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Prohibition without protection: Marriageable age law reforms and adolescent fertility in Mexico

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Prohibition without Protection: Marriageable Age Law Reforms and Adolescent Fertility in Mexico*

Abstract

Between 2014 and 2017, Mexican states implemented minimum marriageable age laws that banned marriages for girls below 18. In this study, I exploit the temporal and geographical variation in law implementation to estimate the impact of these civil law reforms on child marriage rates, teenage birth rates and school attendance using a difference-in-difference methodology. The results show that states adopting minimum marriageable age laws exhibited a 37% decrease in child marriage rates and a 0.9% increase in the likelihood of girls' school attendance compared to non-adopting states. However, contrary to what is expected, I find an increase in teenage birth rates by approximately 11%. To explain these findings, I present a novel theory hypothesizing that adolescent girls used pregnancy as an alternative commitment device in place of marriage. Additional results suggest that this behavioral response is likely to be stronger among girls from lower socio-economic classes due to low-income earning potential and the subsequent need for a man's financial support. An analysis of a cross-sectional, nationally representative survey on child labor further indicate that girls could have been compelled to enter consensual unions during or post-pregnancy as marriage was no longer allowed, exposing them to a higher risk of domestic violence, single-motherhood and abject poverty. The results highlight the importance of considering local socio-cultural contexts before applying international policy guidelines in order to eschew unintended consequences.

JEL Code: J112, J13, J18, K15

Keywords: Adolescent fertility, child marriage, minimum marriageable age laws, consensual unions

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I. Introduction

Child marriage is defined as a formally or informally recognized union in which either or both parties involved are below the age of 18. The United Nations (UN) Convention on the Rights of the Child condemns child marriage as it prematurely ends girls' childhood, which is a fundamental violation of human rights, and aims to eradicate child marriage by 2030 as part of the Sustainable Development Goals (SDGs). In correspondence with international guidelines to eliminate this practice, the 2014 General Law on the Rights of Children and Adolescents (*Ley General de los Derechos de Niñas, Niños y Adolescentes*) was introduced in Mexico to raise the minimum marriageable age to 18 without exceptions.¹ Since then, all thirty-two Mexican states were advised to harmonize family and civil law codes that previously allowed marriages below 18 with federal law.

Prohibiting early marriages is important as it has been linked to early childbearing. In a cross-sectional study on twelve Sub-Saharan African countries, [Maswikwa et al. \(2015\)](#) found that women who married younger than 18 were more likely than their counterparts to be teenage mothers. In the context of Mexico, [Arceo-Gomez and Campos-Vasquez \(2014\)](#) confirmed that teenage pregnancy is positively correlated with early marriage, and negatively associated with educational and labour market outcomes. Across literature, adolescent fertility has additionally been linked to lower human capital accumulation, weaker intra-household decision making power and poorer health outcomes like malnutrition, intimate partner violence, psychological distress, sexually transmitted diseases as well as infant and maternal mortality ([Jensen and Thornton, 2003](#); [Field and Ambrus, 2008](#); [Heath and Mobarak, 2015](#)). Early childbearing is also a key determinant of female-headed households, divorce and excessive fertility which perpetuates the cycle of poverty ([Johnson, 1974](#); [Geronimus and Korenman, 1992](#)).

Adolescent fertility is a grave phenomenon in Mexico where teenage birth rates are currently the highest out of all OECD nations. Whereas most OECD countries have experienced increases in the mean childbearing age, Mexico has seen an opposite trend where the average age of childbirth has

¹ For official documentation of the policy, see: https://www.gob.mx/cms/uploads/attachment/file/339082/LGDNNA__Con_ltimas_reformas_2018__hasta_la_del_20_de_junio_.pdf.

decreased by about 3.6 years since 1970 (OECD, 2018). According to the OECD, the number of births to girls in the 15-19-year-old age group per 1,000 women in the same age bracket was 66.2 in 2016, five times higher than the OECD average. While data on the actual number of underage girls in informal unions remains scarce, statistics from Mexico’s national birth records provide supporting evidence that the rising trends in adolescent fertility are at least in part driven by an increase in the number of girls entering consensual unions. Figure A shows a steady decline in the share of births to married mothers below 18 since 1985, and a concurrent increase in the proportion of births to teenage girls in consensual unions during the same period. Specifically, the proportion of births to married (consensual union) teenage mothers has decreased (increased) from approximately 61 (26) percent in 1985 to 3.3 (63) percent in 2017.

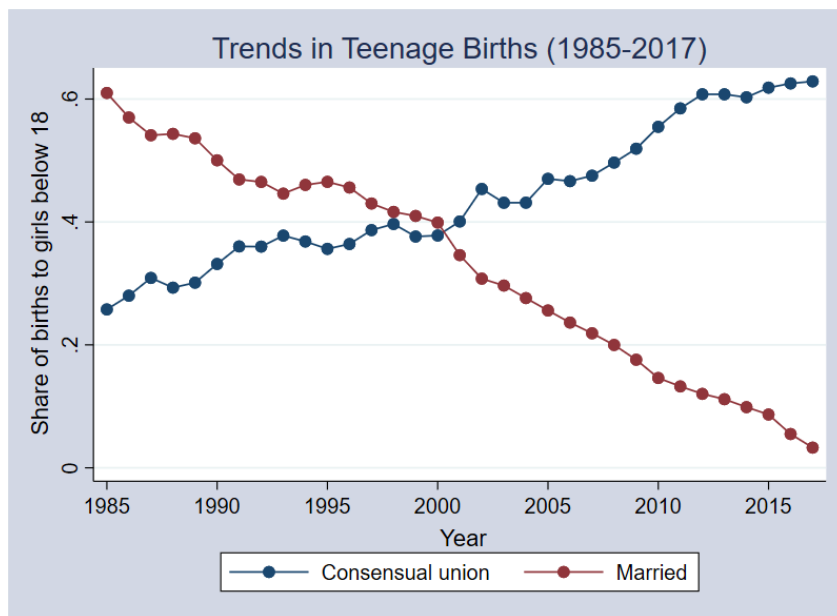


Figure A. Trends in teenage birth rates among girls below 18 (1985 – 2017). *Notes:* This figure plots the share of births to girls below 18 according to marital status (consensual union or married) from 1985 to 2017. Data come from Birth administrative records provided by the National Institute for Statistics and Geography (INEGI). 1985 is the earliest year for which micro-level data is available.

Literature abound about the potential benefits of marriageable age law reforms in reducing the incidence of child marriage and in turn adolescent fertility, yet very few studies have explicitly examined the relationship between these factors. A majority of the papers that have specifically examined this relationship, however, conduct cross-country analyses with data at the

aggregate level and fail to provide local insight into the mechanisms that underlie the correlation (Kim et al., 2013; Maswikwa et al., 2015). The general finding across these cross-country studies is nonetheless that civil law reforms on the marriageable age have been effective in abating child marriage and teenage pregnancy. A study by Bharadwaj (2015) which relates closely to this paper, examined the effect of the 1957 marriage law amendment which raised the marriageable age to 18 in Mississippi, U.S, on child marriage rates and crude birth rates. Similar to the cross-country studies, the author found that both child marriage rates and crude birth rates decreased by 75% and 2-6% respectively. In developing countries like Indonesia, marriageable age law changes have been shown to be less effective in mitigating child marriage rates. Cammack, Young and Heaton (1996) demonstrated that while there was a steady decline in the number of girls marrying below the age of 16 as a result of Indonesia's 1974 National Marriage Act, the law did not have an appreciable effect on the trend.

In this study, I challenge the notion that minimum marriageable age laws are useful in reducing adolescent fertility through the support of an original economic theory, based on the substitution of marriage with pregnancy as a commitment device. Since minimum marriageable age laws effectively remove the formal commitment device (marriage) for girls and their families, they may look to alternative forms of commitment such as pregnancy to make up for the loss in formal commitment. Under these circumstances, total teenage birth rates could instead increase as a result of banning marriages. Especially given differing socio-cultural contexts in a middle-income and developing country like Mexico, it is additionally unclear whether minimum marriageable age laws are effective in influencing teenage birth rates at all. In particular, religion plays a major role in Mexico with approximately 83% of the population belonging to the Catholic faith (Population and Housing Census, 2010). Since abortion is often considered a religious taboo (and is only legal in one state), pregnant teenage girls may be pressured to enter informal unions characterized by cohabitation, in the event that laws prohibiting marriage are in place.² In some cases, family members are also

² The National Institute for Statistics and Geography (INEGI) defines informal unions (*'unión libre'*) as both common law marriages (*'concubinatos'* in Spanish) and non-common law marriages in which couples are involved in a consensual union or domestic partnership. In

responsible for pushing girls into early unions to hide the pregnancy, protect the girl’s and family’s reputation, and to ensure that the man upholds his responsibility in taking care of the girl and the child (Mexican Institute for Health and Demography (INSAD), 2017). Data from the National Institute for Statistics and Geography (INEGI) document an increase (decrease) in the number of informal unions (marriages) since the 1990s (see Figure B), indicating that informal unions have become an increasingly popular substitute for formal unions (marriage). This suggests that prohibiting marriages below 18 may not have an effect on teenage births, if the switch from a formal to an informal union is uncostly.

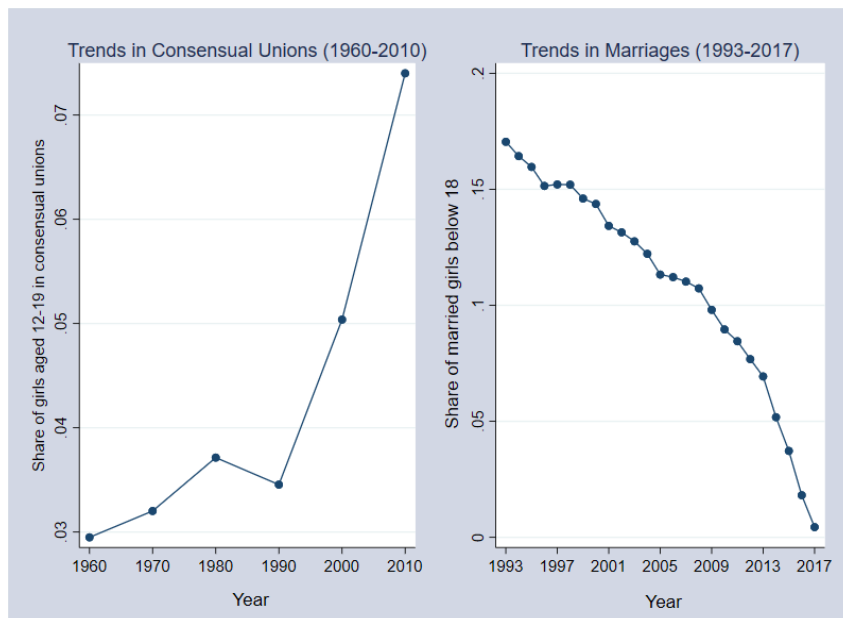


Figure B. Trends in consensual unions among girls between 12-19 years of age (1960 – 2010) and trends in marriages among girls below 18 (1993 – 2017). *Notes:* This figure plots the share of girls who were in consensual unions before age 20 from 1960 to 2010 (left), and the share of girls who were married before age 18 from 1993 to 2017 (right). Data on consensual unions is from the Population and Housing Census collected by the National Institute for Statistics and Geography (INEGI), and is available for the years 1960, 1970, 1980, 1990, 2000 and 2010. Statistics on the number of consensual unions is less frequently documented than marriages since these types of partnerships are not typically recorded in registers by definition. Data on marriages come from Nuptiality administrative records provided by the National Institute for Statistics and Geography (INEGI). 1993 is the earliest year for which micro-level data is available.

this study, I refer to informal unions as consensual unions, domestic partnerships and cohabitation interchangeably, which all carry the same meaning.

Figure B plots the share of girls below 20 in consensual unions between 1960 and 2010 and the share of married girls below 18 from 1993 to 2017.³ Over the entire period, the proportion of girls in consensual unions increased from 2.9 to 5.1 percent, with 1990-2010 experiencing the sharpest growth rate in the share of girls in such unions. Statistics from the 2010 Population and Housing Unit Censuses further indicate that the number of girls between 12 and 19 in consensual unions was approximately 2.4 times more than those in formal unions. Amador (2016) also documented a cohabitation boom in Mexico in the 2000s stemming from growing societal acceptance among both less educated and more educated women. Analyzing marital histories of 99,387 female respondents in the 2009 National Survey of Demographic Dynamics, her results revealed that the cohabitation boom was mainly driven by cohorts born after 1975. On the other hand, the proportion of married girls below 18 fell significantly from 17 percent in 1993 to 0.4 percent in 2017, amounting to a reduction in the number of underaged married girls by a factor of approximately 39.

The evolving socio-cultural trends and underlying economic conditions in Mexico suggest that the relationship between child marriage and teenage motherhood is not as straightforward and predictable. Unlike regions like Africa, consensual unions have thrived in Latin America due to growing acceptance towards this practice over time. Across various African countries, cohabitation before marriage is typically socially unacceptable due to strong traditional values and beliefs. A recent study by Duyilemi, Tunde-Awe and Lois (2018) found that 71.8% of Nigerian undergraduate students perceived domestic partnerships without marriage as a key factor of moral decadence in society, indicating that the act of cohabitation would violate religious and cultural codes and that marriage was important for legitimizing ones' societal standing. Legally restricting the age of marriage to above 18 should thus be effective in reducing child marriage rates and its associated consequences like teenage pregnancy in societies where consensual unions are less of an option.

This study makes several contributions to literature. First, contrary to existing studies which postulate that teenage birth rates should decline along with child marriage rates, I show otherwise. Using a staggered

³ Statistics from the National Institute for Statistics and Geography (INEGI) on consensual unions (*unión libre*) are only presented in age groups of 12-14 and 15-19.

difference-in-differences (D-I-D) approach, the results indicate that notwithstanding the criminalization of underaged marriages which lowered child marriage rates and increased the likelihood of girls' school attendance, the law increased total teenage birth rates with some evidence suggesting that this increase came from girls in consensual unions. I find no effect of the legal reforms on teenage birth rates among married girls below the age of 18, which was the target group of the minimum marriageable age laws. This result is unsurprising however, considering the declining trend in underaged marriages to begin with. Based on [Bowmaker and Emerson's \(2013\)](#) model on entry into marriage, I attribute these findings to a novel theory that girls substituted marriage with pregnancy as an alternative commitment device. No previous studies to my knowledge have used this theory to contest the view that minimum marriageable age laws are necessarily effective in improving adolescent girls' welfare.

Second and importantly, the results help to shed more light on the effects of laws against early marriage on teenage pregnancy in societies like Mexico, where consensual unions are an increasing social norm. This is particularly important for regions like Latin America where consensual unions have grown in popularity, as girls may be more likely to readily accept a consensual union as an alternative to a formal union in the event of pregnancy. According to DHS surveys from the 1990s, consensual unions make up a large proportion of partnerships throughout Latin America with rates of up to 61.5 percent in Dominican Republic ([Castro-Martín, 2002](#)). The findings from this paper using Mexico as a case study are therefore potentially generalizable to other countries in Latin America, assuming similar socio-cultural, economic and political climates.

Lastly, this paper may be interesting for policy-makers who aim to improve the lives and welfare of adolescent girls through international guidelines and policies. The findings from this paper reveal that it is consequential for governments to account for country-specific socio-cultural trends as global policies may not be a one-size-fits-all solution. The rest of the paper is organized as follows: [section II](#) provides a background on minimum marriageable age law reforms, and also covers the theoretical aspects for the topic in question; [section III](#) describes the data used in this study; [section IV](#) focuses on the use of difference-in-differences (D-I-D) as an empirical strategy, and discusses various identifying assumptions associated with the D-I-D

approach; [section V](#) presents the main results of the paper, reports a set of robustness checks, additional results related to schooling, heterogenous effects of the law and also discusses possible channels; [section VI](#) finally concludes.

II. Background and Theoretical Considerations

Legal Conditions

Exactly three decades ago in November 1989, the Convention on the Rights of the Child was unanimously approved by the United Nations General Assembly. Participating members of the United Nations, including Mexico, were constitutionally bound to streamline legislative frameworks to protect children and adolescents' rights without exceptions. The convention asserted that the onus was on policy-makers, governments and individuals to take into account the best interest of the child, which included a life free from discrimination and violence, the right to proper survival and development as well as respect for children's views, opinions and individuality. Since Mexico's ratification of the convention in 2000 which entailed various constitutional amendments, momentous progress has been made in alleviating malnutrition and infant mortality rates, and implementing compulsory primary school education among other advances.

On 4 December, 2014, significant extensions were made to the Law on Protection of the Rights of Girls, Boys and Adolescents, formally enacted in 2000. The reforms to the law in 2014 represented the largest milestone in legislative progress towards achieving greater child rights in Mexico over the last 25 to 30 years. Under the previous version of the law, only 56 articles were stipulated to preserve child rights and did not include legal changes to the minimum marriageable age of girls and boys. The updated 2014 version of the law consisted of a total of 154 articles, divided into 6 chapters. Specifically, chapter two on "The rights of children and adolescents" had been modified to include article 45, which banned marriage below the age of 18 for all boys and girls without exceptions ([Martín et al., 2016](#)). While federal state guidelines to raise the minimum marriageable age to 18 were officially introduced in December 2014, two out of thirty-two Mexican states had enacted the law prior to this date, namely Veracruz in February 2014 and Baja California Sur in June 2014. By the end of 2017, twenty-seven out of

thirty-two states had modified their family and civil law codes to abide to federal law, albeit in a staggered fashion (see [Table 1](#)).⁴

Considering the rising trend in consensual unions in Mexico, it is important to understand the decision to switch from a formally recognized partnership to a consensual one particularly when a child is involved. Prior to February 2017, the marital status of a couple with a registered child did not affect custodial rights or alimony meaning that under Mexican law, parents had full rights, responsibilities and obligations to ensure the support of their child regardless of their relationship status.⁵ Under Chapter VII of the federal penal code, articles 336 and 336 Bis state that in the case of a divorce or separation, a parent who does not voluntarily pay for child support (*'pension alimenticia'*) could face prison time of between 3 to 5 years.⁶ Typically, custody is granted to mothers of the child especially for children younger than seven. In a report prepared for the Federal District Human Rights Commission (CDHDF), about 94% of custody decisions favoured women ([Aspuru Eguiluz, 2006, p.27](#)). Custody laws also state that “the ex-spouse or partner who takes on this obligation is entitled to child support from the other ex-spouse or partner” ([Zamora et al., 2004, p.473](#)). Altogether, these conditions suggest the relative ease of switching from a formal union to an informal partnership especially when a child is concerned, as women who are likely to be poorer and less educated than men should be able to receive child support in the worst-case scenario - a union dissolution.

⁴ [Figure A1](#) of the appendix illustrates the geographical and temporal variation in the enactment of the law across Mexican states.

⁵ On 24 February 2017, the Circuit Plenary in Mexico City established that women or men who were not part of a ‘stable’ union, as defined by a civil marriage or concubinage, were no longer eligible to apply for alimony or claim other forms of maintenance or compensations. The term ‘concubinage’ (*'concubinatos'* in Spanish) in Mexico is equivalent to a common-law marriage where couples cohabit without the formal benefits of marriage. For respective documentation, see: <https://sjf.scjn.gob.mx/sjfsist/Paginas/DetalleGeneralV2.aspx?id=2013735&Clase=DetalleTesisBL>.

⁶ See: http://sil.gobernacion.gob.mx/Archivos/Documentos/2013/04/asun_2969496_20130418_1366649261.pdf for legal documentation.

Table 1. Date of Enactment of Minimum Age Laws

State	Minimum Marriage Age (> 18)	Exceptions
Aguascalientes (AG)	22 February 2016	No
Baja California (BC)*	-	-
Baja California Sur (BS)	30 June 2014	No
Campeche (CM)*	15 May 2016	No
Coahuila (CO)	4 September 2015	No
Colima (CL)	10 September 2016	No
Chiapas (CS)	6 April 2016	No
Chihuahua (CH)	23 December 2017	No
México City (DF)	13 July 2016	No
Durango (DG)	26 February 2017	No
Guanajuato (GT)	-	-
Guerrero (GR)	9 May 2017	No
Hidalgo (HG)	31 December 2016	No
Jalisco (JA)	4 April 2015	No
Mexico (EM)	14 March 2016	No
Michoacán (MI)	25 April 2016	No
Morelos (MO)	17 August 2016	No
Nayarit (NA)	11 March 2016	No
Nuevo Leon (NL)	-	-
Oaxaca (OA)	31 December 2015	No
Puebla (PU)	28 March 2016	No
Queretaro (QT)	-	-
Quintana Roo (QR)	19 December 2014	No
San Luis Potasi (SL)	17 September 2015	No
Sonora (SO)*	-	-
Sinaloa (SI)	19 August 2016	No
Tabasco (TB)	1 July 2017	No
Tamaulipas (TM)	23 June 2016	No
Tlaxcala (TL)	30 December 2016	No
Veracruz (VE)	3 February 2014	No
Yucatan (YU)	12 June 2015	No
Zacatecas (ZA)	29 March 2017	No

* ‘Marry-your-rapist’ laws were implemented in these states in May 2016, and exonerates the perpetrator of the crime, ‘estupro’ (consensual sex with a minor through seduction or deceit) in cases of marriage to the victim. I therefore exclude the three states from the analysis as they serve neither as control nor treatment, since this law goes in the opposite direction of banning marriages below 18. See: <http://www.congresoson.gob.mx:81/Content/InformacionPublica/Articulo17bisA/5/LXI/Dictamenes16/DECRETO93.pdf> for legal documentation.

The Commitment Effect

Drawing from a combination of [Bowmaker and Emerson's \(2013\)](#) theory on marriage entry decisions and [Grossbard-Shechtman's \(1982\)](#) model on informal unions, this paper hypothesizes that girls turn to pregnancy as an alternative commitment device when marriages are banned, suggesting that minimum marriageable age law reforms could have unintended consequences for adolescent girls' welfare. To put this theory into perspective, the imposition of minimum marriageable age laws effectively changes the marriage margin and eliminates marriage as a commitment device for those below 18. As such, a girl may seek to make up for the loss in this commitment channel through other means. [Bowmaker and Emerson's \(2013\)](#) theory consequently suggests that this behaviour places girls in two different situations, depending on their partner types. Assume in a simple setting that there are two types of men: type A, those who give their partners the impression that they are interested in marriage and type B, those who do not. Girls with men of type A should have the incentive to be patient and go through the dating process over time, perhaps through engaging in a consensual union first before getting married. Because a formal union like marriage acted as a buffer for girls against type B men (where they could potentially 'persuade' their partners into marrying them to proof commitment), and this commitment device is no longer available, girls with type B partners may choose pregnancy as an alternative way to gain commitment. Taken together, the theory suggests that the overall effect of minimum marriageable age law reforms on teenage birth rates could be positive, if marriages are substituted by pregnancy as a commitment device.

[Grossbard-Shechtman \(1982\)](#) formalizes a model of men's preference for consensual unions which provides additional support for the theory that girls may select pregnancy as a substitute for marriage as a commitment tool. The model stipulates that men are willing to commit to formal unions (marriage) as long as the peak of a woman's productivity or services she is able to offer her partner like childbearing for instance, exceeds the amount that he is able to compensate her for at that point in time. Considering that females generally reach the zenith of their fertility in their 20s and that males are less likely to achieve economic progress before 30, men prefer consensual unions due to the incentive to exit the union once their peak productivity surpasses a woman's in later periods. To the extent that a wife's peak

productivity is only realized after her husband's, a man should be incentivized to remain in a formal union in order to reap the benefits of his wife's heightened productivity. In addition, because of men's lower search costs in finding a partner through work for example (since women are less likely to work after childbirth like in many developing countries), they have a higher preference for consensual unions that allow easier dissolution. These suppositions suggest that women are disproportionately subject to unstable unions which potentially lead to single-parenthood and abject poverty.

Aside from the *dis*-commitment that males have towards formal partnerships, the commitment effect is especially salient when women take these biological factors into consideration. As shown in [Figure C](#), a woman's utility increases as her indifference curves shift rightwards, which encompasses greater gains from marriage and lower risks of marital dissolution.

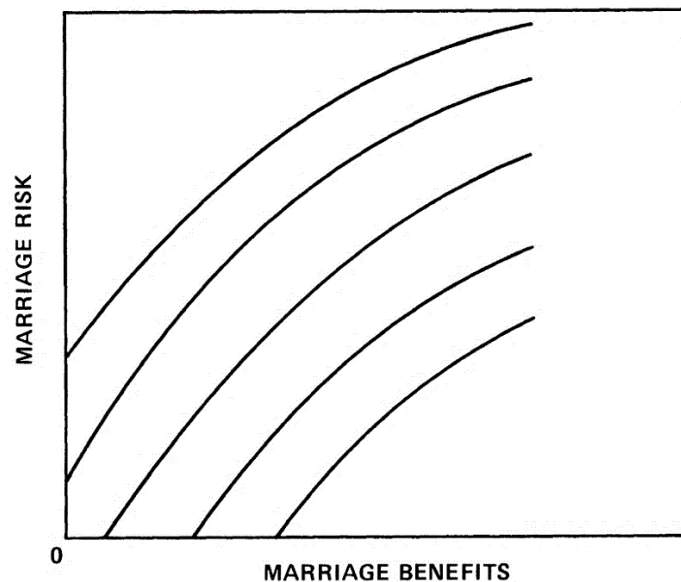


Figure C. A woman's indifference curves along the marriage risk-benefit dimension. *Notes:* This figure is adapted from Grossbard-Shechtman, Amyra. "A theory of marriage formality: the case of Guatemala." *Economic Development and Cultural Change* 30.4 (1982): pp. 819.

An awareness of the *dis*-commitment that men have towards formally recognized unions on the part of a woman in turn incentivizes her to mitigate the risks of a union cessation with her partner. As a result of her risk-averse attitude, any deterrents to dissolution are highly valued. This may come in the form of extravagant wedding celebrations which have been documented to reinforce mutual commitment and reduce the probability of divorce or separation, or deliberately increasing the level of commitment on the side of

her partner through childbearing for example. In essence, because of the high value that a woman places on stable partnerships, she is willing to undertake actions that preclude the dissolution of a union to the best of her ability. This behavioural response may also be stronger among women from lower socio-economic classes who see greater gains from being with a partner who would be able to support them financially. In the case where ‘high-quality’ males are scarce in the marriage market, economically disadvantaged women have been found to be more involved in nonmarital childbearing as it is perceived as an alternative family-formation strategy (Oppenheimer 1988, 1994; Furstenberg 2001, 2003; Edin and Kefalas, 2005) Results from Grossbard-Shechtman’s (1982) empirical study on Guatemala additionally showed that women with greater financial and physical assets were more likely to be married. This suggests that poorer women may have less control over the quality and stability of their relationships, due to weaker bargaining power over marital conditions. Under such circumstances, these women may therefore have a higher propensity to choose pregnancy to make up for the loss of marriage as a formal commitment device.

III. Data

Prior to the 2014 General Law on the Rights of Children and Adolescents, family and civil law codes on the minimum marriageable age in majority of the states were inconsistent with federal law codes. In Aguascalientes for instance, federal law had established 18 as the minimum age that one was allowed to marry, while 16 was the minimum age established by family and civil law codes. Starting from December 2014 however, all states were advised to harmonize family and civil law codes with federal law, which strictly prohibited marriage below the age of 18 without exceptions. Accordingly, this study defines the timing of the law enactment as the date which states had modified their family and civil law codes to complement federal law. Information on the respective dates which states revised their family and civil law codes was provided by the Executive Secretariat of the National System for the Integral Protection of Children and Adolescents, under the Mexican Office for Domestic Affairs (SEGOB).⁷

⁷ Information regarding the dates of law implementation were drawn by the Mexican Office for Domestic Affairs (SEGOB) from the National Supreme Court of Justice.

The National Institute for Statistics and Geography (INEGI) provides unit-level data on registered marriages and births per annum, and includes information on the month and year in which the marriage or birth was registered, the state in which the marriage or birth occurred, the state in which the girl resided, age, education level, marital status, and employment status. Following standard calculations of marriage and fertility rates in existing literature, I define child marriage rates (CMRs) as the absolute number of girls who married below the age of 18 per 1,000 of the population of girls between 12 and 17 years of age. Similarly, teenage birth rates (TBRs) are defined as the absolute number of births to girls below the age of 18 per 1,000 of the population of girls between 12 and 17 years of age.⁸ Since the law prohibits marriages below the age of 18, it is of interest to examine girls in this particular age group who would have been most affected by such legislative changes. For simplicity, child marriage rates and teenage birth rates will be referred to as CMRs and TBRs respectively in the following sections. Given the detailed information on the exact month in which minimum marriageable age laws were enacted in each state, I aggregate observations at the state-month level. Accordingly, I calculate CMRs and TBRs for all represented states using data from 2009 to 2017 which allows for the controlling of sufficient pre-treatment time trends of up to 60 months (5 years) prior to the first law implementation date in the state of Veracruz in February 2014. As data ends in 2017 for the sample of analysis, post-treatment trends of up to 47 months are observed.

Data for state-level covariates are mostly acquired from the National Institute for Statistics and Geography (INEGI). Specifically, baseline controls like the Gross Domestic Product (GDP) is obtained from INEGI's GDP and *National Accounts* database, and the male unemployment rate is taken from the *National survey of Occupation and Employment (ENOE)*. Socio-demographic controls including the male-female sex ratio, population growth rate, proportion of indigenous language speakers and the share of girls aged

⁸ According to the National Health Service (NHS), the average age at which a girl typically reaches fecundity is 12 ([National Health Service, UK, 2016](#)). However, since it is possible that girls may start fecundity as early as 10, I also use the population of girls between 10-17 years old as a robustness check. The significance of the results is unchanged, although the magnitude of the coefficients is smaller as expected since 12 is the minimum age one is allowed to marry in any state across Mexico, and TBRs below that age should thus not be affected by the legal reforms.

between 12-13, 14-15 and 16-17 are from the *Population and Housing Census*. I also control for a potential confounding event, the ENAPEA (*Estrategia Nacional para la Prevención del Embarazo en Adolescentes*) campaign which was introduced in 2015. Specifically, ENAPEA was initiated to combat the high rate of teenage pregnancies across the country. The implementation of the program however, took place in a staggered manner across states between 2015 and 2017, and the exact dates which each state enacted ENAPEA was provided by the *National Population Council (CONAPO)*.⁹ In separate specifications, I additionally include the proportion of junior high school dropouts to proxy for educational attainment, an indisputably important, yet potentially endogenous determinant of early marriage and adolescent pregnancy. Junior high school dropouts data is from the *2017 Annual Statistical and Geographical Yearbook* which contains information on socio-economic, economic and geographical aspects of the country, disaggregated by federal entities. Due to the ongoing Mexican drug war which has led to an increase in national crime rates since 2007, I include the sex crime rate as a control to isolate possible changes in TBRs due to sexual offenses from changes in TBRs as a result of the minimum marriageable age law. I obtain crime data from INEGI's administrative statistical register on *Law Enforcement and Criminal Matters* which provides information on the verdict of the crime committed, the type of crime committed, the location where the crime was reported and the month and year in which the crime was committed.

IV. Empirical Framework

This study relies on the differential timing in the passing of minimum marriageable age laws across states to identify the impact of such legislative reforms on CMRs and TBRs in Mexico. Using both geographical and temporal variation in the timing of legal reforms over time, the identification strategy

⁹ ENAPEA is a multi-sectoral response to combating teenage pregnancy nationwide. To strengthen its implementation, strategic partnerships and cooperation with the Mexican government were established for each of the thirty-two states. The dates provided by CONAPO therefore signify the first effort and commitment made by each state government to reduce and eradicate teenage pregnancies. For official documentation of the ENAPEA program, see: https://www.gob.mx/cms/uploads/attachment/file/232826/ENAPEA_0215.pdf.

is based on a staggered difference-in-differences (D-I-D) approach which estimates the local average treatment effect (LATE). Consequently, the LATE will be estimated through the comparison of states that had and had not implemented the law, before and after the implementation of the law. Treatment is defined as states that had enacted the law in a respective month and year between February 2014 to December 2017, and control states are defined as otherwise. In order to sufficiently account for pre-existing CMR and TBR trends prior to the time the law was first enacted in February 2014, I include data from February 2009 to January 2014 which accounts for pre-treatment periods of up to 60 months. The baseline D-I-D regression is subsequently the following:

$$CMR_{s,t} = B_0 + \beta_1 Law_{s,t} + \beta_2 X_{s,t} + \theta_s + \lambda_t + \varepsilon_{s,t} \quad (1)$$

$$TBR_{s,t+12} = C_0 + C_1 Law_{s,t} + C_2 X_{s,t} + \sigma_s + \tau_t + \mu_{s,t} \quad (2)$$

where the dependent variables $CMR_{s,t}$ is the child marriage rate in state s , during a respective month, t , and $TBR_{s,t+12}$ is the teenage birth rate in state s , 12 months (1 year) after the law was implemented at time t to account for the gestational length of a typical pregnancy and possible information dissemination lags about the enactment of the law.¹⁰ $Law_{s,t}$ is a dichotomous variable equal to 1 in the month and year after state s passed the law in time t , and null otherwise. θ_s and σ_s are the state fixed effects which control for any time-invariant inter-state differences that influence CMRs or TBRs, and that may also be correlated with the timing of law enactment. Month fixed effects, λ_t and τ_t are included to account for aggregate shocks that could have impacted CMRs and TBRs in the absence of the legal reform. The inclusion of month fixed effects is crucial in eliminating bias that may arise from unobservable factors that change over time but are constant across states.

$X_{s,t}$ is a vector of time-varying state level controls that influence the

¹⁰ While this is a standard measure across economic literature on fertility rates, I also examine the effect of the law on TBRs 9,10 and 11 months after the implementation of the law. The results remain significant, although the magnitude of coefficients is smaller for the 9th,10th and 11th month compared to the 12th month. This indicates some delay in fertility responses, possibly due to lags in behavioural changes or information dissemination about the law. Additionally, the policy reform does not have an impact on TBRs prior to 9 months providing additional support that other confounding factors or events were unlikely to precede the law.

CMRs or TBRs. Specifically, I include the GDP per capita growth rate to account for changes in a state’s economy over time and add the male unemployment rate as a proxy for the labour market situation and the ‘quality’ of men. [Greene and Rao \(1995\)](#) among others have suggested that informal unions are typically preferred over marriages during bad economic times, attributing this trend to lower costs and the fact that women favour engaging in more solidified relationships with economically stable men. $X_{s,t}$ also contains various socio-demographic characteristics such as the population growth rate, male-female sex ratio, the proportion of indigenous language speakers, and the share of girls aged between 12-13, 14-15 and 16-17 to account for any compositional changes in the population. In the baseline regressions, I additionally control for the timing of the ENAPEA campaign aforementioned, which undoubtedly had a direct effect on TBRs. I additionally include a proxy for education represented by the proportion of junior high school dropouts in a separate specification, due it’s possible endogeneity to the main outcome variable. As part of the 2006 Secondary Education Reform (RES), the Secretariat of Public Education (SEP) introduced a new RES Programme which included sex education in seventh-grade biology textbooks in Mexico ([SEP, 2018](#)). Since grade seven corresponds to the start of junior high (*‘secundaria’*), individuals leaving school before that grade would have had less exposure to sex education which inevitably affects TBRs. Lastly, amidst the ongoing Mexican drug war, I control for the sex crime rate measured as the absolute number of sex-related offenses per 1,000,000 of the population, due to it’s possible correlation with the timing of the law and impact on TBRs ([Tsaneva and Gunes, 2018](#)). $\varepsilon_{s,t}$ and $\mu_{s,t}$ are the usual disturbance terms.

Timing of law enactment

It is important to verify that the timing of the enactment of minimum marriageable age laws was not influenced by pre-existing trends in CMRs within states. In order to provide supporting evidence of the independence of events aforementioned, I plot the correlation between the mean child marriage rate and changes in the mean child marriage rate in 2013, one year prior to when the law was first implemented in any state. Specifically, [Panels A and B in Figure D](#) show that neither child marriage rates nor child marriage growth rates explain the timing of marriageable age law reforms across states.

As seen in both graphs, there appears to be no defined pattern in the timing of law implementation in states with average child marriage rates or growth rates above the median and below the median.

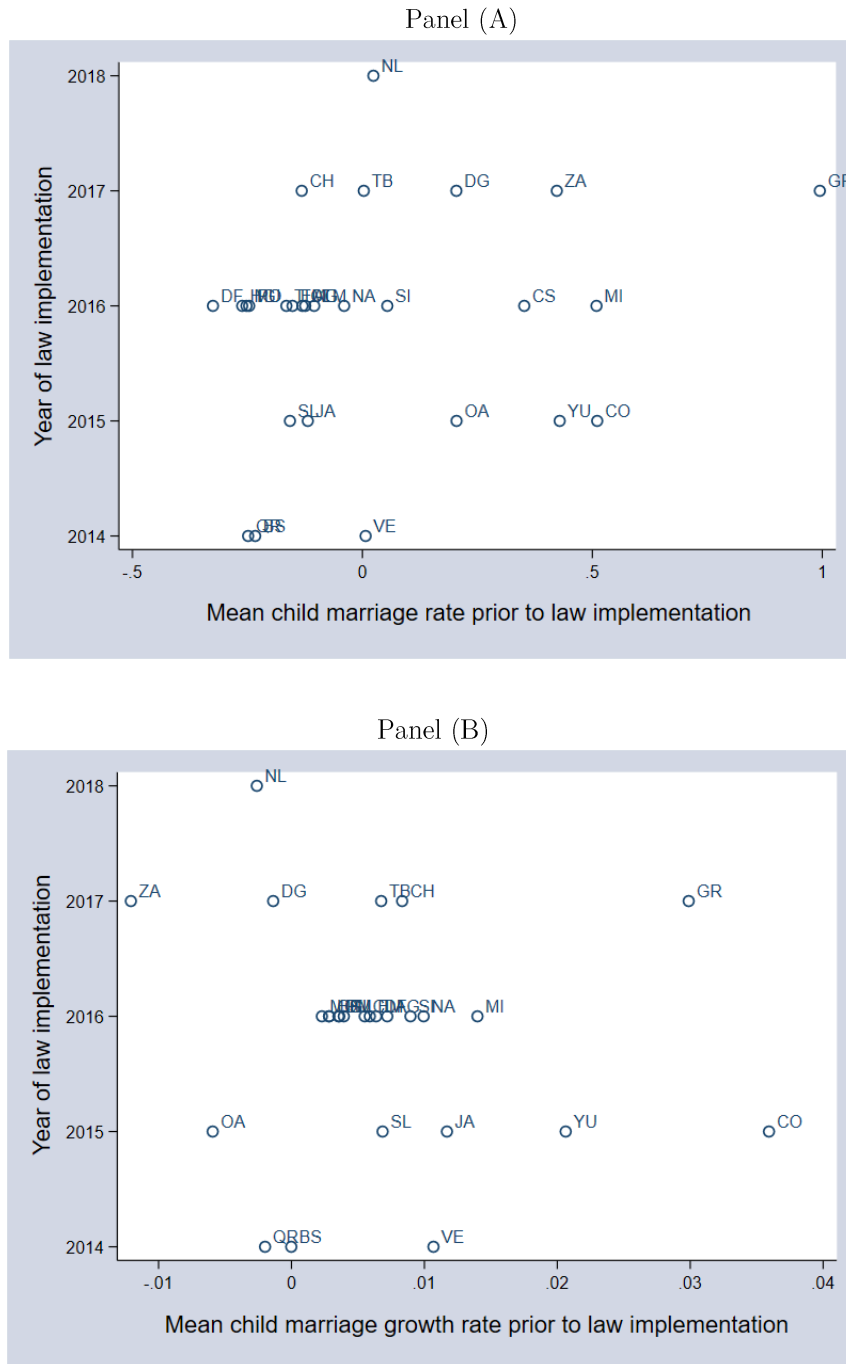


Figure D. A graphical analysis of the correlation between pre-existing child marriage rates (Panel A) and child marriage growth rates (Panel B), and the year of law enactment. *Notes:* Panels A and B show a scatter plot of the relationship between mean child marriage rates and mean child marriage growth rates prior to law implementation respectively. Abbreviation for states are represented by two-letter codes.

Panel A shows that states with similar positive mean child marriage rates like Zacatecas ('ZA'), Chiapas ('CS') and Yucatan ('YU') for instance implemented laws in 2017, 2016 and 2015 respectively, and an analogous pattern is observed for states with negative mean child marriage rates. Guerrero ('GR'), an outlier in the data with higher average child marriage rates than other states had minimum marriageable age laws enacted relatively later in 2017. Considering the negative implications of child marriage and the subsequent urgency to eliminate the act, it is conceivable that states with higher child marriage rates and growth rates would implement the law sooner.

Coincidentally, Panel B shows no clear relationship between mean child marriage growth rates and the year in which the minimum marriageable age laws were enacted. In particular, the states of Quintana Roo ('QR') and Oaxaca ('OA') with negative average child marriage growth rates appear to have implemented the law sooner (2014 and 2015 respectively) than other states like Zacatecas ('ZA') and Nuevo Leon ('NL') that also experienced negative mean child marriage growth rates (law only implemented in 2017 and 2018 respectively). Outlier states like Guerrero ('GR') and Coahuila ('CO') which experienced higher than average growth rates in child marriage additionally do not appear to have implemented the law sooner. Lastly, regressing the year in which the law was enacted on the child marriage rate and rate of change in child marriage reveal statistically insignificant estimates with small t -statistics of 1.40 and -0.54 respectively.

In order to provide further support that covariates included in equations (1) and (2) are exogenous to the timing of the law, I perform a regression of $Law_{s,t}$ on the vector of controls described above. The results show that only one of the covariates, namely the share of girls between 16-17 have a statistically significant relationship with the timing of the law enactment. This indicates that the rate at which states decided to implement the policy was by and large unlikely to be influenced by underlying observable factors that could have also affected CMRs or TBRs.¹¹ To check that CMRs were not influenced by other confounding events that preceded the minimum marriageable age law reforms, I regress $Law_{s,t}$ on CMRs 1,2 and 3 years prior

¹¹ Estimation output for the regression of Law on the set of controls are shown in Table A2 of the appendix. As a robustness test, I exclude the share of girls between 16-17 as a covariate from baseline regressions. Estimates do not change by a large magnitude, and t -statistics for estimates with and without this covariate are similar.

to when the law was implemented in each state. Table A3 of the appendix shows the results from this analysis, with estimates close to zero or with small magnitudes.

Lastly, there may still be concerns about the impact of certain political parties on the speed of law enactment. For instance, political parties that were more progressive (conservative) in nature could have implemented the law sooner (later). To mitigate this concern, I examine five different political parties governing the twenty-seven Mexican states that had implemented the law by 2017, in 2013. As can be seen from Figure E, states with mayors affiliated to the Institutional Revolutionary Party (PRI), the same party as Mexico’s president in 2014, President Peña Nieto, on average enacted minimum marriageable age laws in 2016.

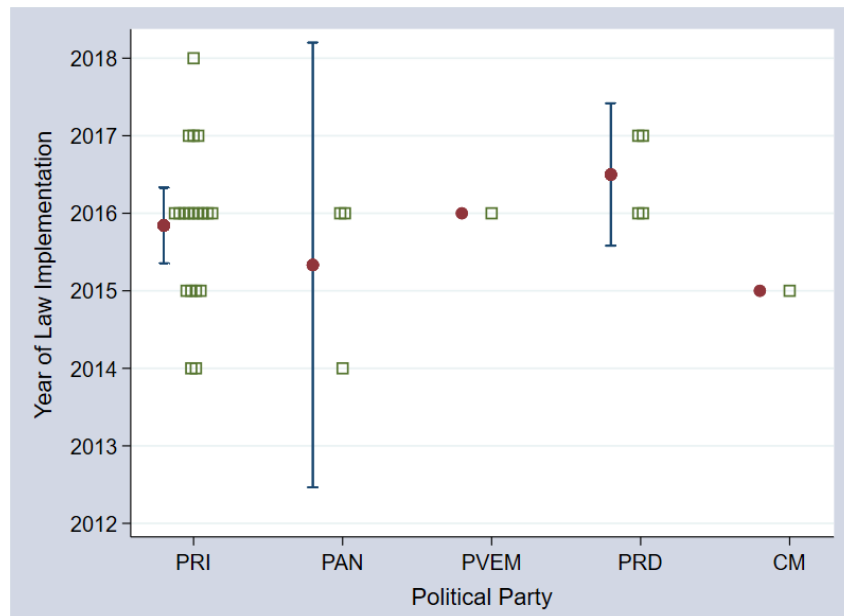


Figure E. A graphical representation of states’ political party affiliations and the timing of law implementation. *Notes:* This figure uses data on state mayors’ political party affiliation in 2013, one year before the law was first implemented. PRI, PAN, PVEM, PRD and MC are the 5 political parties that governed Mexican states represented in the sample. The blue bars represent 95% confidence intervals and mean point estimates are represented by the maroon dots. Each green point represents a state. Data is from the Mexican Centre for Research and Development (CIDAC).

Overall, Figure E shows that most states affiliated with the PRI party implemented the law between 2015 and 2017. Interestingly, the mean implementation year for the PAN party, which has been known to be relatively more conservative on social issues and focused on foreign matters

was in early 2015, earlier than PRI affiliated states. Since only one state was affiliated with each of the PVEM and the MC party, inferences cannot be made on the average year of law implementation. Finally, although states affiliated with the PRD party appear to have enacted the law slightly later, the average difference in the timing of law implementation was only roughly half a year. Altogether, I argue that the rate at which legal reforms took place across states was likely to be exogenous and random given the evidence presented in this section.

Selective Marriage Registration

Despite the inclusion of month and state fixed effects in addition to a set of controls that influence CMRs and TBRs, a potential threat to identification remains due to selective marriage registration across states. For example, girls who resided in a state where marriage below the age of 18 was banned could have registered their marriages in states that had yet to enforce the law. Neglecting such responses could subsequently bias estimates upwards as states in which the law was implemented would have lower than actual CMRs and TBRs and the opposite would be true for states where the law had not yet been enacted. To test for such behavioural responses, I estimate the proportion of girls who registered their marriages in states different from the one that they resided, in the absence of the law. More formally, I estimate the following fixed effects model:

$$Share_{s,t}^* = D_0 + D_1 No_Law_{s,t} + D_2 X_{s,t} + \varphi_s + \omega_t + \epsilon_{s,t} \quad (3)$$

Where $Share_{s,t}^*$ is calculated as the number of girls in state s , who resided in a different state from the one where their marriage was registered, out of the total number of girls who were married below the age of 18 in that state. $No_Law_{s,t}$ is a binary variable equal to one for the years *before* state s , implemented the law at time t , $X_{s,t}$ are the same set of time-varying state level covariates described in equations (1) and (2) above, φ_s and ω_t are the state and month fixed effects respectively and $\epsilon_{s,t}$ is the error term. The results from equation (3) are shown in [Table 2](#), where column (I) is a stripped-down version which includes no controls, column (II) includes baseline covariates like the population growth rate, the male-female sex ratio, the proportion of indigenous language speakers, the share of girls aged 12-13, 14-

15 and 16-17, the GDP per capita growth rate and the male unemployment rate. Column (III) additionally includes the proportion of junior high school dropouts and the sex crime rate per 1,000,000 people.

Table 2 provides evidence of selective marriage registration behaviour in marriage registration, in response to the staggered implementation of minimum marriageable age laws across states.

Table 2

Evidence of selective migration/location of marriage registration.

Dependent variable - Proportion of girls below 18 who got married in state in which they do not reside in

	(I)	(II)	(III)
No Law	0.036**	0.028**	0.028**
	(0.014)	(0.012)	(0.012)
	[0.015]	[0.014]	[0.014]
Controls	No	Yes	Yes
Sex crime rate, share of high school dropouts	No	No	Yes
State FE	Yes	Yes	Yes
Month FE	Yes	Yes	Yes
Wild-Cluster Bootstrapped SE [.]	Yes	Yes	Yes
Observations	3103	3103	3103
Mean dep. var	0.053	0.053	0.053

Notes: Standard errors clustered at the state level and reported in parentheses (.). As a robustness check, wild cluster bootstrapped standard errors are reported in parentheses [.] as recommended by Cameron et al. (2008) when the number of clusters is below 40. Controls include the population growth rate, proportion of indigenous language speakers, male-female sex ratio, GDP per capita growth rate, male unemployment rate, the share of girls aged between 12-13, 14-15, 16-17 and the ENAPEA program. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

The findings suggest that migration was possibly driven by the difference in the timing of legal reforms on the marriageable age as the share of girls below 18 who registered their marriages in a state, and who did not reside in that state increased by approximately 53 percent (0.028/0.053) in states where the law had not been enacted (column II). The inclusion of potentially endogenous covariates in column (III) does not change the results. Coefficients are significant at the 5% level and are positive across all three specifications. As a consequence of selective migration, CMRs and TBRs are calculated based on the state of *residence* of girls, as opposed to the state in which their

marriages or births were registered in order to circumvent the issue of selective marriage registration across states. By fixing individuals to their states of residence, any migration influenced by the date of the law enactment should not affect their assigned subjection to the law. The results presented in the following sections should therefore be interpreted as intent-to-treat (ITT) estimates rather than the LATE, and albeit this approach potentially attenuates estimates, it rules out the possibility that selective marriage registration drives the results.

Law Enforcement

It is important to understand the nature of compliance in policy implementation. Across several South Asian countries, nearly half, a quarter and a fifth of the women aged 20 to 24 were married by age 15 in Bangladesh, India and Nepal respectively, despite laws against early marriage ([WHO, 2003](#)). In a cross-country analysis on the effectiveness of age-of-marriage laws, [Collin and Talbot \(2017\)](#) found that the introduction of such laws is generally not accompanied by proper enforcement. In the event that laws are weakly imposed, some girls would still be allowed to marry below 18, undermining the effectiveness of the policy reform in improving girls' welfare. In order to test if marriageable age laws were properly imposed in the context of Mexico, I examine the mean of CMRs calculated according to the state where marriages were registered, both in the presence and absence of the law. If the law was appropriately enforced, CMRs should be zero in states where child marriage is banned, as the registration of marriages among girls below 18 would no longer be permitted. The results from the descriptive analysis are presented in [Table 3](#) and provide evidence that minimum marriageable age laws were by and large properly enforced, albeit without perfect compliance. The mean CMR after the implementation of the law is 0, compared to the mean CMR before the law was introduced with a rate of 0.5. The above zero value (0.7) of the upper bound in states where the law had been enacted however indicates that while the policy was enforced in general, it was not strictly imposed.¹²

¹² Apart from imperfect compliance, one cannot rule out the possibility of age fabrication during marriage registration as well ([Bunting, 2005](#)). The falsification of one's age is also made easier when birth certificates are not properly registered. According to the INEGI

Table 3. Law Enforcement

Child marriage rates according to state of registration					
	Mean	SD	Min	Max	N
Law = 1	0.0	0.1	0	0.7	552
Law = 0	0.5	0.4	0	3.1	2,551

Notes: Law=1 for months after state banned marriage below 18. Law=0 for months before state banned marriage below 18.

Finally, I plot separate CMRs for girls belonging to age groups of between 12 and 24 as shown in [Figure F](#).¹³ I do so for the year 2013, one year before the law was first implemented in any state, and for 2017, the last year observed for the sample of analysis.

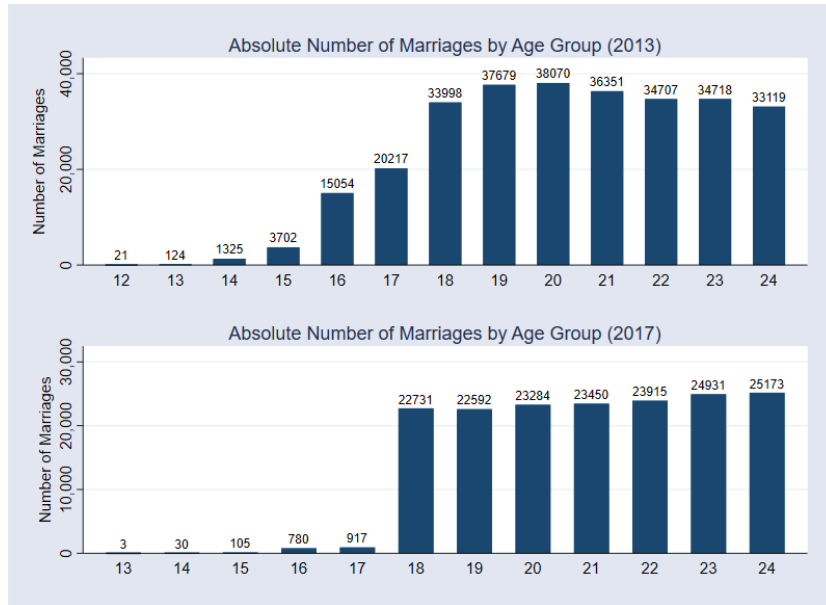


Figure F. A comparison of age-specific CMRs in 2013 and 2017. *Notes:* This figure presents CMRs calculated for each age group between 12 to 24 for 2013, one year before the law was first implemented and 2017, the last year for the sample of analysis. Each blue bar represents the CMR for the respective age group. Data come from Nuptiality administrative records provided by the National Institute for Statistics and Geography (INEGI).

As can be seen, the difference between CMRs for girls aged 17 and 18 increased by about 0.66 between 2013 and 2017. In 2013, the difference in CMRs

however, majority of births (over 95%) occur in hospitals which register these births, leaving less room for bias arising from this issue.

¹³ I do not plot the CMRs for girls aged between 10 and 11 because 12 was the earliest age at which one could get married in any state before the legal reforms. Notwithstanding, I examine CMRs for these two age groups as a robustness check and observe zero-bound effects.

between these two age groups was 0.94 and by 2017, this difference had increased to 1.60. CMRs especially for girls aged 16 and 17 fell drastically from 1.11 to 0.07 and 1.40 to 0.08 respectively. The remaining above zero CMRs for girls below 18 are likely to be from the five states that had yet to implement the law by the end of 2017. Taken together, these statistics suggest that the proper enforcement of minimum marriageable age law reforms in Mexico successfully alleviated the issue of child marriage in the country.

V. Results

Child Marriage Rates (CMRs)

The validity of a difference-in-difference (D-I-D) set up is contingent upon the common trend assumption, where treated and untreated states follow similar CMR and TBR trends prior to the imposition of minimum marriageable age laws. The fulfilment of this condition should in theory, strengthen the causal interpretation of estimates. To test if this identifying assumption holds, I consider a 54-month window, ranging from 36 months before the enactment of the law to 18 months after the law was introduced, and estimate the impact of minimum marriageable age laws on CMRs in the following regression:¹⁴

$$CMR_{s,t} = B_0 + \beta_1 Law_{s,t}^{-36} + \beta_2 Law_{s,t}^{-35} + \dots + \beta_{54} Law_{s,t}^{+18} + \theta_s + \lambda_t + \varepsilon_{s,t} \quad (4)$$

Where $CMR_{s,t}$ is the child marriage rate in state s during month t , regardless of the state where marriages were registered. $Law_{s,t}^{-k}$ equals to one in the k^{th} year before the law was enacted, and $Law_{s,t}^{+k}$ is equal to one in the k^{th} year after restrictions on the minimum marriageable age was imposed. To illustrate the effect of the policy distinctly and dynamically, the month in which the law was implemented is excluded to de-trend and centre estimates around month 0, defined as the month of the policy change. θ_s and λ_t are vectors of

¹⁴ I also include leads of up to 36 months for reference where pre-treatment trends remain unchanged. Results are presented in [Figure A4](#) of the appendix. It should be noted that due to the staggered nature of the introduction of the law, there is a reduction in statistical power as the number of post-treatment months increase. The observed rise in the percentage change in CMRs should thus be interpreted with discretion as data points are not comparable. [Figure A5](#) additionally includes lags of up to 60 months (5 years) prior to law implementation and shows that mean estimates are similarly centred around zero.

state and year dummies which control for time-constant and time-specific factors that may influence CMRs across states. $\varepsilon_{s,t}$ is the error term. Accordingly, [Figure G](#) plots the results from equation (4) in six-month bins, and includes 95% confidence intervals.

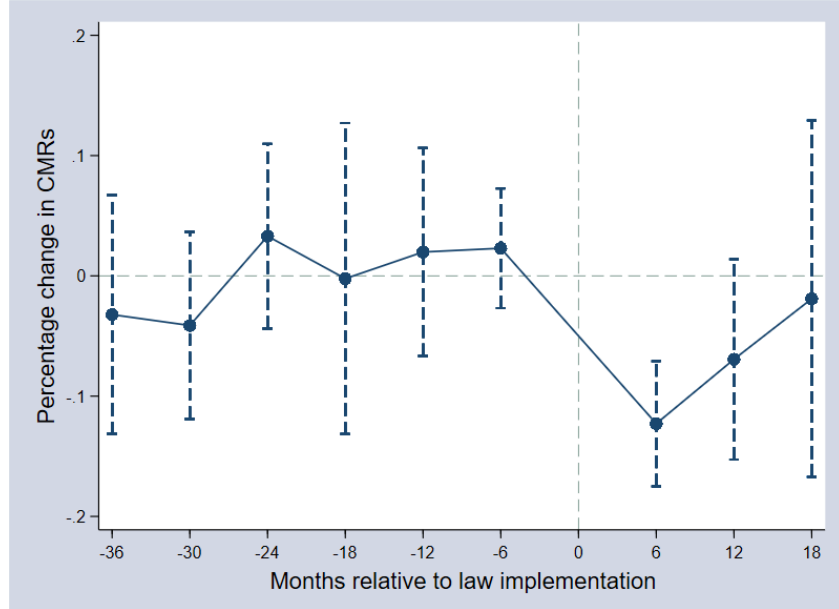


Figure G. The dynamic evolution of CMRs before and after the law. *Notes:* This figure plots trends in the child marriage rate 36 months prior to the implementation of the law and 18 months after the law was enacted. CMRs are calculated according to girls’ state of residence (ITT approach) and regressions include baseline controls. Data come from Nuptiality administrative records provided by the National Institute for Statistics and Geography (INEGI). The dashed bars represent 95% confidence intervals and point estimates are plotted in 6-month bins adjusted for clustering at the state-level.

As can be seen, the average percentage change in CMRs prior to the policy change is centred around zero, indicating that a decline in CMRs did not precede the implementation of minimum marriageable age laws. The dramatic fall in CMRs six months after the legislative reforms suggests the effectiveness of legal restrictions on the marriageable age in curbing child marriage practices. Point estimates six months before and after the law show that CMRs fell by about 15 percent due to legal reforms on the marriageable age. The impact of the policy also appears to persist for at least 18 months after it’s official implementation. [Table 4](#) presents results from the first-order outcome of interest, which estimates equation (1) of the relationship between minimum marriageable age laws and CMRs. Column (I) includes state and month fixed effects without the inclusion of controls, column (II) adds baseline

controls that are conceivably exogenous to the timing of the law implementation and CMRs, and column (III) incorporates potentially endogenous covariates such as the proportion of junior high school dropouts, and the sex crime rate per 1,000,000 people.

Table 4

Effect of the law on child marriage rates.

	(I)	(II)	(III)
Law	-0.196** (0.076) [0.082]	-0.163** (0.067) [0.081]	-0.163** (0.067) [0.076]
Controls	No	Yes	Yes
Sex crime rate, share of high school drop outs, proportion of indigenous language speakers	No	No	Yes
State FE	Yes	Yes	Yes
Month FE	Yes	Yes	Yes
Wild-Cluster Bootstrapped SE [.]	Yes	Yes	Yes
Observations	3103	3103	3103
Mean dep. var	0.441	0.441	0.441
Control mean dep. var	0.533	0.533	0.533

Notes: Standard errors clustered at the state level and reported in parentheses (.). As a robustness check, wild cluster bootstrapped standard errors are reported in parentheses [.] as recommended by [Cameron et al. \(2008\)](#) when the number of clusters is below 40. Controls include the population growth rate, proportion of indigenous language speakers, male-female sex ratio, GDP per capita growth rate, male unemployment rate, the share of girls aged between 12-13, 14-15, 16-17 and the ENAPEA program. Child marriage rates are calculated according to girls' state of residence (ITT approach). *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

Using column (II) as the benchmark specification which includes baseline controls, the enactment of minimum marriageable age laws appears to have decreased CMRs by 37% (0.163/0.441) with significant estimates at the 5% level. In comparison to the control mean indicating the average CMR in the absence of the law, the effect is slightly smaller with a reduction in CMRs by about 31%. The coefficient from the regression of CMR on $Law_{s,t}$ without the inclusion of any controls shows that CMRs had declined by about 44%. Baseline estimates do not change with the addition of potentially endogenous covariates in column (III). To provide additional support for the proper enforcement of the law, I further investigate the effect of the policy change on CMRs calculated according to where marriages were registered rather than

the state where girls resided. Coefficients from the analysis are shown in [Table A6](#) of the appendix, and are significant and negative similar to those show in [Table 4](#). The estimates are however enlarged as expected, given evidence of proper law enforcement as shown in [Table 3](#).

Under proper enforcement, one should also see a decrease in CMRs only among those below 18. To test this and to gain an overview of which age groups below 18 were most affected by the law, I further examine the effect of the law on age-specific CMRs. [Figure H](#) presents the coefficient plot of separate regressions of age-specific CMRs on the law variable, $Law_{s,t}$.

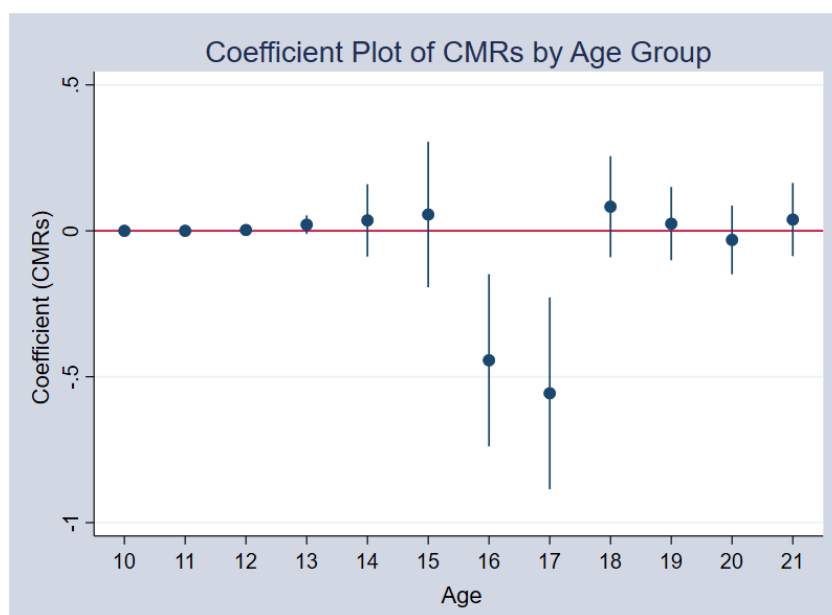


Figure H. Coefficient plot of age-specific CMRs. *Notes:* This graph presents coefficient estimates of the regression of age-specific CMRs on the law with the inclusion of baseline controls. CMRs are calculated according to girls' state of residence (ITT approach). Data come from Nuptiality administrative records provided by the National Institute for Statistics and Geography (INEGI). The straight-lined bars represent 95% confidence intervals and point estimates are adjusted for clustering at the state-level.

The results show that girls in the 16-17-year-old age group were most affected by the legal reform out of all other age groups. In particular, estimates for these two age groups are highly significant, negative and large (t -statistics are -3.08 and -3.47 respectively for 16- and 17-year olds).¹⁵ Considering that the probability of entering a relationship increases with age especially among

¹⁵ [Table A7](#) of the appendix presents the output from the regressions of age-specific CMRs on the independent law variable.

adolescent girls, this result is unsurprising. [Table A7](#) of the appendix also shows that CMR coefficients for girls aged 18 are positive, although not statistically significant.

Teenage birth rates (TBRs)

Mexico currently ranks first in the number of teenage pregnancies out of all other countries in the OECD, calling for an urgent investigation of the determinants of this phenomenon. Considering the strong positive link between early unions and premature childbearing, placing restrictions on the minimum marriageable age should lower the incidence of teenage births. [Table 5](#) presents results from the second-order outcome of interest which estimates equation (2) of the relationship between minimum marriageable age law reforms and adolescent pregnancy. In order to distinguish pregnancies arising from formal and informal unions, I further segregate TBRs according to two marital status groups believed to be most affected by the policy reform: married and consensual union, and group TBRs for other conjugal status groups plausibly unaffected by the law together. Accordingly, TBR coefficients presented in [Table 5](#) are estimated in separate regressions. The benchmark regression in column (II) indicates that the law had no significant impact on TBRs among married girls, the target group of the marriage law reforms, or TBRs among girls from other marital status groups. Instead, the results show an increase in total TBRs of approximately 11 percent (0.109/0.994), an unexpected outcome of the law, with significant estimates at the 10% level.

A separate regression of TBRs for girls in consensual unions on the law reveal some evidence that the increase in total TBRs stemmed at least partially from girls in this particular conjugal status group. Although estimates for the baseline specification in column (II) are not significant, consensual union TBRs are positive and sizably larger than TBR estimates for all other marital status types. In column (III), including potentially endogenous covariates increases the significance of these consensual union TBR estimates to the 5% level. Due to the fact that the timing of the law enactment may have been correlated with other observable characteristics

associated with higher adolescent fertility, estimates in column (I) without the inclusion of any controls cannot be interpreted.¹⁶

Table 5

Effect of law on teenage birth rates (TBRs), according to marital status.

<i>Effect of minimum marriageable age laws on:</i>			
	(I)	(II)	(III)
Total TBRs	0.053 (0.087) [0.092]	0.109* (0.064) [0.074]	0.116* (0.060) [0.076]
TBRs (married)	0.013 (0.044) [0.045]	0.031 (0.045) [0.053]	0.034 (0.044) [0.054]
TBRs (consensual union)	0.038 (0.057) [0.062]	0.078 (0.051) [0.058]	0.086** (0.040) [0.050]
TBRs (others)	0.003 (0.020) [0.051]	0.000 (0.020) [0.023]	-0.004 (0.015) [0.013]
Controls	No	Yes	Yes
Sex crime rate, share of high school dropouts	No	No	Yes
State FE	Yes	Yes	Yes
Month FE	Yes	Yes	Yes
Wild-Cluster Bootstrapped SE [.]	Yes	Yes	Yes
Observations	2755	2755	2755
Mean (Total TBRs)	0.994	0.994	0.994
Control mean (Total TBRs)	1.013	1.013	1.013

Notes: Standard errors clustered at the state level and reported in parentheses (.). As a robustness check, wild cluster bootstrapped standard errors are reported in parentheses [.] as recommended by [Cameron et al. \(2008\)](#) when the number of clusters is below 40. Controls include the population growth rate, proportion of indigenous language speakers, male-female sex ratio, GDP per capita growth rate, male unemployment rate, the share of girls aged between 12-13, 14-15, 16-17 and the ENAPEA program. Teenage birth rates are calculated according to girls' state of residence (ITT approach). *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

¹⁶ Since a girl's marital status may be endogenous to minimum marriageable age law reforms, the estimates for TBRs among girls in consensual unions should not be interpreted causally. In the following section under '*Heterogenous effects and additional results*', I nonetheless provide evidence that girls' marital statuses were likely to be exogenous to the law.

To provide further support for a causal relationship between total TBRs and marriage law reforms, I repeat the analysis of the common trend assumption in equation (4), but replace the dependent variable with TBRs calculated as the absolute number of births to girls below 18 per 1,000 of the population of girls between 12 and 17 years of age. Figure I exhibits pre and post reform TBR trends in six-month bins with 95% confidence intervals.¹⁷

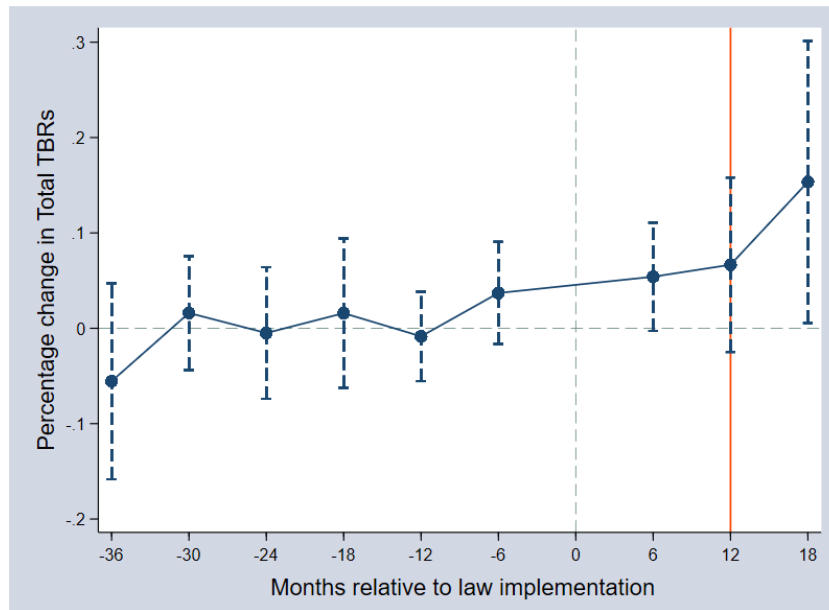


Figure I. The dynamic evolution of TBRs before and after the law. *Notes:* This figure plots trends in the teenage birth rate 36 months prior to the implementation of the law and 18 months after the law was enacted. TBRs are calculated according to girls’ state of residence (ITT approach) and regressions include baseline controls. Data come from Birth administrative records provided by the National Institute for Statistics and Geography (INEGI). The dashed bars represent 95% confidence intervals and point estimates are plotted in 6-month bins adjusted for clustering at the state-level.

Similar to CMR trends, the overall average change in TBRs is centred around zero prior to the enactment of the law with mean percentage changes in TBRs spanning from -0.05 to 0.03 percent during the 36-month pre-reform period. The gestational length of a typical pregnancy and possible information dissemination lags regarding the newly implemented minimum marriageable age laws reveal that the impact of the law on total TBRs is realized approximately 1 year (12 months) after. Point estimates show that TBRs

¹⁷ Results of leads of up to 36 months are shown in Figure A8 of the appendix for similar reasons stated in footnote 14. Figure A9 plots TBR pre-trends of up to 60 months (5 years) and show that TBR mean estimates are similarly centred around zero.

roughly doubled in the period of 12 to 18 months after the law was enacted, changing from 0.07 to 0.15 percent. The evident jump in TBRs after the 12-month mark indicates that while legal restrictions on the marriageable age should have reduced the incidence of teenage births, it had on the contrary increased total TBRs. Taken together, the findings suggest that the issue of teenage pregnancy could be aggravated in a milieu where consensual unions are increasingly accepted and if girls choose pregnancy as an alternative commitment device in place of marriage.

Robustness

In this section, I check the sensitivity of the main results to various specifications and conduct a series of falsification tests to provide support for the internal validity of the baseline estimates. [Table 6](#) presents the findings from four different sensitivity analyses. Column (I) represents the benchmark estimate from [Table 5](#) for comparison. First, one may argue that states with relatively higher population growth rates have different TBR patterns, which could have driven the main results. To check the robustness of the estimates to the exclusion of such states, I omit three states with the highest population growth rates as reported in the INEGI's 2015 Intercensal Survey: Quintana Roo (+13.3%), Baja California Sur (+11.8%) and Queretaro (+11.5%). As can be seen in column (II), the results are not sensitive to the omission of these states and remain significant at the 10% level, with the coefficient decreasing by about 0.002 in magnitude. This is an expected effect, as human interaction is likely to be higher in states experiencing population booms and therefore the impact of the law on TBRs excluding these states would be lower.

Second, there may be concerns regarding the chosen sample. In order to check the sensitivity of the time period selected, I create a unique identifier for each month and omit odd numbered months from the analysis, that is, only alternate months are included in the sample. I do the same for even numbered months and observe that results remain significant and are not affected greatly by the sample modification in column (III) (the magnitude of the coefficient increases minimally by 0.006).

Next, I exclude three states with the highest proportion of proclaimed Catholics between the ages of 10 and 19: Aguascalientes (93.6%), Zacatecas (94.3%) and Guanajuato (94.5%). Due to the paucity of regular data on

religion or other proxies for religion such as church attendance, the inclusion of religion as a control in the main regressions is not feasible. Yet, religion plausibly plays a major role in teenage pregnancy as pre-marital sex for instance is frowned upon, especially in Catholicism. As shown in column (IV), the omission of relatively more religious states increases the baseline estimate in column (I) by a magnitude of 0.012, and the coefficient remains statistically significant at the 10% level. The increase in the size of the TBR coefficient excluding religious states is unsurprising since the catholic faith opposes pre-marital sex and hence, TBRs are likely to be lower in states where religion plays a stronger role.

Table 6

Sensitivity analysis of the effect of the law on teenage birth rates (TBRs) among girls in consensual unions.

	(I)	(II)	(III)	(IV)	(V)
Total TBRs	0.109*	0.107*	0.115*	0.121*	0.105
	(0.064)	(0.051)	(0.066)	(0.068)	(0.067)
	[0.074]	[0.054]	[0.076]	[0.077]	[0.080]
Excludes high population growth rate states	No	Yes	No	No	No
Omit alternate months	No	No	Yes	No	No
Excludes religious states	No	No	No	Yes	No
Excludes Mexico City	No	No	No	No	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Sex crime rate, share of high school dropouts	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes
Wild-Cluster	Yes	Yes	Yes	Yes	Yes
Bootstrapped SE [.]					
Observations	2755	2470	1392	2470	2660

Notes: Standard errors clustered at the state level and reported in parentheses (.). As a robustness check, wild cluster bootstrapped standard errors are reported in parentheses [.] as recommended by [Cameron et al. \(2008\)](#) when the number of clusters is below 40. Controls include the population growth rate, proportion of indigenous language speakers, male-female sex ratio, GDP per capita growth rate, male unemployment rate, the share of girls aged between 12-13, 14-15, 16-17 and the ENAPEA program. Teenage birth rates are calculated according to girls' state of residence (ITT approach). *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

Lastly, abortion law reforms in Mexico could have also confounded the main results presented. In 2007, abortion was legalized in the Federal District of Mexico (Mexico City) where women could demand abortion services upon request in the first 12 weeks of the pregnancy.¹⁸ Up till 2017, Mexico City remained the only state where abortion was legal, while abortion continued to be restricted across other states. Consequently, I exclude Mexico City from the analysis as coefficients could be downward bias if girls who had access to abortion decided to terminate their pregnancies. The omission of Mexico City however, results in a decrease rather than increase in the coefficient of total TBRs by approximately 0.004 (column (V)). The estimate also loses statistical significance at the 10% level, but remains significant at the 12% level. Altogether, this suggests that despite the availability of abortion, girls in Mexico City may not have chosen to do so due to a variety of factors such as age, choice, religion and social pressure, among others. The results also indicate that high population density states like Mexico City in part drove the main results. This is expected, since the chance of human interaction is higher in areas that are more densely populated.

To further demonstrate that the results are not spurious, I run two falsification tests to check the validity of the common trend assumption. First, I analyse the effect of the law on a group of girls who should not have been affected by the reform such as those who are single, widowed, divorced, separated and in unspecified relationships. Specifically, I divide TBRs among the ‘other’ group as shown in [Table 5](#), into five different categories: single, divorced, widowed, separated and unspecified, and examine the effect of the law on each of these groups in separate regressions. As the results in [Table 7](#) reveal, TBR coefficients for each of these marital status groups that should not have been affected by the law are insignificant and zero-bound, other than those belonging to the separated group. The magnitude of the coefficient on TBRs among separated girls is nonetheless considerably small (0.002) and is not large enough for any meaningful economic interpretation.

In the second falsification test, I simulate a random month and year of law implementation between 2009 and 2017, which are the first and last

¹⁸Prior to 2016, Mexico City was officially called the ‘Federal District of Mexico’. For clarification, the legalization of abortion did not take place in the State of Mexico (state code ‘EM’, see [Table 1](#)), which is a separate entity from the Federal District of Mexico (state code ‘DF’).

years in the sample. By doing so, states are assigned a placebo legal reform date, different from their actual date of law enactment. If the rise in TBRs truly came from legal changes to the minimum marriageable age and no other events, one should expect the TBR coefficients of this placebo test to be zero or at least close to zero.

Table 7

Effect of law on teenage birth rates (TBRs) among other marital status groups.

<i>Effect of minimum marriageable age laws on:</i>			
	(I)	(II)	(III)
TBRs (single)	-0.008 (0.023) [0.054]	-0.018 (0.019) [0.022]	-0.025 (0.018) [0.016]
TBRs (widowed)	0.001 (0.001) [0.001]	0.002 (0.002) [0.002]	0.002 (0.002) [0.002]
TBRs (divorced)	-0.000 (0.000) [0.000]	-0.000 (0.000) [0.000]	-0.000 (0.000) [0.000]
TBRs (separated)	0.001** (0.001) [0.001]	0.002** (0.001) [0.001]	0.002*** (0.001) [0.001]
TBRs (unspecified)	0.008 (0.015) [0.015]	0.016 (0.020) [0.023]	0.016 (0.019) [0.023]
Controls	No	Yes	Yes
Sex crime rate, share of high school dropouts	No	No	Yes
State FE	Yes	Yes	Yes
Month FE	Yes	Yes	Yes
Wild-Cluster Bootstrapped SE [.]	Yes	Yes	Yes
Observations	2755	2755	2755

Notes: Standard errors clustered at the state level and reported in parentheses (.). As a robustness check, wild cluster bootstrapped standard errors are reported in parentheses [.] as recommended by [Cameron et al. \(2008\)](#) when the number of clusters is below 40. Controls include the population growth rate, proportion of indigenous language speakers, male-female sex ratio, GDP per capita growth rate, male unemployment rate, the share of girls aged between 12-13, 14-15, 16-17 and the ENAPEA program. Teenage birth rates are calculated according to girls' state of residence (ITT approach). *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

Accordingly, the main specification in equation (2) is re-estimated with the placebo dates of law implementation. This exercise is repeated 20,000 times and point estimates from each regression are stored. As shown in Figure J, the distribution of the estimated coefficients from the 20,000 simulations in the probability density plot is centred around zero. Specifically, the mean TBR estimate from this exercise is equal to -0.00063 and the red line representing the benchmark estimate in column (II) of Table 5 additionally shows that the probability of getting the same baseline estimate out of the 20,000 simulations is relatively low.

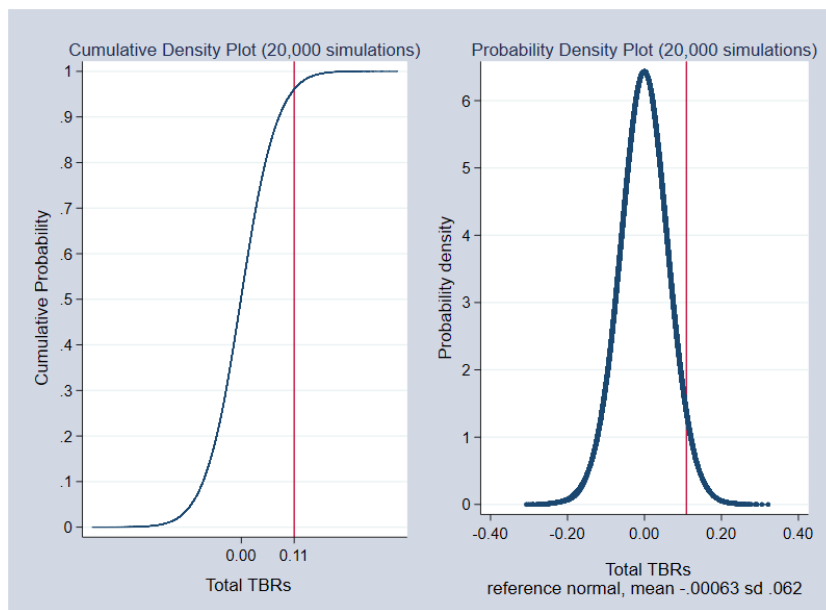


Figure J. Results from 20,000 simulated placebo law enactment dates. *Notes:* This figure plots the cumulative distribution function (left) and the probability density function (right) of the estimated coefficients from 20,000 simulations using a randomly generated law implementation date.

Lastly, I probe the robustness of the difference-in-differences identification method by including state-specific linear time trends. The inclusion of the state-specific linear time trends renders the estimates for total TBRs insignificant with coefficients reducing greatly in size. CMR estimates however remain significant and increase in magnitude. Under these conditions, it is not possible to rule out that trends in TBRs prior to the sample period played an important role in the development of TBR patterns after the implementation of minimum marriageable age laws. Caution should thus be

exercised in attributing the rise in total TBRs solely to minimum marriageable age laws.

Heterogenous effects and additional results

The theory suggests that girls from lower socio-economic classes have a higher propensity to select pregnancy as an alternative commitment device in place of marriage. This is because when marriage as a commitment device and means of income sharing is no longer available, they may be incentivized to get pregnant deliberately to ‘compel’ their partners into being with them and providing them with financial support. To test this theory, I examine the effect of the law on TBRs calculated according to girls’ socio-economic characteristics like their level of education, employment status and whether or not they are engaged in domestic work, which serve as proxies for poverty. [Table 8](#) presents the results from this analysis and provides support for the theory that girls who are economically disadvantaged are more susceptible to teenage pregnancy in the presence of minimum marriageable age laws. In particular, the law increased TBRs among unemployed girls by approximately 12 percent (0.110/0.885), lowly educated girls by 22 percent (0.081/0.354) and girls in domestic work by about 14 percent (0.112/0.784), with significant estimates at the 5-10% level.¹⁹

Next, drawing from a separate Child Labor Module (MTI) survey which interviews children aged between 5 and 17 in Mexico, I further examine the effect of marriageable age law reforms on adolescent girls’ school attendance. One of the consequences of child marriage relates to low human capital accumulation as girls typically exit schooling after marriage. This results in severe long-term ramifications not just for girls’ welfare, but potentially their children’s as well. The MTI is collected on a biennial basis starting from 2007 with the latest survey conducted in 2017, indicating four pre-treatment survey years and two post-treatment survey years. It interviewed over 53,000 households with nearly 100,000 individuals in each round, and contains information on girls’ conjugal statuses and a set of other

¹⁹ Lowly-educated girls are defined as individuals who had completed primary school but not junior high school (‘secundaria’). As the Secretariat of Public Education (SEP) only introduced sex education in seventh-grade biology textbooks corresponding to the start of junior high (‘secundaria’), girls who dropped out of school before that level would have had less exposure to sex education which could have in turn affected TBRs (SEP, 2018).

individual and household level characteristics such as age, number of children, level of education, school attendance, household size, household head's educational attainment and employment status, single-parent household, female-headed household and rural residential status.

Table 8

Effect of law on teenage birth rates (TBRs), according to socio-economic status.

<i>Effect of minimum marriageable age laws on:</i>				
	(I)	(II)	(III)	Mean
TBRs (<i>unemployed girls</i>)	0.064 (0.081) [0.088]	0.110* (0.055) [0.063]	0.105* (0.053) [0.065]	0.885
TBRs (<i>lowly-educated girls</i>)	0.066 (0.042) [0.045]	0.081** (0.039) [0.045]	0.084** (0.038) [0.043]	0.354
TBRs (<i>girls in domestic work</i>)	0.073 (0.081) [0.090]	0.112* (0.061) [0.070]	0.117* (0.059) [0.075]	0.784
Controls	No	Yes	Yes	
Sex crime rate, share of high school dropouts	No	No	Yes	
State FE	Yes	Yes	Yes	
Month FE	Yes	Yes	Yes	
Wild-Cluster Bootstrapped SE [.]	Yes	Yes	Yes	
Observations	2708	2708	2708	

Notes: Standard errors clustered at the state level and reported in parentheses (.). As a robustness check, wild cluster bootstrapped standard errors are reported in parentheses [.] as recommended by [Cameron et al. \(2008\)](#) when the number of clusters is below 40. Controls include the population growth rate, proportion of indigenous language speakers, male-female sex ratio, GDP per capita growth rate, male unemployment rate, the share of girls aged between 12-13, 14-15, 16-17 and the ENAPEA program. Teenage birth rates are calculated according to girls' state of residence (ITT approach). *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

Accordingly, I use information on girls' school attendance as the dependent variable and estimate a linear probability model of the following form:

$$AttSchool_{i,t} = B_0 + B_1 Law_{s,t} + B_2 X_{i,s,t} + \emptyset_s + \delta_t + \varepsilon_{i,s,t} \quad (5)$$

where $AttSchool_{i,t}$ is a binary variable equal to one if a girl is in school and zero otherwise. $Law_{s,t}$ is a dummy equal to one for the survey years after minimum marriageable age laws were introduced in state s . $X_{i,s,t}$ is a vector of time-varying individual and household level covariates as described above that could influence girls' school attendance. I additionally control for the timing of ENAPEA given its direct influence on TBRs. \emptyset_s and δ_t are the state and survey year fixed effects respectively, to account for any time-constant state level factors that may affect the dependent variable of interest, and any aggregate shocks that could influence girls' schooling status. $\varepsilon_{i,s,t}$ is the usual disturbance term. Results from equation (5) are presented in Table 9 and show increases in the likelihood of girls attending school by approximately 0.9% with estimates significant at the 5% level (column II). The inclusion of potentially endogenous variables like the number of children and educational level increases the effect to 1.2% in column (III). Altogether, albeit the effect on schooling is small, the results indicate that legal reforms to the marriageable age have a positive effect on girls' educational outcomes.

Table 9

Effect of law on the probability of school attendance.

	(I)	(II)	(III)
School attendance	0.010*** {0.011} (0.003) [0.004]	0.009** {0.009} (0.004) [0.004]	0.012* {0.012} (0.007) [0.009]
Controls	No	Yes	Yes
Number of children, education level	No	No	Yes
State FE	Yes	Yes	Yes
Month FE	Yes	Yes	Yes
Wild-Cluster	Yes	Yes	Yes
Bootstrapped SE [.]			
Observations	260,819	260,819	124,106

Notes: Standard errors clustered at the state-year level and reported in parentheses (.). As a robustness check, wild cluster bootstrapped standard errors are reported in parentheses [.] as recommended by Cameron et al. (2008) when the number of clusters is below 40. Marginal effects from the probit model are reported in parentheses {.}. Controls include age, household size, household head's educational attainment and employment status, a dummy denoting if the individual belongs to a single-parent household or female-headed household and rural residential status. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

Possible Channels

The rise in total and consensual union TBRs as shown in [Table 5](#) can possibly be explained by three main channels. First, the prohibition of a formal union could have encouraged girls to enter informal unions (before pregnancy), given the conditions that make the latter a good substitute for the former. This compositional change across marital status groups effectively re-allocates pregnancies from married girls to girls in consensual unions, generating an increase in TBRs among girls in this group. Yet, this effect only explains the rise in consensual union TBRs but not total TBRs since it simply re-allocates pregnancies across marital status groups. The increase in consensual union TBRs could have also been driven by teenage girls who were pregnant at the time when the marriage age law reforms took place, but were no longer allowed to get married post-pregnancy, and were thus forced to enter a consensual union with their partners. Third, the commitment effect could have led to the observed increase in aggregate TBRs, where girls chose to get pregnant deliberately to make up for the loss of marriage as a commitment device.

In order to disentangle the channels from each other, I run a regression analogous to equation (5) substituting the dependent variable with a dummy indicating if a girl was in a consensual union or otherwise. The data is similarly provided by the Child Labor Module (MTI) survey which contains information on girls' marital statuses. [Table 10](#) shows the results from this analysis and provides some indication that the latter two mechanisms were responsible for the rise in consensual union TBRs. The coefficient of the consensual union variable in the baseline specification (II) is negative with a magnitude of 0.007 (0.7%) and significant at the 5% level. If the law had encouraged girls to move from a formal union to an informal one (first channel), one should see a positive and significant coefficient on the consensual union dummy indicator. The fact that a negative and significant estimate is observed instead suggests that the law had positive spillover effects as it discouraged girls from entering not just formal unions but also informal unions at a young age. More importantly however, these findings indicate that minimum marriageable age laws could have unintended consequences if girls are encouraged to push forward their fertility decisions, or are coerced to enter consensual unions since formal unions through marriage are no longer an

option. Especially for the latter situation, girls are left even less protected from domestic violence for instance.

Table 10

Effect of law on the probability of being in a consensual union.

	(I)	(II)	(III)
Consensual union	-0.008*** {-0.008}	-0.007**{-0.006}	-0.005*{-0.003}
	(0.003)	(0.003)	(0.003)
	[0.004]	[0.003]	[0.003]
Controls	No	Yes	Yes
Number of children, education level	No	No	Yes
State FE	Yes	Yes	Yes
Month FE	Yes	Yes	Yes
Wild-Cluster	Yes	Yes	Yes
Bootstrapped SE [.]			
Observations	124,119	124,119	124,098

Notes: Standard errors clustered at the state level and reported in parentheses (.). As a robustness check, wild cluster bootstrapped standard errors are reported in parentheses [.] as recommended by [Cameron et al. \(2008\)](#) when the number of clusters is below 40. Marginal effects from the probit model are reported in parentheses {.}. Controls include age, household size, household head's educational attainment and employment status, a dummy denoting if the individual belongs to a single-parent household or female-headed household and rural residential status. For consistency, only girls between 12 to 17 are included in the sample. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

Over the last two decades, states across Mexico began to allow domestic violence as grounds for divorce and introduced unilateral and no-fault divorce where proof for cause and mutual agreement for a union dissolution was no longer required. Since these legal reforms, suicide and intimate partner violence (IPV) rates have declined due to the effectiveness of such legislative frameworks in protecting women against violent acts perpetrated by their partners ([Beleche, 2017](#)). Therefore, because minimum marriageable age laws obstruct girls' access to such marriage-related rights that could enhance their well-being, they may be subject to even greater susceptibility in certain situations as a result of the policy change. In the case where girls choose pregnancy as a substitute commitment device for marriage, the probability of single-motherhood, which has been associated with the perpetuation of poverty increases. This is because despite a girls' pregnancy, there is no guarantee that her partner would support her in the short run,

and even more so in the longer term, especially if the relationship is unstable. Girls from lower socio-economic classes may also be more likely to choose the pregnancy path to gain commitment from their partners given their low-income earning potential. Taken together, marriage age law reforms may therefore disproportionately affect vulnerable and poorer girls by impoverishing them further and leaving them less protected.

VI. Conclusion

This paper was mainly motivated by the need for a greater understanding of country-specific socio-cultural contexts in global policy implementation. The complete prohibition of marriage below the age of 18 is undoubtedly a positive step towards protecting adolescent girls from the consequences of child marriage such as teenage pregnancy among others, although the effectiveness of such policies may differ across places. It is important to consider that international standards and guidelines may not necessarily be a one-size-fits-all solution. Given the combination of evolving trends in marriage and informal unions in Mexico, the importance of religion, underlying economic conditions and heterogenous behavioural responses, it is not completely clear that minimum marriageable age law reforms would be effective in reducing teenage birth rates.

In this study, I show that while minimum marriageable age law reforms in Mexico were successful in mitigating child marriage rates by 37% and increasing girls' likelihood of attending school by about 0.9%, total teenage birth rates increased by approximately 11%. I find no effect on teenage birth rates among married girls which was the policy's target group. The results indicate that the rise in total teenage birth rates at least in part stemmed from the increase in teenage birth rates among girls in consensual unions, although the estimates cannot be interpreted causally due to the potential endogeneity of girls' marital statuses to the law. These findings together with results from the additional MTI survey provide evidence that girls may have substituted marriage with pregnancy as a commitment device, or they could have been compelled to enter consensual unions post-pregnancy as marriage was no longer permitted.

Girls from lower socio-economic classes could also be disproportionately affected by legal reforms to the marriageable age. In

particular, poorer girls who see greater gains from being with a man able to financially provide for them, may be more likely to turn to pregnancy as an alternative commitment device in the event that marriage is banned. This behavioural response could increase the probability of single-motherhood due to girls' unstable relationships (as their 'unstable' partners do not incentivize them to wait through the dating process), and the risk that their partners may not end up supporting them in the short-term or long-term despite the pregnancy. Ultimately, this perpetuates the cycle of poverty for girls who are already vulnerable and economically disadvantaged to begin with.

In the case where girls are forced to enter consensual unions post-pregnancy as marriage is no longer allowed, they may be left less protected in the event of domestic violence as they would no longer have access to laws that allow them to exit the union under these circumstances. In the long run, these negative effects could trickle-down to their children as unregistered children may not be able to enrol in proper schooling for instance, or may have to participate in the labor force at an early age, among other consequences.²⁰

Lastly, while this paper provides a novel theory to explain the rise in total teenage birth rates, it is not able to separate the extent to which girls substituted marriage with pregnancy as a commitment device, from being compelled to enter consensual unions post-pregnancy. This is due to the paucity of data on fertility choice, changes in the perceived costs of formal and informal unions and official documentation on informal unions for example, which would have helped to distinguish both channels better. The implications of this study could potentially be extended to countries in the Latin American region where consensual unions thrive, assuming similar legal and socio-cultural conditions. Considering the widespread practice of cohabitation without marriage, and under the circumstances of poverty, efforts to protect adolescent girls from the consequences of child marriage through the prohibition of marriage may not have a large impact, and could instead have inadvertent effects as demonstrated.

²⁰ The state of Nayarit for example does not permit the official registration of a child if parents are not of legal marriageable age (see article 354 of Nayarit's civil code which is documented here: <https://www.nayarit.gob.mx/transparenciafiscal/marcoregulatorio/ordenamientos/c%C3%B3digo%20civil%20para%20el%20estado%20de%20nayarit.htm>).

Appendix

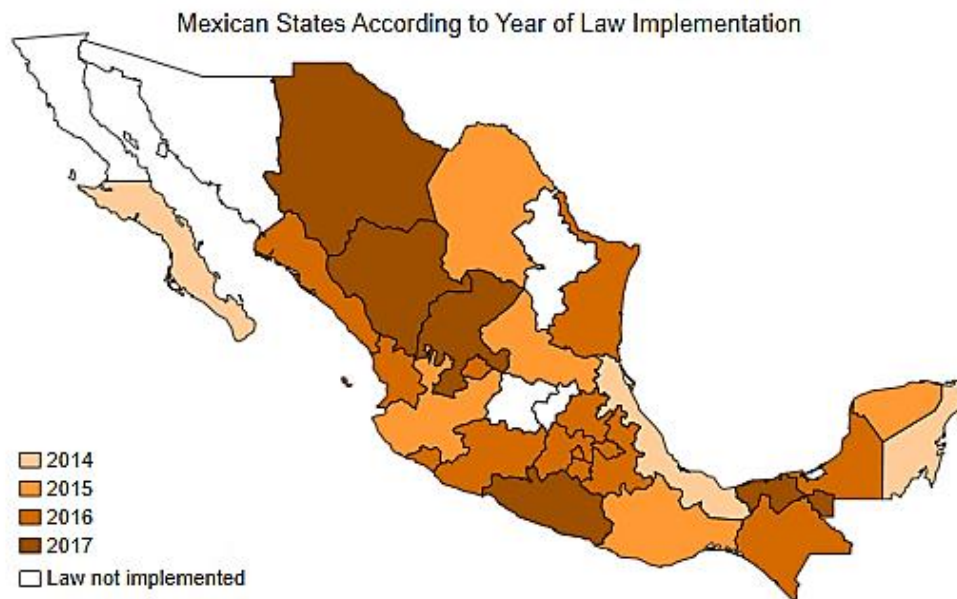


Figure A1. Geographical and temporal variation in the timing of the law enactment. *Notes:* This figure illustrates the year in which states across Mexico implemented minimum marriageable age laws. Unshaded areas represent states where the policy has not been implemented.

Table A2

Effect of state-level observable characteristics on the timing of law implementation.

<i>Dependent variable - Law_{s,t}</i>	(I)
Population growth rate	-0.857 (6.655)
Male-female sex ratio	-9.551 (5.053)
GDP growth rate	0.004 (0.004)
Male unemployment rate	-0.013 (0.020)
Share of girls (12-13 years old)	-25.58 (15.49)
Share of girls (14-15 years old)	44.36 (27.98)
Share of girls (16-17 years old)	-26.22* (13.17)
Share of high school drop outs	-0.278

	(0.925)
Sex crime rate (per 1,000,000 individuals)	0.002 (0.007)
Share of indigenous language speakers	-0.060 (0.057)
ENAPEA	0.125 (0.086)
State FE	Yes
Month FE	Yes
Observations	3103

Notes: Standard errors clustered at the state level and reported in parentheses (.). *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

Table A3

Effect of the law on child marriage rates 1,2 and 3 years prior to law implementation.

	(<i>t</i> -1)	(<i>t</i> -2)	(<i>t</i> -3)
Law	0.001 (0.055) [0.062]	0.041 (0.054) [0.068]	0.055 (0.049) [0.062]
Baseline controls	Yes	Yes	Yes
State FE	Yes	Yes	Yes
Month FE	Yes	Yes	Yes
Wild-Cluster Bootstrapped SE [.]	Yes	Yes	Yes
Observations	2755	2407	2059

Notes: Standard errors clustered at the state level and reported in parentheses (.). As a robustness check, wild cluster bootstrapped standard errors are reported in parentheses [.] as recommended by [Cameron et al. \(2008\)](#) when the number of clusters is below 40. Controls include the population growth rate, proportion of indigenous language speakers, male-female sex ratio, GDP per capita growth rate, male unemployment rate, the share of girls aged between 12-13, 14-15, 16-17 and the ENAPEA program. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

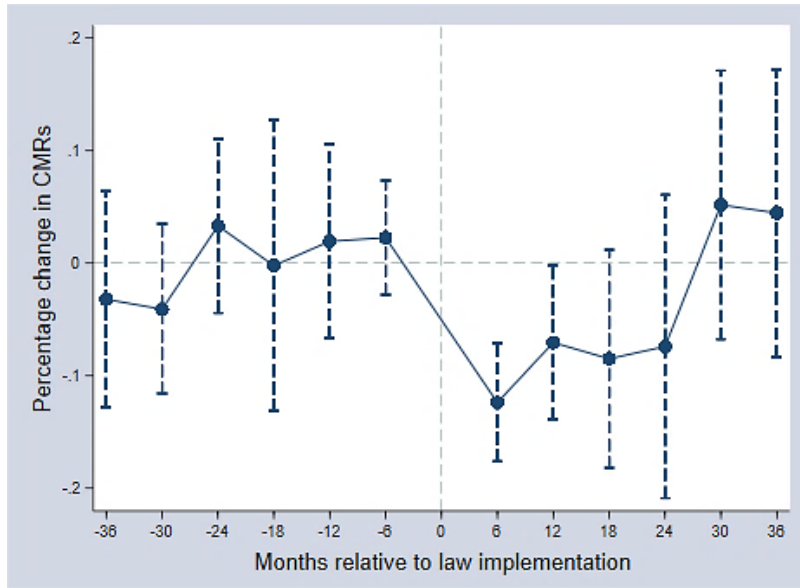


Figure A4. The dynamic evolution of CMRs before and after the law. *Notes:* This figure plots trends in the child marriage rate 36 months prior to the implementation of the law and 36 months after the law was enacted. CMRs are calculated according to the state where marriages were registered. Data come from Nuptiality administrative records provided by the National Institute for Statistics and Geography (INEGI). The dashed bars represent 95% confidence intervals and point estimates are plotted in 6-month bins adjusted for clustering at the state-level.

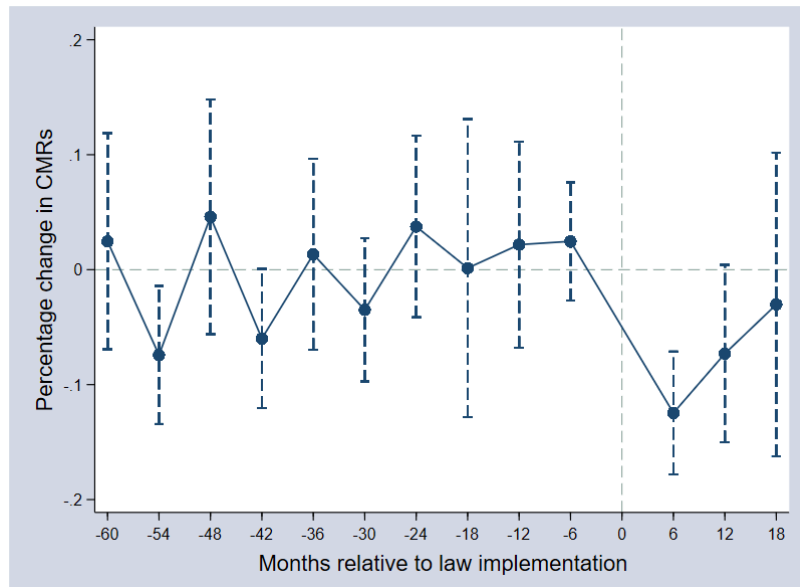


Figure A5. The dynamic evolution of CMRs before and after the law. *Notes:* This figure plots trends in the child marriage rate 60 months (5 years) prior to the implementation of the law and 18 months after the law was enacted. CMRs are calculated according to individuals' state of residence. Data come from Nuptiality administrative records provided by the National Institute for Statistics and Geography (INEGI). The dashed bars represent 95% confidence intervals and point estimates are plotted in 6-month bins adjusted for clustering at the state-level.

Table A6

Effect of the law on child marriage rates, based on state of registration.

	(I)	(II)	(III)
Law	-0.210** (0.077) [0.084]	-0.173** (0.065) [0.074]	-0.173** (0.064) [0.072]
Controls	No	Yes	Yes
Sex crime rate, share of high school drop outs, proportion of indigenous language speakers	No	No	Yes
State FE	Yes	Yes	Yes
Month FE	Yes	Yes	Yes
Wild-Cluster Bootstrapped SE [.]	Yes	Yes	Yes
Observations	3103	3103	3103
Mean	0.442	0.442	0.442
Control Mean	0.532	0.532	0.532

Notes: Standard errors clustered at the state level and reported in parentheses (.). As a robustness check, wild cluster bootstrapped standard errors are reported in parentheses [.] as recommended by [Cameron et al. \(2008\)](#) when the number of clusters is below 40. Controls include the population growth rate, proportion of indigenous language speakers, male-female sex ratio, GDP per capita growth rate, male unemployment rate, the share of girls aged between 12-13, 14-15, 16-17 and the ENAPEA program. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

Table A7

Effect of law on child marriage rates (CMRs) by age group.

Effect of minimum marriageable age laws on:

	(I)	(II)	(III)
CMRs (age 12)	0.001 (0.001) [0.001]	0.003 (0.002) [0.002]	0.003 (0.002) [0.002]
CMRs (age 13)	0.008 (0.010) [0.009]	0.021 (0.016) [0.018]	0.021 (0.015) [0.017]
CMRs (age 14)	-0.011 (0.044) [0.047]	0.036 (0.061) [0.072]	0.036 (0.060) [0.074]
CMRs (age 15)	-0.024 (0.089) [0.098]	0.056 (0.122) [0.149]	0.056 (0.121) [0.148]
CMRs (age 16)	-0.480*** (0.176)	-0.444*** (0.144)	-0.444*** (0.143)

	[0.191]	[0.161]	[0.159]
CMRs (age 17)	-0.583*** (0.203)	-0.557*** (0.160)	-0.557*** (0.158)
	[0.214]	[0.174]	[0.178]
CMRs (age 18)	0.114 (0.070)	0.083 (0.085)	0.083 (0.084)
	[0.076]	[0.098]	[0.103]
CMRs (age 19)	0.031 (0.061)	0.024 (0.061)	0.025 (0.061)
	[0.063]	[0.064]	[0.065]
CMRs (age 20)	-0.018 (0.060)	-0.031 (0.057)	-0.030 (0.057)
	[0.064]	[0.063]	[0.061]
CMRs (age 21)	0.035 (0.060)	0.039 (0.061)	0.040 (0.059)
	[0.064]	[0.066]	[0.061]
Controls	No	Yes	Yes
Proportion of high school drop outs, sex crime rate	No	No	Yes
State FE	Yes	Yes	Yes
Month FE	Yes	Yes	Yes
Observations	3103	3103	3103

Notes: Standard errors clustered at the state level and reported in parentheses (.). As a robustness check, wild cluster bootstrapped standard errors are reported in parentheses [.] as recommended by [Cameron et al. \(2008\)](#) when the number of clusters is below 40. Controls include the population growth rate, proportion of indigenous language speakers, male-female sex ratio, GDP per capita growth rate, male unemployment rate, the share of girls aged between 12-13, 14-15, 16-17 and the ENAPEA program. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

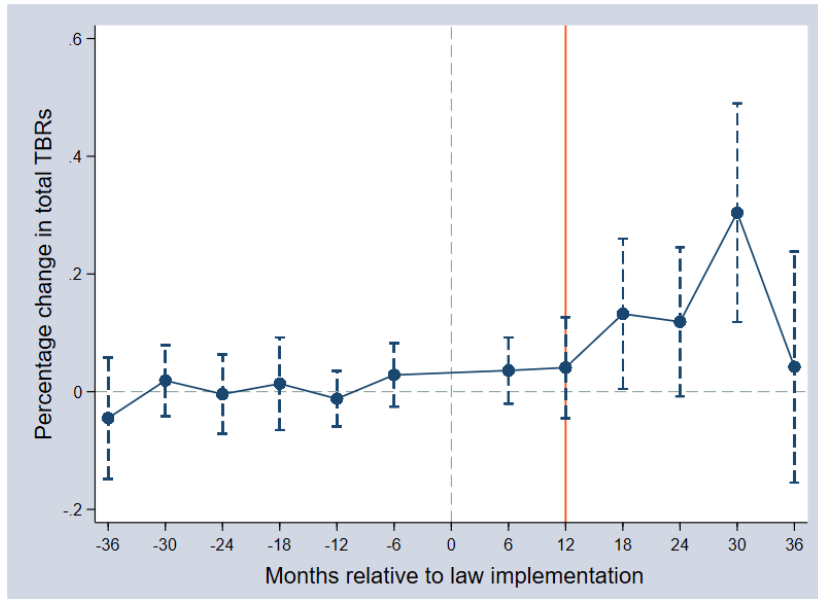


Figure A8. The dynamic evolution of TBRs before and after the law. *Notes:* This figure plots trends in the teenage birth rate 36 months prior to the implementation of the law and 36 months after the law was enacted. TBRs are calculated according to girls' state of residence (ITT approach). Data come from Birth administrative records provided by the National Institute for Statistics and Geography (INEGI). The dashed bars represent 95% confidence intervals and point estimates are plotted in 6-month bins adjusted for clustering at the state-level.

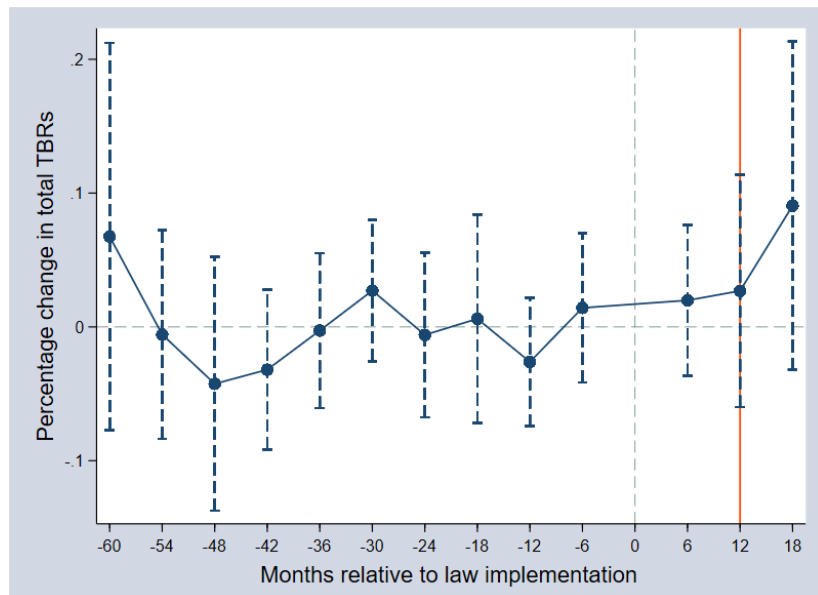


Figure A9. The dynamic evolution of TBRs before and after the law. *Notes:* This figure plots trends in the teenage birth rate 60 months (5 years) prior to the implementation of the law and 18 months after the law was enacted. TBRs are calculated according to girls' state of residence (ITT approach). Data come from Birth administrative records provided by the National Institute for Statistics and Geography (INEGI). The dashed bars represent 95% confidence intervals and point estimates are plotted in 6-month bins adjusted for clustering at the state-level.

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