential differences in

[17] The data section provides information for the source of those dates and a brief explanation of the goal of each policy.

[18] Figure A1 displays the raw trends in birth rates by the number of year elapsed since GDL implementation. Even though I show in Figure A1 that treatment and control groups follow similar trends in birth rates prior to the implementation of GDL, including these age-specific trends formally takes into account any potential convergence that may arise slightly prior to the implementation. In addition, Figure 1 showed that teen births decreased at a slightly faster rate than birth rates among young adults. Thus, including these age-specific trends are crucial for β_3 to be well identified.

fertility rates between treatment and control group that are correlated with GDL, which would be the case if states that implemented GDL earlier implemented simultaneously other policies to reduce teen births. In such case, including age by state fixed effects (γ_{as}) takes care of differences in birth rates across states that are correlated with state's MLDA policies. The state-specific linear trends ($\gamma_s * t$) control for state-specific unobservables that vary linearly within state and may be correlated with GDL. Finally, I weight this regression by the number of females in the relevant age category that reside in state s in year t and cluster the standard errors at the state level.

In order to relax the assumption that GDL affects fertility of teen mothers between the ages of 16 to 18 homogeneously, I allow for GDL to affect the fertility of 16, 17 and 18 year olds differentially relative to the control group, by replacing $\mathrm{Treat_a}$ with three indicators ($Treat_{a=16}$, $Treat_{a=17}$ and $Treat_{a=18}$)[19].

Finally, I also evaluate whether the nighttime driving restrictions or the passengers restriction were more effective at changing fertility using the subsample of states that implemented the driving curfews at a different year than the passenger restriction component. For this specification, I replace $\mathrm{Post_{st}}$ with $\mathrm{Post\_Curf_{st}}$, $\mathrm{Post\_Pass_{st}}$, and $\mathrm{Post\_Both_{st}}$ to separately identify the effect of the nighttime driving curfew and the passenger restrictions[20].

---

[19] That is, I estimate equation1 after replacing:
$\beta_1 Treat_a$ with $\beta_1^{a=16} Treat_{a=16} + \beta_1^{a=17} Treat_{a=17} + \beta_1^{a=18} Treat_{a=18}$
and $\beta_3 Treat_a Post_{st}$ with $\beta_3^{a=16} Treat_{a=16} Post_{st} + \beta_3^{a=17} Treat_{a=17} Post_{st} + \beta_3^{a=18} Treat_{a=18} Post_{st}$

[20] That is, I replace $\beta_2 \mathrm{Post_{st}}$ with $\beta_2^{curf} \mathrm{Post\_Curf_{st}} + \beta_2^{pass} \mathrm{Post\_Pass_{st}} + \beta_2^{both} \mathrm{Post\_Both_{st}}$ and I replace $\beta_3 \mathrm{Treat_a Post_{st}}$ with $\beta_3^{curf} \mathrm{Treat_a Post\_Curf_{st}} + \beta_3^{pass} \mathrm{Treat_a Post\_Pass_{st}} + \beta_3^{both} \mathrm{Treat_a Post\_Both_{st}}$

Event Study

Previously, we have relied on variation in the date of GDL implementation to identify the effects of driving curfews on teen fertility. In order to credibly estimate the treatment effects of GDL we must provide evidence that the laws were not enacted in response to state-specific trends in teen fertility. Estimating an event study formally tests whether GDL was implemented endogenously in response to already-existing changes in state-specific fertility trends, in addition to recovering the dynamic effects of its implementation (Kline, 2012).

I estimate the following dynamic model where the dependent variable Y_{ast} is the counts of births per 1000 women of age a in state s in year t. The variables γ_s, γ_t represent the state and year effects, respectively, and $\gamma_s * t$ is the state-specific linear trends. The standard errors are clustered at the state level. The vector of controls X_{st} is defined as before. I estimate the following equation with and without state-linear trends.

$$\ln(Y_{ast}) = \alpha + \sum_j \beta^j I[D_{st}^j = 1] + \beta_4 X_{st} + \gamma_s + \gamma_t + \gamma_s * t + \varepsilon_{ist} \quad (2)$$

The coefficients of interest are β^j. I define D^j as a dummy variable that has the value of 1 when GDL enactment occurred j years ago in state s as of year t. Because there is heterogeneity in the year of implementation, we have an unbalanced panel in the number of years before and after GDL enactment. Hence, estimating an event study that includes a long period of event dummies would give unequal weight to states that enacted curfews early or late (Kline, 2012). To overcome this challenge, I restrict the analysis to state-year cells that are within 8 years of GDL implementation and impose the endpoint restrictions for state-year cells that are six or more years away from the year of GDL implementation. After placing these restrictions, I identify the effect of GDL implementation in teen fertility within six years of implementation off of a nearly balanced panel of states (Kline, 2012) .

I normalize β^{-2} to zero and therefore all parameters β^{j} should be interpreted as the increase or decrease in the natural logarithm of number of births per 1000 women between the ages of 16 and17 relative to two years before GDL implementation. While it is unlikely that GDL was enacted in response to state-specific teen fertility trends in the pre-GDL period since its ultimate goal was to promote traffic safety, it is still important to formally test that the timing of GDL implementation is exogenous. Testing that β^{j}=0 for j<0 implies that GDL enactment is not preceded by trends in state-specific trends in teen fertility (Kline, 2012) and hence our estimate recover dynamics of the impact of curfew enactment.

Event study formalizes the idea that teenagers who, in 1998, resided in a state that implemented GDL nighttime curfews in 1996 are in the same position as teenagers who, in 2000, resided in a state that implemented GDL nighttime driving curfews in 1998 (Deza and Litwok 2016).

<u>Differences-in-Differences</u>

As a robustness check, I compare 16-18 year old teenagers in GDL states with 16-17 year old teenagers in non-GDL states over the same time period, implicitly assuming that teenagers of the same age group across states are a proper counterfactual. Exploiting the variation in the dates of GDL implementation, I estimate the following differences-in-differences model. For this analysis, I restrict the universe to 16-18 year-old mothers and estimate the following model with and without quadratic trends[21].

$$\ln(Y_{ast}) = \delta_0 + \delta_1 Post\_NonTough_{st} + \delta_2 Post\_Tough_{st} + \rho X_{st} + \gamma_s + \gamma_s * t + \gamma_s * t^2 + \varepsilon_{ast} \quad (4)$$

The controls are the same as in the previous specifications, and I estimate this model with and without linear and quadratic trends. The regression is weighted by the size of the population of females and the standard errors are clustered at the state level.

IV. RESULTS

In order for the triple differences model to be well identified, I need to provide evidence that the control group represents the counterfactual scenario that the treatment group would have followed had GDL laws never been implemented. Before discussing the triple differences estimates, I will present evidence of the following: (1) treatment and control group share similar trends prior to the implementation of GDL , (2) GDL was not endogenously implemented in response to changing trends in teen fertility, (3) GDL implementation only affected birth rates of women in the ages affected by the nighttime curfews, indicating that my estimates are not picking up the effect of other policies that may have been implemented around the same time as GDL.

First, a triple differences estimation implicitly assumes that treatment and control groups follow parallel trends prior to the implementation of GDL. Figure A1 presents evidence that birth rates of both treatment and control groups share a similar trend prior to the implementation of GDL, with some convergence over time. Controlling for age

---

[21] Table A5 reports the estimates of a linear and quadratic specification with state by age fixed effects and age trends.

specific linear trends in the triple differences model takes into account this potential convergence (Barreca and Page, 2015)[22].

Second, identification of β_3 implicitly assumes that the timing of GDL implementation was exogenous and not endogenously determined as a response to an unusual trend in teen fertility. I estimate an event study as defined in equation 2 and present the coefficients β^j for j={-5,5} for both treatment and control group in Figure 2. Figure 2 presents evidence that there is no trend in births prior to the implementation of GDL, and this is the case for both the treatment or the control group. This indicates that GDL was not implemented in response to changes in teen births and in fact the timing of GDL implementation was exogenous. The event study is also helpful to understand the dynamics of the impacts of GDL. Figure 2 indicates that teen birth rates are lower even five years after the implementation of GDL relative to years prior GDL enactment[23].

Finally, if the passage of GDL decreases fertility among teenagers and also among young adults who are not affected by GDL, that would indicate that the effects are at least partially attributed to other policies that may have been implemented around the same time as GDL. Figure 2 also presents the event study coefficients β^j for j={-5,5} for the control group, which indicate that GDL has not affected birth rates of young adults. I also present a formal triple differences estimation with placebo treatment and control groups in the falsification diagnostics.

---

[22] The same patterns arise with all the other definitions of treatment and control group.

[23] Because I restrict the analysis to state-year cells within 8 years of GDL implementation, the event study is estimated off of a nearly balanced panel. As a robustness check, I re-estimate this event study using an actual balanced panel. I present the results in Figure A2, which indicate a similar pattern to the one presented in Figure 2.

Triple Differences, Homogeneous Effects

Table 4 reports the parameter of interest β_3 corresponding to equation 1, using as the universe mothers between the ages of 16 and 24.[24]. I explore with three different definitions of treatment groups: ages 16-18 (columns 1-2-3), ages 17-18 (columns 4-5-6), and ages 16-17 after omitting age 18 from the control group (columns 7-8-9). While women who give birth at age 17 must have conceived at age 16 or 17 while being subjected to GDL, teen moms that give birth at age 16 may have conceived either under GDL at 16 or prior to GDL at 15. Similarly, teen moms that give birth at age 18 may have conceived at age 17 while under GDL or at age 18 after they already obtained their unrestricted driver license. In addition to the main definition of treatment group being mothers 16-18 years old, I exclude teen moms who gave birth at 16 (columns 4-5-6) and then exclude teen moms who gave birth at 18 (columns 7-8-9) from the treatment groups to ensure that the effects are driven by mothers who conceived while they were subject to GDL.

For each of these sets of treatment and control, I estimate equation (1) separately for states with "non-tough" GDL (i.e. the minimum age in which nighttime restrictions can be lifted is at most 17, indicating that the restriction is only required for less than a

[24] As a robustness check, I explore two additional control groups: Mothers between the ages of 19-20 and 19-21. The results are presented in Table A1 and A2, respectively. The results are similar to the main results presented in Table 4 and the results are similar regardless of whether I include 21 year old mothers in the control group. In particular, GDL decreases teen fertility by 4.3% when I use mothers of age 19-20 as the control group and it decreases by 4.1% when I use mothers of age 19-21 as the control group. The effects are statistically significant only in states in states with "tough" GDL. The results remain statistically indistinguishable from zero in states with "non-tough" GDL for both control groups.

year) and for “tough” GDL (i.e. the minimum age at which the restriction can be lifted is age 17 and hence the restriction is required for at least a year)

The first three columns of Panel A of Table 4 show that the passage of GDL resulted in a 4.2 percent decline in fertility among 16-18 year old girls relative to 19-24 year old girls in states with “tough” GDL. On the other hand, states with “non-tough” GDL did not experienced a statistically significant effect of GDL on fertility[25].

Columns 4-5-6 of Table 4 indicate that teen fertility decreased by approximately 3.4 percent among teen moms of ages 17 to 18 relative to young adults following the implementation of “tough GDL. Similarly, teen fertility decreased by 5.3 percent among 16-17 year old mothers relative to the control group mothers of age 19 and older, following the implementation of “tough” GDL (last three columns). One thing in common in these three different treatment groups is that the effects are only statistically significant in states that implemented the “tough” GDL[26].

<u>Triple Differences, Heterogeneous Effects</u>

While equation (1) assumes that GDL affected the fertility of 16 to 18 year old women homogeneously, this section relaxes this assumption and allows the effects to vary with age. Panel B of Table 4 reports the coefficients $\beta_3^{a=16}$, $\beta_3^{a=17}$, and $\beta_3^{a=18}$, which indicate that GDL decreased fertility of 16-year olds by 5.8%, decreased fertility

[25] The effect of “non-tough” GDL implementation is statistically insignificant at the conventional level and it is significantly smaller in magnitude than the effect of “tough” GDL implementation.

[26] I explore with an alternative specification of a fully interacted model with an indicator “tough.” That is, I include an indicator for whether state s has “tough” GDL as a control. In addition, I interact that indicator with $Treat_a$, $Post_{st}$ and with their interaction. I report β_1^0 and β_1^1 corresponding to $\beta_1^0 Treat_a + \beta_1^1 Treat_a X Tough$ in Table A3.

of 17-year olds by 4.8% and decreased fertility of 18-year old teenagers by 2% in states with "tough" GDLs. These results remained robust to the choice of control group[27].

Table 5 presents the effectiveness of nighttime driving curfews (β_3^{curf}), the effectiveness of passenger restrictions (β_3^{pass}), and the effectiveness of both components jointly (β_3^{both}) in the 27[28] states that implemented these components at different times. The results indicate that curfews are more effective at decreasing crime than the passenger component. Given that we only have 27 states, I perform this analysis looking at all states without separating by whether GDL was "tough." In the main specification where the treatment group is composed of 16-18 year old mothers and the treatment group is composed of 19-24 year old mothers, the passage of curfews alone reduced teen fertility by 4.2% while the passage of the passenger restriction alone reduced teen fertility by 2% but this coefficient is not statistically significant at the conventional level. Furthermore, the implementation of the passenger restriction does not complement the effectiveness of curfews at decreasing teen fertility and in fact lowers the effectiveness of curfews at decreasing teen fertility.

When the treatment group is composed of women between the ages of 17 and 18, the curfews decreased teen fertility by 3.2% relative to the control group. Finally, when the treatment group is composed of women between the ages of 16 and 17, the curfews decreased by 5.4%. Whether the treatment group is composed of women between the

[27] Table A1 indicates that when I define the control group as mothers between the ages of 19-20, GDL decreased fertility by 5.9% among 16-year old women, by 4.9% among 17-year old women, and by 2.2% among 18 year old women. The results are statistically indistinguishable when I define the control group as individuals of age 19-21 and those results are presented in Table A2.

[28] I restrict this analysis to the 27 states that implemented the curfew component at a different time from the passenger restriction component, including states that implemented the curfew component prior to 1995.

ages of 16-18, 17-18 or 16-17, the coefficients indicate that the nighttime driving curfews are more effective at decreasing fertility than the passenger restrictions. The fact that β_3^{pass} is statistically indistinguishable from zero could be driven because there are not many states that implemented passenger restrictions prior to implementing curfews[29].

Falsification tests

In order to assumer that β_3 captures the effect of GDL on 16-17 year old relative to young adults, I need to make sure that GDL is not affecting the fertility patterns of individuals in the control groups. While the event study already showed that the control group does not respond to the implementation of GDL, I corroborate that by estimating a triple differences model using a set of placebo treatment and control groups. First, I define 21 year old mothers as the placebo treatment and 22 year old mothers as the placebo control group. Second, I define 19 year old mothers as the placebo treatment and 20 year old mothers as the placebo control.

Table 6 reports β_3 and indicates that the effect of GDL implementation on the placebo treatment group is statistically indistinguishable from zero even in states with "tough" GDL.

Differences-in-Differences

Table 7 presents the parameters δ_1 and δ_2 from equation 4, which indicate the extent to which "non-tough" and "tough" GDL implementation affected teen fertility

[29] Table A4 corroborates that curfews are more effective at decreasing teen fertility than the passenger restriction and that these components do not act as complements at decreasing fertility. These patterns hold whether the control group is composed of 19-20 or 19-21 year old women and whether the treatment group is composed of 16-18, 16-17 or 17-18 year old women.

rates. I restrict the analysis to 16-18, 17-18 and 16-17 year-old women in the first, second and third column, respectively.

The results indicate that "tough" GDL implementation resulted in a 1.8% decrease in fertility among 16-18 year olds, a 2.6% decrease in fertility among 17-18 year olds, and 1.4% decrease among 16-17 year olds. The effects of "non-tough" GDL are statistically indistinguishable from zero.

I estimate additional specifications with and without quadratic trends and also with an without age specific linear trends and state by age fixed effects, and report them in Table A5.

<u>Long Term Effects of GDL</u>

It is important for policy evaluation to determine whether GDL affects teenagers only while they are directly affected by it or if it changes individual's behavior in a way that persists even after they obtain their unrestricted driver license. On one hand, GDL may make it into a habit for teenagers to be off the streets at night, when teenagers are more likely to engage in sexual intercourse, and this habit may persist even after obtaining their unrestricted drivers license. If this is the case, we would expect that females who were affected by GDL at age 16 are less likely to have unintended pregnancies than females who were not affected by GDL at age 16, even after they obtained their unrestricted driver license.

On the other hand, if GDL does not change individual behavior or preferences and merely reduces driving prevalence during the intermediate phase of GDL, we would expect that females with unrestricted driver licenses who were affected by GDL at age 16 have the same fertility rates as females who were not affected by GDL.

Finally, teenagers may be just displacing the fertility effects from 16-17 to age 18. In that case, we would observe that females with unrestricted driver licenses who were affected by GDL at age 16 have higher fertility rates than females who were not affected by GDL.

Following Deza and Litwok (2016), I estimate the following equation among individuals of age 19 through 24, for each age category separately. In the following equation, the coefficient of interest is β and the variable $Treat_{s,t-(a-16)}$ indicates GDL laws were implemented by the year in which this cohort was 16. For instance, if a=19, then we need an indicator for whether GDL was in place in state s in year t-3.

$$\ln(Y_{ast}) = \alpha + \beta\, Treat_{s,t-(a-16)} + \gamma_t + \gamma_{as} + \gamma_a * t + \gamma_s * t + \varepsilon_{ast} \quad (5)$$

Because the evidence indicates that only "tough" GDL affected teen fertility, it is relevant to separately identify the effect of past "tough" GDL versus past "non-tough" GDL. I explore with an additional specification where I replace $Treat_{s,t-(a-16)}$ with two indicators: $Treat_{s,t-(a-16)}^{tough}$ and $Treat_{s,t-(a-16)}^{non-tough}$, which indicate whether the respondent was affected by GDL in a "tough" GDL or a "non-tough" GDL state at age 16[30].

Panel A of Table 8 reports β , which indicates that having been exposed to GDL at age 16 does not affect fertility rates once individuals obtain their unrestricted license Panel B of Table 8 presents evidence that the same result holds regardless of whether these teenagers were affected by a "tough" or "non-tough" GDL at age 16. This is consistent with GDL merely reducing driving prevalence during the intermediate phase

[30] I define a state to be a "tough" or "non-tough" GDL state as a time-invariant measure, taking into account only the amount of time teenagers must remain in the intermediate phase before they can obtain their unrestricted driver license.

of GDL without an ultimate long term change in behavior (Karaca-Mandic, Ridgeway, 2010).

V. CONCLUSION

To the extent that adult supervision decreases teen fertility, public policies that place restrictions on unsupervised driving may decrease teen fertility even though they aimed at reducing teen traffic fatalities. To the best of my knowledge, this is the first paper to examine the unintended consequences of decreasing unsupervised nighttime teen driving generated by the GDL on teen fertility.

Using data from the National Vital Statistics System and a triple differences approach, this paper finds that births decreased by 4% among female teenagers relative to young adult females, following the implementation of GDL. These effects are statistically significant at the conventional level in states where the nighttime driving curfews are required for longer before transitioning into an unrestricted driver license (i.e “tough GDL” states). The decrease is particularly large among 16 year-old females, and it is driven mostly by the nighttime driving restrictions and not by the passenger restrictions component of GDL[31].

[31] It is relevant for policy to understand whether this decrease in fertility results in a cohort with particularly healthy birth and maternal health outcomes. Table A6 presents the effects of a triple differences model similar to the one presented in equation 1 where the dependent variable are : (1) total number of prenatal visits during pregnancy, (2) birth weight in grams, and (3)Weight gain during pregnancy. While the results are imprecisely estimated, the data suggests that GDL did not affect the number of prenatal visits and slightly decreased birth weight and weight gain during pregnancy. I am not saying that GDL affected pregnancy outcomes directly. I am not claiming that GDL affected maternal outcomes directly. This pattern could arise if women who are more likely to have heavier children or gain the most weight during pregnancy are those whose pregnancies were prevented with GDL.

The conclusions remain robust to using a variety of specifications and to changing the definition of treatment and control groups[32]. While the event study suggests that GDL was still effective at decreasing teen fertility even five years after the implementation, the effects were transitory in the sense that GDL only decreases fertility among women directly affected by the curfews with no effect once they transition to an unrestricted driver license.

Given the ineffectiveness of school-based sex education programs and the unintended consequences of access to over-the-counter emergency contraception, GDL presents an alternative tool to fight crime, which is slightly more effective than more controversial policies. In particular, GDL decreased teen fertility by approximately 4% among teenagers, which is comparable to the 4% decrease in teen fertility from the Medicaid expanded access of waivers for family planning (Kearney and Levine, 2009) and even larger than the 2% decrease in teen fertility that results from expanded over-the-counter access to emergency contraception (Gross, :afortune and Low, 2014). Taken together, this paper indicates that previous cost-benefit analyses of GDL underestimate its full benefits[33].

---

[32] While the dependent variable in equation 1 in the natural logarithm of the number of births per 1000 women, I explore an additional specification where the dependent variable is the natural logarithm of the number of births and I control for the size of population of females in the relevant age group. The results remain unchanged and β_3 is presented in Table A7.

[33] The decrease in teen births could be driven by either a decrease in teen pregnancies or by an increase in abortions. It is unlikely that the GDL nighttime driving curfews affect abortion rates because abortion clinics only operate during the day. However, passenger restrictions may affect access to abortion clinics since it will make it more costly for teenagers to obtain a ride from their other minor friends. I test this hypothesis by estimating a differences-in-differences model using abortion rates data from the CDC and the results presented in Table A8 suggest that GDL did not affect teen abortion rates. The

Future work needs to explore alternative potential mechanisms through which GDL affects fertility. For instance, teenagers may transition from activities that are more popular at night such as attending a party to activities that are more popular during the day such as going to the movies. Additionally, teenagers may interact with fewer friends at a given event in response to the passenger restrictions. While exploring changes in their activities as a potential mechanism is beyond the scope of this study, future research should explore the extent to which GDL implementation changes teenagers' activities.

---

lack of effect on abortion rates indicates that the decrease in teen fertility is in fact driven by a decrease in teen pregnancies.

REFERENCES

Ananat, E. and D. Hungerman (2012) The Power of the Pill for the Next Generation: Oral Contraception's Effects on Fertility, Abortion, and Maternal and Child Characteristics. The Review of Economics and Statistics 94 (1), 37-51

Ananat, E. J. Gruber, P. Levine, and D. Staiger (2009) Abortion and Selection. The Review of Economics and Statistics 91(1), 124-136.

Ashcraft, A., I. Fernandez-Val and K. Lang "The consequences of teenage childbearing: Consistendt estimates when abortion makes miscarriage non –random" The Economic journal 123-571 (2013) 875-905

Assistant Secretary for Planning and Evaluation (1999). Approval and implementation dates of major AFDC waivers and TANF, 1992–1998. Retrieved January 12, 2005, from http://aspe.hhs.gov/hsp/Waiver-Policies99/Table_A.PDF.

Colman, S., and T. Joyce (2011) Regulating Abortion: Impact on Patients and Providers in Texas. Journal of Policy Analysis and Management 30(4), 775-797

Bailey, M. (2006) More power to the pill: The impact of contraceptive freedom on women's life cycle labor supply. The Quarterly Journal of Economics 121 (1), 289-320

Barreca, A., & M. Page. (2015). A pint for a pound? Minimum drinking age laws and birth outcomes. Health Economics, 24, 400-418.

Dee, T. (2001). The effects of minimum legal drinking ages on teen childbearing. Journal of Human Resources, 36(4), 823-828.

Dee, T., D. Grabowski, & M. Morrisey. (2005). Graduated Driver Licensing and teen traffic fatalities. Journal of Health Economics, 24, 571-589.

DeLeire, T. and L. Lopoo (2006) Did Welfare Reform Influence the Fertility of Young Teens? . Journal of Policy Analysis and Management 25(2), 275-298

Deza, Monica and Daniel Litwok (2016) Do Nighttime Driving Restrictions Reduce Criminal Participation Among Teenagers? Evidence from Graduated Driver Licensing. Journal of Policy Analysis and management 35(2), 306-332

Fletcher, Jason M (2012). "The effects of teenage childbearing on the short-and long-term health behaviors of mothers." Journal of Population Economics 25 (1): 201-218

Fletcher, Jason M., and Barbara L. Wolfe (2009). "Education and labor market consequences of teenage childbearing evidence using the timing of pregnancy outcomes and community fixed effects." Journal of Human Resources 44(2) : 303-325.

Goldin, C. and L. Katz (2002) The power of the pill: oral contraceptives and women's career and marriage decisions. Journal of Political Economy 110(4), 730-770.

Gross, T., J. LAfortune, C. Low (2014) "What happens the morning after? The Costs and Benefits of Expanding Access to Emergency Contraception" Journal of Policy Analysis and Management 33(1), 70-93

Gruber, Levine and Staiger (1999) Abortion Legalization and Child Living Circumstances: Who is the "Marginal Child"? Quarterly Journal of Economics 114(1), 263-292

Guttmacher Institute (1997) Issues in Brief: The Limitations of US Statistics on Abortion (New York: Alan Guttmacher Institute)

Haas-Wilson, Deborah (1993) The Economic Impact of State Restrictions of Abortion: Parental Consent and Notification Laws and Medicaid Funding Restrictions. Journal of Policy Analysis and Management 12(3)

Hofferth, Sandra (1987) "The Social and Economic Consequences of Teenage Childbearing" in Cheryl Hayes and Sandra Hofferth (eds.), Risking the Future: Adolescent Sexuality, Pregnancy and Childbearing, vol II (Washington, D.C.: National Academy Press).

Hotz, J., S. McElroy and S. Sanders (2005) Teenage Childbearing and Its Life Cycle Consequences: Exploiting a Natural Experiment. Journal of Human Resources 40(3).

Hotz, J., C. Mullin, and S. Sanders (1997) Bounding causal effects using data from a contaminated natural experiment: analysis the effects of teenage childbearing. The Review of Economic Studies 64(4): 575-603.

Joyce, T. and R. Kaestner (1996) State Reproductive Policies and Adolescent Pregnancy Resolution: The Case of Parental Involvement Laws. Journal of Health Economics 15. 579-607.

Joyce, T. and R. Kaestner (2001) "The Impact of Mandatory Waiting Periods and Parental Consent Laws on the Timing of Abortion and State of Occurrence among adolescents in Mississippi and South Carolina" Journal of Policy Analysis and Management 20(2)

Karaca-Mandic, P. & G. Ridgeway (2010) Behavioral impact of Graduated Driver Licensing on teenager driving risk and exposure. Journal of Health Economics, 29, 48-61.

Kearney, Melissa and Phillip Levine (2015) Investigating recent trends in the U.S. Teen Birth Rate. Journal of Health Economics 41. 15-29

Kearney, Melissa and Phillip Levine (2009) Subsidized Contraception, Fertility, and Sexual Behavior." The Review of Economics and Statistics 91(1): 137-151

Kearney, Melissa, and Phillip Levine (2012) Why is the Teen Birth Rate in the United States so High and Why Does it Matter? NBER Working paper 17965

Kearney, Melissa (2004) Is There an Effect of Incremental Welfare Benefits on Fertility Behavior? A Look at the Family Cap. Journal of Human Resources 39(2), 295-325

Kirby, D. (2001) Emerging Answers: Research Findings on Programs to Reduce Teen Pregnancy. American Journal of Health Education 32(6), 348-355

Kline, P. (2014) The Impact of Juvenile Curfew Laws on Arrests of Youth and Adults. American Law and Economic Review 14(1), 44-67

Lang, Kevin, and Russell Weinstein. The Consequences of Teenage Childbearing Before Roe v Wade. No. w19627. National Bureau of Economic Research, 2013.

Levine, P. (2003) Parental Involvement Laws and Fertility Behavior. Journal of Health Economics 22, 861-878

Lopoo, L. (2005) "Maternal Employment and Teenage Childbearing: Evidence from the PSID" Journal of Policy Analysis and Management 24(1)

Lopoo, L. and T. DeLeire (2006) Did Welfare Reform Influence the Fertility of Young Teens? Journal of Policy Analysis and Management 25(2)

Pirog-Good M. , D. Good (1995) Child Support Enforcement for Teenage Fathers: Problems and Prospects. Journal of Policy Analysis and Management 14(1)

Rashad, I. and R. Kaestner (2004) Teenage Sex, Drugs and Alcohol Use: Problems Identifying the Cause of Risky Behaviors." Journal of Health Economics 23. 493-503

Ribar, D. (1994) Teenage Fertility and High School Completion. The Review of Economics and Statistics 76. 413-424

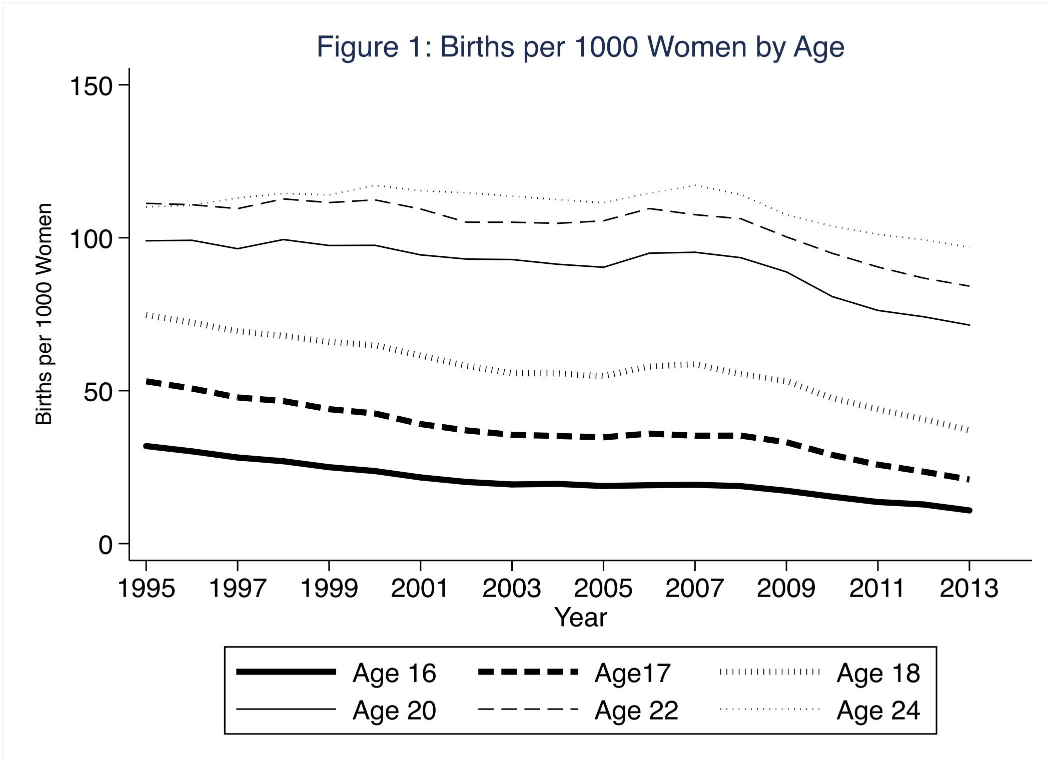
Sabia, J. (2006) "Does Sex Education Affect Adolescent Sexual Behaviors and Health" Journal of Policy Analysis and Management 25(4)

Sabia, J. and D. Mark Anderson (2016) The Effect of Parental Involvement Laws on Teen Birth Control Use. Journal of Health Economics 45. Pp.55-62.

Thomas, A. (2012) "Three Strategies to Prevent Unintended Pregnancies" Journal of Policy Analysis and Management 31(2)

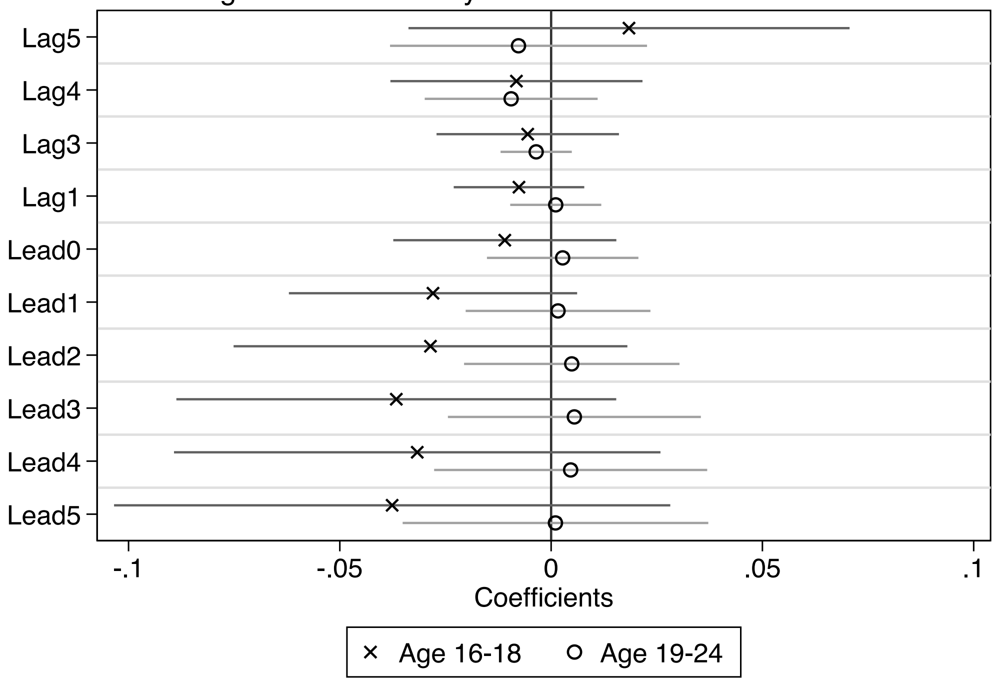
Trenholm, C., B. Devaney, K. Fortson, M. Clark, L. Quay, J. Wheeler (2008) Impacts of Abstinence Education on Teen Sexual Activity, Risk of Pregnancy, and Risk of Sexually Transmitted Diseases. Journal of Policy Analysis and Management 27(2), 255-276

Zuppann, A. (2011) The Impact of Emergency Contraception on Dating and Marriage. Working paper



Note: This figure shows the raw trends in the natural logarithm of the number of births per 1,000 women by age.
Source: Authors' calculations.

Figure 2: Event Study for Ln Births Per 1000 Females



Note: This figure graphs the parameters estimated by the event study by the time proximity to enactment date (in years) for 16-18 and 19-24 year old mothers.
Source: Authors' calculations.

Table 1: Effective dates (1995-2011) of intermediate phase with nighttime restriction

		Date of restriction implementation		Characteristics at time of implementation	
State	Date in Dee et al (2005)	Nighttime restriction	Passenger restriction	Curfew begins	Min. age to lift curfew
Alabama	October 1, 2002	October 1, 2002	October 1, 2002	12:00 AM	17 years
Alaska	-	January 1, 2005	January 1, 2005	1:00 AM	16 years, 6 months
Arizona	-	June 30, 2008	June 30, 2008	12:00 am	16 years, 6 months
Arkansas	July 1, 2002	July 30, 2009	July 30, 2009	11:00 pm	18 years
California	July 1, 1998	July 1, 1998	July 1, 1998	12:00 am	17 years
Colorado	July 1, 1999	July 1, 1999	July 1, 2005	12:00 am	17 years
Connecticut	-	October 1, 2005	October 1, 2003	12:00 am	18 years
Delaware	July 1 1999	July 1 1999	July 1 1999	9:00 pm	16 years, 10 months
District of Columbia	-	January 1, 2001	January 1, 2001	seasonal	18 years
Florida	July 1, 1996	July 1, 1996	None	11:00 pm (16), 1:00 am (17)	18 years
Georgia	July 1, 1997	July 1, 1997	July 1, 1997	1:00 am	18 years
Hawaii	-	January 9, 2006	January 9, 2006	11:00 pm	17 years
Idaho	January 1, 2001	Only for learner permit holders	May 29, 2007	None	16 years
Illinois	January 1, 1998	Effective since before 1995	June 1, 2004	11:00pm (Sun-Th), 12:00 am (Fri-Sat)	18 years
Indiana	January 1, 1999	July 1, 1998	July 1, 1998	11:00pm (Sun-Fr), 1:00 am (Sat-Sun)	18 years
Iowa	January 1, 1999	January 1, 1999	None	12:30 am	17 years
Kansas	-	January 1, 2010	January 1, 2010	9:00 pm	16 years, 6 months
Kentucky	-	April 1, 2007	April 1, 2007	12:00 am	17 years
Louisiana	January 1, 1998	Effective since before 1995	None	11:00pm (M-Fr), 12:00 am (Sa-Sun)	17 years
Maine	August 11, 2000	September 15, 2003	August 1, 2000	12:00 am	16 years, 6 months
Maryland	July 1, 1999	Effective since before 1995	October 1, 2005	12:00 am	17 years, 9 months
Massachusetts	November 4, 1998	Effective since before 1995	November 4, 1998	12:00 am	18 years
Michigan	April 1, 1997	April 1, 1997	March 30, 2011	12:00 am	17 years
Minnesota	-	August 1, 2008	August 1, 2008	12:00 am	16 years, 6 months
Mississippi	July 1, 2000	July 1, 2000	None	10:00 pm	16 years
Missouri	January 1, 2001	January 1, 2001	August 28, 2006	1:00 am	18 years
Montana	-	July 1, 2006	July 1, 2006	11:00 pm	16 years
Nebraska	January 1, 1999	January 1, 1999	January 1, 2008	12:00 am	17 years
Nevada	July 1, 2001	October 1, 2005	July 1, 2001	10:00 pm	18 years
New Hampshire	January 1, 1998	January 1, 1998	January 1, 2003	1:00 am	17 years, 1 month
New Jersey	January 1, 2001	January 1, 2001	January 1, 2001	12:00 am	18 years
New Mexico	January 1, 2000	January 1, 2000	January 1, 2000	12:00 am	16 years, 6 months
New York	-	Effective since before 1995	September 1, 2003	9:00 pm	17 years
North Carolina	December 1, 1997	December 1, 1997	December 1, 2002	9:00 pm	16 years, 6 months
North Dakota	-	January 1, 2012	None	9:00 pm	16 years
Ohio	January 1, 1999	January 1, 1999	April 6, 2007	1:00 am	17 years

(Continue) Table 1: Effective dates (1995-2011) of intermediate phase with nighttime restriction

State	Date in Dee et al (2005)	Date of restriction implementation: Nighttime restriction	Date of restriction implementation: Passenger restriction	Characteristics at time of implementation: Curfew begins	Characteristics at time of implementation: Min age to lift curfew
Oklahoma	-	November 1, 2005	November 1, 2005	11:00 pm	16 years, 6 months
Oregon	March 1, 2000	March 1, 2000	March 1, 2000	12:00 am	17 years
Pennsylvania	December 22, 1999	Effective since before 1995	December 24, 2011	11:00 pm	17 years
Rhode Island	January 1, 1999	January 1, 1999	July 9, 2005	1:00 am	17 years, 6 months
South Carolina	July 1, 1998	Effective since before 1995	March 5, 2002	8:00 pm	16 years, 6 months
South Dakota	January 1, 1999	Effective since before 1995	None	8:00 pm	16 years
Tennessee	July 1, 2001	July 1, 2001	July 1, 2001	11:00 pm	17 years
Texas	January 1, 2002	January 1, 2002	January 1, 2002	12:00 am	16 years, 6 months
Utah	July 1, 1999	July 1, 1999	July 1, 2001	12:00 am	17 years
Vermont	July 1, 2000	None	July 1, 2000	None	None
Virginia	July 1, 2001	July 1, 2001	July 1, 1998	12:00 am	18 years
Washington	July 1, 2001	July 1, 2001	July 1, 2001	1:00 am	17 years
West Virginia	January 1, 2001	January 1, 2001	January 1, 2001	11:00 pm	17 years
Wisconsin	July 1, 2000	September 1. 2000	September 1, 2000	12:00 am	16 years, 9 months
Wyoming	-	September 16, 2005	September 16, 2005	11:00 pm	16 years, 6 months

Source: This table corresponds to Table 1 in Deza and Litwok (2016)
Note from Deza and Litwok (2016): The second column shows the dates presented in Dee, Grabowski, and Morrisey (2005). The third and fourth columns present the dates in which each state first implemented nighttime driving restrictions and passenger restrictions, respectively. The IIHS does not provide exact date of nighttime driving curfew implementations for states that enacted them prior to GDL. For these states, we only know that the curfews were in place since before 1995.
Source: IIHS http://www.iihs.org/iihs/topics/laws/graduatedlicenseintro?topicName=teenagers

Table 2: Counts of Births by Age and Year, 1995-2013

	Ages 16-18	Ages 19-20	Ages 21-24
Panel A: Characteristics for Each Age Group			
Birth Rate (per 1000 women)	38.478	85.046	104.428
Number of Births	4684.862	6836.646	15864.850
Population	118828.900	79763.350	155246.100
Total Number of Prenatal Visits	10.342	10.757	11.088
Birth Weight (Grams)	3167.677	3212.673	3262.110
Weight Gain	32.988	32.428	30.948
Panel B: Share of State-Year Cells Affected by Laws			
% Zero Tolerance Laws		0.938	
% Parental Involvement Laws		0.627	
% Medicaid Subsidized Contraception		0.260	
% Over-the-counter access to emergency pill		0.102	
% ADFC Waiver		0.701	
%TANF		0.895	
Unemployment Rate		5.623	
Number of Cells	969	969	969

Note: This table presents average yearly summary statistics averaged over 19 years (1995-2013) for mothers of three different age groups: 16-18, 19-20, and 21-24. Each cell corresponds to a state-year category for all 51 states for 19 years between 1995-2013.
Source: Author's calculations

Table 3: Descriptive Statistics of Teenage Sexual Behaviors, NLSY97

	Both genders				Male				Female			
	All	Age of First Time			All	Age of First Time			All	Age of First Time		
		<16	16-17	18+		<16	16-17	18+		<16	16-17	18+
Panel A: First Sexual Intercourse, Time of Day												
7am-12:00pm	5.25	6.97	4.17	3.9	6.19	8.2	4.89	4.03	4.28	5.37	3.53	3.78
12:00pm-3pm	9.76	12.74	9.55	5.41	10.51	14.06	9.05	5.66	8.97	11.04	10.01	5.2
3:00pm-6:00pm	14.82	18.98	14.37	8.96	15.23	19.45	14.12	8.71	14.39	18.38	14.6	9.17
6:00pm-10:00pm	26.05	25.02	29.65	23.38	24.34	22.55	27.24	24.18	27.81	28.21	31.83	22.68
10pm-7am	44.13	36.28	42.25	58.35	43.73	35.74	44.71	57.41	44.54	36.99	40.03	59.17
N	7329	3029	2324	1976	3730	1707	1105	918	3599	1322	1219	1058
Panel B:First Sexual Intercourse, Location												
Your family home	20.41	24.38	21.42	13.09	23.6	26.05	25.76	16.41	17.1	22.22	17.5	10.23
Your own home/apt/dorm	6.35	2.92	2.94	15.64	6.67	3.11	2.78	18.03	6.03	2.68	3.08	13.58
Partner's family home	26.69	28.64	31.47	18.09	23.82	25.59	27.11	16.52	29.67	32.59	35.41	19.44
Partners home/apt/dorm	12.57	8.44	10.43	21.44	8.2	6.61	5.57	14.36	17.1	10.81	14.83	27.53
Friend's home	11.68	14.45	11.88	7.2	13.97	16.1	14.54	9.29	9.32	12.3	9.48	5.4
Car or truck	4.89	3.6	6.56	4.9	5.77	3.8	8.17	6.59	3.97	3.36	5.11	3.44
Hotel or motel	6.17	4.38	5.24	10	5.56	4.31	4.49	9.18	6.79	4.47	5.92	10.7
Park or outdoor place	3.26	4.58	3.07	1.45	3.92	5.29	4.04	1.19	2.58	3.65	2.19	1.67
someplace else	7.98	8.6	6.98	8.2	8.49	9.14	7.54	8.42	7.45	7.9	6.48	8
N	7429	3080	2348	2001	3779	1739	1114	926	3650	1341	1234	1075
Panel C: First Sexual Experience, Age of Partner												
Mean Age of Partner	18.16	16.50	17.57	20.95	17.36	15.99	16.90	19.96	18.97	17.14	18.16	21.84
Partner at Most 18 years old	68.22	86.43	79.49	32.72	78.37	91.09	90.40	46.41	57.80	80.54	69.74	20.37
N	7644	3015	2340	2289	3874	1684	1104	1086	3770	1331	1236	1203

Note: This table presents descriptive statistics about the first time the respondent had sexual intercourse with a person of the opposite sex using data from the NLSY97. From the original 8984 respondents, N=7768 reported their age at time of their first sexual intercourse. Among those respondents, N=7329 reported a valid time of the day, N=7429 reported the location, and N=7644 reported the partner's age at the time of their first sexual experience.
Source: Author's calculations

Table 4: Effects of GDL on Teen Fertility

	All	Non-Tough	Tough	All	Non-Tough	Tough	All	Non-Tough	Tough
	Treat 16-18, Control 19-24			Treat 17-18, Control 19-24			Treat 16-17, Control 19-24		
Panel A: Homogeneous Effects									
Treat X Post	-0.015	0.025	-0.042*	-0.010	0.020	-0.034*	-0.021	0.031	-0.053*
	(0.022)	(0.021)	(0.017)	(0.019)	(0.016)	(0.016)	(0.024)	(0.025)	(0.018)
Constant	4.866*	5.094*	4.785*	4.856*	5.043*	4.814*	4.862*	4.968*	4.780*
	(0.022)	(0.078)	(0.027)	(0.022)	(0.053)	(0.028)	(0.022)	(0.056)	(0.027)
N	8721	3078	5643	7752	2736	5016	7752	2736	5016
Panel B: Heterogeneous Effects by Age									
Treat16 X Post	-0.024	0.034	-0.058*				-0.024	0.034	-0.058*
	(0.027)	(0.032)	(0.020)				(0.027)	(0.032)	(0.020)
Treat17 X Post	-0.019	0.028	-0.048*	-0.019	0.028	-0.048*	-0.019	0.028	-0.049*
	(0.022)	(0.018)	(0.016)	(0.022)	(0.018)	(0.016)	(0.022)	(0.018)	(0.016)
Treat18 X Post	-0.002	0.013	-0.020	-0.002	0.013	-0.020			
	(0.017)	(0.014)	(0.016)	(0.017)	(0.014)	(0.016)			
Constant	4.866*	5.286*	4.785*	4.856*	4.953*	4.775*	4.862*	5.142*	4.780*
	(0.022)	(0.082)	(0.027)	(0.022)	(0.056)	(0.029)	(0.022)	(0.078)	(0.027)
N	8721	3078	5643	7752	2736	5016	7752	2736	5016

Note: These estimates are based on a triple differences estimation, where the control group is composed of 19-24 year old mothers and the treatment group is composed of 16-18, 17-18, and 16-17 year old mothers. Regressions are weighted by the size of female population of the relevant ages. There is a total of N=8721 age-state-year cells which result from 9 age groups, 51 states and 19 years (1995-2013).

These regressions include year fixed effects, state by age fixed effects, age-specific linear trends, and state-specific linear trends. The regressions are weighted by the size of female population in the relevant age category. The standard errors are clustered at the state level. These regressions include indicators for whether the following policies are implemented in a given state-year cell: Zero tolerance laws, parental involvement laws, Medicaid subsidized contraception, over-the-counter access to emergency contraception, AFDC waivers, TANF waivers.

+ indicates $P \leq 0.10$, * indicates $P \leq 0.05$, ** indicates $P \leq 0.01$, *** indicates $P \leq 0.001$

Source: Author's calculations

Table 5: Heterogeneous Effects of GDL By Component

	Treat 16-18, Control 19-24	Treat 17-18, Control 19-24	Treat 16-17, Control 19-24
Treat X Post-Curfew	-0.042*	-0.032+	-0.054*
	(0.020)	(0.019)	(0.022)
Treat X Post-Passenger	-0.022	-0.014	-0.035
	(0.018)	(0.018)	(0.022)
Treat X Post-Both	0.038+	0.024	0.055*
	(0.021)	(0.020)	(0.023)
Constant	4.781*	4.796*	4.779*
	(0.019)	(0.018)	(0.019)
N	4617	4104	4104

Note: These estimates are based on a triple differences estimation, where the control group is composed of 19-24 year old mothers and the treatment group is composed of 16-18, 17-18, and 16-17 year old mothers. Regressions are weighted by the size of female population of the relevant ages. This analysis is restricted to the 27 states that implemented these components at different times (or only implemented one component), regardless of whether the curfew was implemented as part of the GDL or prior to 1995: CO, FL, HI, ID, IL, IA, LA, ME, MD, MA, MI, MS, MO, NE, NV, NH, NY, NC, ND, OH, PA, RI, SC, SD, UT, VT, VA. These 9 age categories, 27 states and 19 years results in N=4617 age-state-year cells.
These regressions include year fixed effects, state by age fixed effects, age-specific linear trends, and state-specific linear trends. The regressions are weighted by the size of female population in the relevant age category. The standard errors are clustered at the state level. These regressions include indicators for whether the following policies are implemented in a given state-year cell: Zero tolerance laws, parental involvement laws, Medicaid subsidized contraception, over-the-counter access to emergency contraception, AFDC waivers, TANF waivers.
+ indicates $P \leq 0.10$, * indicates $P \leq 0.05$, ** indicates $P \leq 0.01$, *** indicates $P \leq 0.001$
Source: Author's calculations

Table 6: Falsification Diagnostics, Placebo Triple Differences

	All	Non Tough	Tough
Panel A: Treatment 21, Control 22			
Treat X Post	0.006	0.009	0.001
	(0.007)	(0.011)	(0.007)
Constant	4.848*	4.964*	4.803*
	(0.026)	(0.057)	(0.037)
N	1938	684	1254
Panel B: Treatment 19, Control 20			
Treat X Post	0.008	0.011	0.002
	(0.006)	(0.007)	(0.007)
Constant	4.829*	4.785*	4.792*
	(0.029)	(0.076)	(0.041)
N	1938	684	1254

Note: These estimates are based on a triple differences estimation with placebo treatment and control groups. Regressions are weighted by the size of female population of the relevant ages. These 2 age groups, 51 states, and 19 years results in N=1938 age-state-year cells.
These regressions include year fixed effects, state by age fixed effects, age-specific linear trends, and state-specific linear trends. The regressions are weighted by the size of female population in the relevant age category. The standard errors are clustered at the state level. These regressions include indicators for whether the following policies are implemented in a given state-year cell: Zero tolerance laws, parental involvement laws, Medicaid subsidized contraception, over-the-counter access to emergency contraception, AFDC waivers, TANF waivers.
+ indicates $P \leq 0.10$, * indicates $P \leq 0.05$, ** indicates $P \leq 0.01$, *** indicates $P \leq 0.001$
Source: Author's calculations

Table 7: Alternative Specification, Differences-in-Differences

	Universe 16-18	**Universe 17-18**	**Universe 16-17**
Post Tough	-0.018*	-0.026*	-0.014
	(0.008)	(0.010)	(0.009)
Post Non Tough	0.001	0.000	0.001
	(0.022)	(0.019)	(0.025)
Constant	3.725*	4.179*	3.745*
	(0.022)	(0.020)	(0.031)
Observations	2907	1938	1938

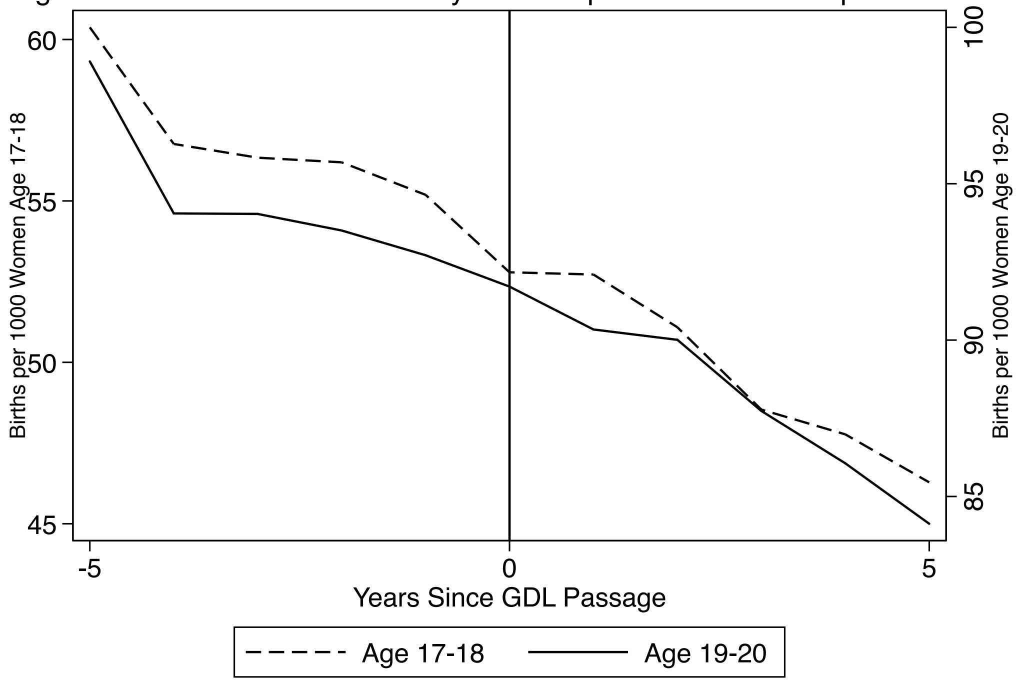
Note: These estimates are based on a differences-in-differences estimation, where the indicator that GDL is implemented in state s and year t (Post) is replaced by two indicators, one for tough GDL and one for non-tough GDL. Regressions are weighted by the size of female population of the relevant ages.
The sample in the first column is restricted to 16-18 year old mothers, the second column is restricted to 17-18 year old mothers and the third columns is restricted to 16-17 year old mothers. These 3 age categories, 51 states and 19 years results in N=2907 age-state-year cells.
These regressions include year fixed effects, state fixed effects, state-specific linear and quadratic trends. The regressions are weighted by the size of female population in the relevant age category. The standard errors are clustered at the state level.
These regressions include indicators for whether the following policies are implemented in a given state-year cell: Zero tolerance laws, parental involvement laws, Medicaid subsidized contraception, over-the-counter access to emergency contraception, AFDC waivers, TANF waivers.
+ indicates $P \leq 0.10$, * indicates $P \leq 0.05$, ** indicates $P \leq 0.01$, *** indicates $P \leq 0.001$
Source: Author's calculations

Table 8: Long Run Effects from Past GDL Participation

	Age 19	Age 20	Age 21	Age 22	Age 23	Age 24
Panel A: All States						
Past GDL	-0.002	-0.001	-0.004	0.003	0.011	0.007
	(0.008)	(0.008)	(0.009)	(0.011)	(0.013)	(0.009)
Constant	4.770*	4.832*	4.851*	4.853*	4.790*	4.735*
	(0.032)	(0.027)	(0.028)	(0.029)	(0.021)	(0.021)
Panel B: By "Toughness"						
Past Tough GDL	-0.002	-0.002	-0.006	-0.001	0.012	0.008
	(0.009)	(0.009)	(0.009)	(0.012)	(0.015)	(0.010)
Past Non Tough GDL	-0.004	0.002	0.002	0.015	0.009	0.002
	(0.017)	(0.016)	(0.017)	(0.009)	(0.010)	(0.013)
Constant	4.770*	4.832*	4.849*	4.849*	4.790*	4.737*
	(0.033)	(0.028)	(0.027)	(0.028)	(0.021)	(0.022)
Observations	969	969	969	969	969	969

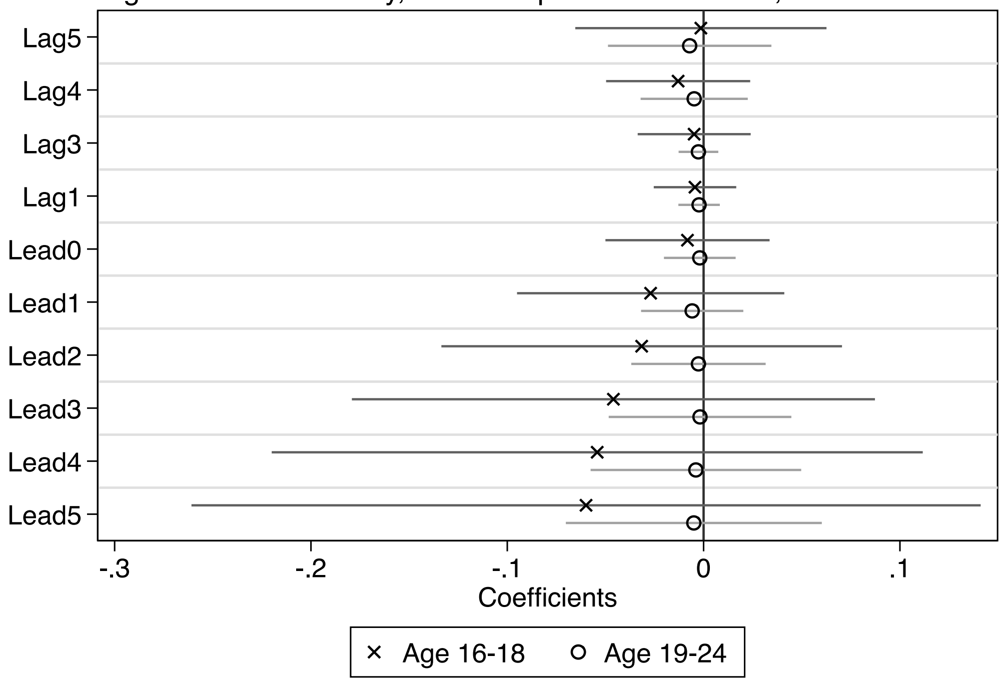
Note:
These regressions include year fixed effects, state by age fixed effects, age-specific linear trends, and state-specific linear trends. The regressions are weighted by the size of female population in the relevant age category. The standard errors are clustered at the state level. These regressions include indicators for whether the following policies are implemented in a given state-year cell: Zero tolerance laws, parental involvement laws, Medicaid subsidized contraception, over-the-counter access to emergency contraception, AFDC waivers, TANF waivers.
+ indicates $P \leq 0.10$, * indicates $P \leq 0.05$, ** indicates $P \leq 0.01$, *** indicates $P \leq 0.001$. Each age category observed in 51 states for 19 years results in N=969 state-year cells.
Source: Author's calculations

Figure A1: Trends in Birth Rates by Time Elapsed Since GDL Implementation



Note: This figure shows the raw trends in the natural logarithm of the number of births per 1,000 women by the time proximity to enactment date (in years). Unlike the event study, these are raw summary statistics.
Source: Authors' calculations.

Figure A2: Event Study, Ln Births per 1000 Females, Balanced Panel



Note: This figure graphs the parameters estimated by the event study by the time proximity to enactment date (in years) for 16-18 and 19-24 year old mothers. Unlike Figure 2, this graph analyzes only states for which we have a balanced panel. That is, we analyze only states for which we have as many leads as we have lags.
Source: Authors' calculations.

Table A1: Effects of GDL on Teen Fertility, Control Age 19-20

	All	Non Tough	Tough	All	Non Tough	Tough	All	Non Tough	Tough
	Treat 16-18, Control 19-20			Treat 17-18, Control 19-20			Treat 16-17, Control 19-20		
Panel A: Homogeneous Effects									
Treat X Post	-0.022	0.015	-0.043*	-0.017	0.011	-0.035*	-0.028	0.021	-0.054*
	(0.016)	(0.016)	(0.013)	(0.014)	(0.012)	(0.011)	(0.019)	(0.021)	(0.014)
Constant	4.857*	4.638*	4.769*	4.844*	4.846*	4.809*	4.797*	5.218*	4.767*
	(0.024)	(0.058)	(0.031)	(0.024)	(0.100)	(0.030)	(0.025)	(0.066)	(0.032)
N	4845	1710	3135	3876	1368	2508	3876	1368	2508
Panel B: Heterogeneous Effects by Age									
Treat16 X Post	-0.030	0.024	-0.059*				-0.031	0.024	-0.059*
	(0.021)	(0.028)	(0.016)				(0.021)	(0.028)	(0.016)
Treat 17 X Post	-0.025	0.019	-0.049*	-0.025	0.018	-0.049*	-0.025	0.018	-0.049*
	(0.016)	(0.015)	(0.013)	(0.016)	(0.015)	(0.013)	(0.016)	(0.015)	(0.013)
Treat 18 X Post	-0.009	0.003	-0.022+	-0.009	0.003	-0.022+			
	(0.011)	(0.009)	(0.011)	(0.011)	(0.009)	(0.011)			
Constant	4.857*	4.170*	4.315*	4.613*	4.460*	4.592*	4.331*	3.669*	4.820*
	(0.023)	(0.063)	(0.038)	(0.026)	(0.097)	(0.038)	(0.028)	(0.065)	(0.028)
N	4845	1710	3135	3876	1368	2508	3876	1368	2508
Controls					Y				
Year FE					Y				
State FE					Y				
Age FE					Y				
State By Age FE					Y				
Age-Specific Linear Trend					Y				
State-Specific Linear Trends					Y				
Cluster by State					Y				

Note: These estimates are based on a triple differences estimation, where the control group is composed of 19-20 year old mothers and the treatment group is composed of 16-18, 17-18, and 16-17 year old mothers. Regressions are weighted by the size of female population of the relevant ages.
+ indicates $P \leq 0.10$, * indicates $P \leq 0.05$, ** indicates $P \leq 0.01$, *** indicates $P \leq 0.001$
Source: Author's calculations

Table A2: Effects of GDL on Teen Fertility, Age 19-21

	All	Non Tough	Tough	All	Non Tough	Tough	All	Non Tough	Tough
	Treat 16-18, Control 19-21			Trat 17-18, Control 19-21			Treat 16-17, Control 19-21		
Panel A: Homogeneous Effects									
Treat X Post	-0.018	0.018	-0.041*	-0.014	0.013	-0.033*	-0.025	0.024	-0.052*
	(0.017)	(0.016)	(0.014)	(0.015)	(0.012)	(0.013)	(0.020)	(0.021)	(0.015)
Constant	4.883*	4.651*	4.846*	4.839*	4.944*	4.804*	4.880*	4.645*	4.843*
	(0.024)	(0.059)	(0.028)	(0.024)	(0.098)	(0.032)	(0.024)	(0.059)	(0.029)
N	5814	2052	3762	4845	1710	3135	4845	1710	3135
Panel B: Heterogeneous Effects by Age									
Treat 16 X Post	-0.027	0.027	-0.056*				-0.027	0.027	-0.057*
	(0.023)	(0.028)	(0.018)				(0.023)	(0.028)	(0.018)
Treat 17 X Post	-0.022	0.021	-0.047*	-0.022	0.021	-0.047*	-0.022	0.021	-0.047*
	(0.018)	(0.015)	(0.014)	(0.018)	(0.015)	(0.014)	(0.018)	(0.015)	(0.014)
Treat 18 X Post	-0.005	0.006	-0.019	-0.005	0.006	-0.019			
	(0.013)	(0.009)	(0.013)	(0.013)	(0.009)	(0.013)			
Constant	4.619*	4.646*	4.846*	4.871*	4.462*	4.834*	4.880*	4.325*	4.843*
	(0.025)	(0.061)	(0.028)	(0.025)	(0.094)	(0.031)	(0.024)	(0.066)	(0.029)
N	5814	2052	3762	4845	1710	3135	4845	1710	3135
Controls					Y				
Year FE					Y				
State FE					Y				
Age FE					Y				
State By Age FE					Y				
Age-Specific Linear Trend					Y				
State-Specific Linear Trends					Y				
Cluster by State					Y				

Note: These estimates are based on a triple differences estimation, where the control group is composed of 19-21 year old mothers and the treatment group is composed of 16-18, 17-18, and 16-17 year old mothers. Regressions are weighted by the size of female population of the relevant ages.
+ indicates $P \leq 0.10$, * indicates $P \leq 0.05$, ** indicates $P \leq 0.01$, *** indicates $P \leq 0.001$
Source: Author's calculations

Table A3: Heterogeneous Effect of GDL on Fertility

	Universe 16-24	Universe 16-20	Universe 16-21
Panel A: Treatment 16-18 year old mothers			
Treat X Post	0.039	0.017	0.024
	(0.030)	(0.021)	(0.024)
Treat X Post X Tough	-0.084*	-0.061*	-0.066*
	(0.033)	(0.024)	(0.027)
Constant	4.847*	4.924*	5.299*
	(0.025)	(0.035)	(0.025)
N	8721	4845	5814
Panel B: Treatment 17-18 year old mothers			
	Universe 17-24	**Universe 17-20**	**Universe 17-21**
Treat X Post	0.039	0.017	0.024
	(0.025)	(0.017)	(0.019)
Treat X Post X Tough	-0.078*	-0.054*	-0.060*
	(0.028)	(0.019)	(0.022)
Constant	5.017*	4.148*	3.970*
	(0.027)	(0.030)	(0.037)
N	7752	3876	4845
Panel C: Treatment 16-17 year old mothers (Excluding 18 year olds from Treatment and Control)			
	Universe 16-24	**Universe 16-20**	**Universe 16-21**
Treat X Post	0.037	0.015	0.023
	(0.034)	(0.026)	(0.028)
Treat X Post X Tough	-0.092*	-0.068*	-0.074*
	(0.038)	(0.029)	(0.032)
Constant	4.932*	3.636*	5.226*
	(0.024)	(0.026)	(0.024)
N	7752	3876	4845
Controls		Y	
Year FE		Y	
State FE		Y	
Age FE		Y	
State By Age FE		Y	
Age-Specific Linear Trend		Y	
State-Specific Linear Trends		Y	
Cluster by State		Y	

Note: These estimates are based on a triple differences estimation, where the control group is composed of 19-24, 19-20 and 19-20 year old mothers and the treatment group is composed of 16-18, 17-18, and 16-17 year old mothers. Regressions are weighted by the size of female population of the relevant ages.
+ indicates $P \leq 0.10$, * indicates $P \leq 0.05$, ** indicates $P \leq 0.01$, *** indicates $P \leq 0.001$
Source: Author's calculations

Table A4:Heterogeneous Effects by components, Triple Differences Estimates with Alternative Treat-Control

	Treat 16-18, Control 19-20	Treat 17-18, Control 19-20	Treat 16-17, Control 19-20
Panel A: Control 19-20			
Treat X Post-Curfew	-0.039*	-0.030*	-0.051*
	(0.015)	(0.014)	(0.017)
Treat X Post-Passenger	-0.033	-0.026	-0.046+
	(0.020)	(0.018)	(0.025)
Treat X Post-Both	0.050*	0.037+	0.067*
	(0.023)	(0.021)	(0.027)
Constant	4.754*	4.687*	4.753*
	(0.023)	(0.023)	(0.025)
N	2565	2052	2052
Panel B: Control 19-21			
	Treat 16-18, Control 19-21	**Trat 17-18, Control 19-21**	**Treat 16-17, Control 19-21**
Treat X Post-Curfew	-0.038*	-0.029+	-0.050*
	(0.017)	(0.015)	(0.018)
Treat X Post-Passenger	-0.033	-0.026	-0.046+
	(0.020)	(0.019)	(0.025)
Treat X Post-Both	0.047+	0.034	0.064*
	(0.023)	(0.022)	(0.027)
Constant	4.754*	4.756*	4.753*
	(0.023)	(0.022)	(0.024)
N	3078	2565	2565
Controls		Y	
Year FE		Y	
State FE		Y	
Age FE		Y	
State By Age FE		Y	
Age-Specific Linear Trend		Y	
State-Specific Linear Trends		Y	
Cluster by State		Y	

Note: These estimates are based on a triple differences estimation, where the control group is composed of 19-20 and 19-21 year old mothers and the treatment group is composed of 16-18, 17-18, and 16-17 year old mothers. Regressions are weighted by the size of female population of the relevant ages.

+ indicates $P \leq 0.10$, * indicates $P \leq 0.05$, ** indicates $P \leq 0.01$, *** indicates $P \leq 0.001$

Source: Author's calculations

Table A5: Differences-in-Differences, More Specifications

	Linear		Quadratic	
Panel A: Universe 16-18				
Post Tough	-0.017	-0.019	-0.018*	-0.019*
	(0.014)	(0.014)	(0.008)	(0.009)
Post Non Tough	0.009	0.008	0.001	0.001
	(0.031)	(0.031)	(0.022)	(0.023)
Constant	3.757*	3.174*	3.725*	3.143*
	(0.026)	(0.029)	(0.022)	(0.026)
observations	2907	2907	2907	2907
Panel B: Universe 17-18				
Post Tough	-0.021	-0.021	-0.026*	-0.027*
	(0.015)	(0.015)	(0.010)	(0.010)
Post Non Tough	0.007	0.007	0.000	-0.000
	(0.027)	(0.028)	(0.019)	(0.020)
Constant	4.219*	3.992*	4.179*	3.955*
	(0.035)	(0.037)	(0.020)	(0.021)
observations	1938	1938	1938	1938
Panel C: Universe 16-17				
Post Tough	-0.016	-0.016	-0.014	-0.015
	(0.015)	(0.015)	(0.009)	(0.009)
Post Non Tough	0.009	0.009	0.001	0.001
	(0.034)	(0.034)	(0.025)	(0.025)
Constant	3.753*	3.458*	3.745*	3.443*
	(0.043)	(0.045)	(0.031)	(0.033)
observations	1938	1938	1938	1938
Controls	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
State FE	Y	Y	Y	Y
State-Specific Linear Trends	Y	Y	Y	Y
State-Specific Quadratic Trends	N	Y	N	Y
State X Age Effect	N	Y	N	Y
Age-Specific Linear Trend	N	Y	N	Y
Cluster by State	Y	Y	Y	Y

Note: These estimates are based on a differences-in-differences estimation, where the indicator that GDL is implemented in state s and year t (Post) is replaced by two indicators, one for tough GDL and one for non-tough GDL. Regressions are weighted by the size of female population of the relevant ages.

The sample in the first column is restricted to 16-18 year old mothers, the second column is restricted to 17-18 year old mothers and the third columns is restricted to 16-17 year old mothers.

+ indicates $P \leq 0.10$, * indicates $P \leq 0.05$, ** indicates $P \leq 0.01$, *** indicates $P \leq 0.001$

Source: Author's calculations

Table A6: Effects of GDL on Pregnancy Health Outcomes

	All	Non-Tough	Tough	All	Non-Tough	Tough	All	Non-Tough	Tough
	Universe 16-24			Universe 16-20			Universe 16-21		
Panel A: Total number of Prenatal Visits									
Treat X Post	0.014	0.012	0.002	-0.002	0.013	-0.011	0.001	-0.001	-0.005
	(0.031)	(0.031)	(0.039)	(0.024)	(0.030)	(0.032)	(0.025)	(0.025)	(0.034)
Constant	11.283*	9.426*	11.753*	10.816*	9.610*	11.002*	10.968*	9.119*	11.290*
	(0.208)	(0.249)	(0.234)	(0.206)	(0.313)	(0.229)	(0.209)	(0.634)	(0.226)
N	8721	3078	5643	4845	1710	3135	5814	2052	3762
Panel B: Birth Weight in grams									
	Universe 17-24			Universe 17-20			Universe 17-21		
Treat X Post	-2.674	-3.978	-3.728	-3.334+	-4.028	-4.450+	-3.288+	-4.894	-4.145+
	(1.934)	(3.276)	(2.516)	(1.985)	(3.511)	(2.535)	(1.883)	(3.245)	(2.420)
Constant	3240.950*	3242.850*	3271.318*	3191.942*	3167.096*	3187.817*	3214.261*	3179.095*	3228.905*
	(5.820)	(12.008)	(5.542)	(5.727)	(8.135)	(6.383)	(5.782)	(16.727)	(6.181)
N	8721	3078	5643	4845	1710	3135	5814	2052	3762
Panel C: Weight Gain During Pregnancy									
	Universe 16-24 (Excluding 18)			Universe 16-20 (Excluding 18)			Universe 16-21 (Excluding 18)		
Treat X Post	-0.328	-0.047	-0.391	-0.524	-0.083	-0.674	-0.423	-0.073	-0.526
	(0.268)	(0.226)	(0.316)	(0.379)	(0.208)	(0.469)	(0.316)	(0.222)	(0.375)
Constant	29.185*	27.074*	28.420*	29.556*	29.623*	29.316*	29.260*	30.380*	28.446*
	(0.377)	(1.532)	(0.477)	(0.422)	(1.065)	(0.580)	(0.415)	(1.491)	(0.542)
N	8721	3078	5643	4845	1710	3135	5814	2052	3762
Controls					Y				
Year FE					Y				
State FE					Y				
Age FE					Y				
State By Age FE					Y				
Age-Specific Linear Trend					Y				
State-Specific Linear Trends					Y				
Cluster by State					Y				

Note: These estimates are based on a triple differences estimation, where the control group is composed of 19-20 year old mothers and the treatment group is composed of 16-18, 17-18, and 16-17 year old mothers. Regressions are weighted by the size of female population of the relevant ages.

+ indicates $P \leq 0.10$, * indicates $P \leq 0.05$, ** indicates $P \leq 0.01$, *** indicates $P \leq 0.001$

Source: Author's calculations

Table A7: Effects of GDL on Teen Fertility, Ln Counts of Births

	All	Non-Tough	Tough	All	Non-Tough	Tough	All	Non-Tough	Tough
	Treat 16-18, Control 19-24			Trat 17-18, Control 19-24			Treat 16-17, Control 19-24		
Treat X Post	-0.015	0.035	-0.040*	-0.013	0.030+	-0.036*	-0.021	0.038	-0.049*
	(0.021)	(0.021)	(0.015)	(0.019)	(0.016)	(0.014)	(0.024)	(0.026)	(0.016)
Constant	8.122*	9.546*	8.048*	8.108*	6.197*	8.035*	8.123*	9.582*	8.051*
	(0.045)	(0.278)	(0.046)	(0.048)	(0.057)	(0.048)	(0.045)	(0.276)	(0.046)
N	8721	3078	5643	7752	2736	5016	7752	2736	5016
Controls					Y				
Year FE					Y				
State FE					Y				
Age FE					Y				
State By Age FE					Y				
Age-Specific Linear Trend					Y				
State-Specific Linear Trends					Y				
Cluster by State					Y				

Note: These estimates are based on a triple differences estimation, where the control group is composed of 19-24 year old mothers and the treatment group is composed of 16-18, 17-18, and 16-17 year old mothers. Regressions are weighted by the size of female population of the relevant ages. The dependent variable is the natural logarithm of the counts of births in state s in year t. I control for size of the female population of the relevant age group in state s in year t.

+ indicates $P \leq 0.10$, * indicates $P \leq 0.05$, ** indicates $P \leq 0.01$, *** indicates $P \leq 0.001$

Source: Author's calculations

Table A8: Abortion Rates from CDC for ages 16-18

	All			Non-Tough (Min. Age <17)			Tough (Min. age 17+)		
	No Trends	Linear Trends	quadratic	none	linear	quadratic	none	linear	quadratic
Panel A: Post Curfew									
Post-Curfew	-0.056	0.009	0.010	-0.041	-0.003	0.001	-0.059	0.025	0.025
	(0.035)	(0.039)	(0.037)	(0.044)	(0.035)	(0.036)	(0.046)	(0.065)	(0.065)
Constant	2.854*	2.954*	2.863*	-0.176+	2.686*	1.506*	2.789*	2.979*	2.882*
	(0.070)	(0.070)	(0.074)	(0.094)	(0.151)	(0.105)	(0.093)	(0.102)	(0.096)
Obs	784	784	784	294	294	294	490	490	490
Panel B: Post Passenger									
Post-Passenger	0.019	0.038	0.029	0.012	0.004	-0.002	0.030	0.068	0.060
	(0.028)	(0.027)	(0.024)	(0.031)	(0.037)	(0.035)	(0.039)	(0.041)	(0.036)
Constant	2.863*	2.960*	2.866*	-0.172+	2.691*	1.505*	2.818*	2.992*	2.878*
	(0.073)	(0.067)	(0.072)	(0.093)	(0.149)	(0.102)	(0.093)	(0.102)	(0.095)
Observations	784	784	784	294	294	294	490	490	490
Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
State FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
State-Specific Lin Trend	N	Y	Y	N	Y	Y	N	Y	Y
State-Specific Quad Trend	N	N	Y	N	N	Y	N	N	Y
Cluster by State	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note: These estimates are based on a differences-in-differences estimation, where the indicator that GDL is implemented in state s and year t (Post) is replaced by two indicators, one for the passage of the curfew component and one for the passage of the passenger restriction. Regressions are weighted by the size of female population of the relevant ages. The sample is restricted to 16-18 year old mothers. The dependent variable is the natural logarithm of the counts of births among 16-18 year old mothers per 1000 16-18 year old women in a state-year cell.

+ indicates $P \leq 0.10$, * indicates $P \leq 0.05$, ** indicates $P \leq 0.01$, *** indicates $P \leq 0.001$

Source: Author’s calculations