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Assessing the Impact of Local Violence on Teenage Fertility: The Case of Mexico

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Abstract

Using the case of Mexico, I evaluate the effect of local homicide rates on fertility for teenage women. I assess the effects of exposure to homicide rates on birth rates using fixed-effects panel analysis and aggregate data on births from the Mexican Civil Registry. Results show that exposure to violence has different implications for more and less educated women. For more educated women, models suggest that local violence reduces birth rates. This is consistent with a response to violence-driven economic uncertainty. For less educated women, my analyses suggest that local violence increases birth rates, and this is driven by births to unmarried, cohabiting women. An exploration of potential causal mechanisms suggests that increasing births to less educated unmarried women may be explained by worsening local marriage market conditions. In other words, desirable partners become scarcer due to violence-driven unemployment, as well as increasing probabilities of crime involvement and victimization, among other factors. In this scenario, less educated women may increase premarital sex and childbearing as strategies to secure a long-term partner. As an alternative causal mechanism, violence-driven economic decline may decrease less educated women's opportunity costs of childbearing, because their chances of having a stable job may deteriorate more sharply than those of their more educated counterparts.

Key words: Adolescents, Crime, Violence, Demography, Fertility

1. Introduction

"*You go out to the city and think, ´if it happens, it happens,´ because the way things are right now, you leave your house, go to work, to school, wherever you want, but you don't know if you'll come back, not because you are a* narco*, a police man, or anything like that, but because you are in the middle of all this* [violence]*."*

Anonymous young man from Tamaulipas, Mexico
(Gómez and Almanza 2016)

Globally, homicide is one of the most widespread forms of social unrest. Its epidemic character and its profound impacts on exposed populations have gained its recognition as "a leading worldwide public health problem" by the World Health Assembly (CDC 2009). Homicide as a form of violent crime affects exposed populations in ways that go beyond the number of casualties. Acute violence is often accompanied by political instability and economic shocks. Along with fear, displacement, lower property values, and productivity losses, these factors can greatly shape family wellbeing (Shemyakina 2013, Staveteigh 2011, Jones and Ferguson 2006). The demographic consequences of homicide gain relevance in light of its concentration in a particular intersection of age, gender and class: globally, 79% of homicide victims and 95% of homicide perpetrators are men, and 35% of homicide victims are young males between 15 and 29 (UNODC 2013, Krug et al. 2002). In addition, the incidence of homicide is highly concentrated in unequal, impoverished localities around the world (Krug et al. 2002).

Far from being a phenomenon pertaining to distant regions, homicide is particularly pervasive in the Americas. Taken as a whole, the Americas is both the region with the highest homicide rates in the world, and the only one where the male homicide rate is more than 8 times higher than the female homicide rate (UNODC 2013). Even in a developed country like the US, the homicide

rate for young African American males is almost twice as high as the global rate for males in the same age range[1] (CDC 2013, UNODC 2013). But despite its epidemic character and its drastic economic and psychological impacts on affected communities, we know surprisingly little about how exposure to high homicide rates, mostly concentrated among disadvantaged young males, would impact young women's behavior and wellbeing. In particular, how does violence affect young women's fertility, and how do these effects vary across education levels? This paper aims to answer this question.

My empirical analysis focuses on the case of Mexico. There are several reasons that make this country an ideal case study. Mexico has a population of over 100 million, and it has experienced drastic temporal and geographic variation in homicide rates. In 2010, the state of Chihuahua had a homicide rate of 1.82 (per 1,000), twice as high as the rate in Honduras in the same year. But there were also states such as Yucatan, with a homicide rate of 0.02, equivalent to that in Finland in the same year (UNODC 2013). As a whole, the country observed high homicide rates during the early 90s that peaked in 1992 (0.19 homicides per 1,000 people), and declined progressively until 2007 (0.08 homicides per 1,000 people) when they rose sharply again, reaching a homicide rate of 0.22 in 2012 (INEGI 2014b). According to existing research, Mexico's criminal violence has proven powerful enough to have profound consequences for the exposed population, such as reducing property values (Ajzenman, Galiani, and Seira 2014), hindering the educational outcomes of children (Caudillo and Torche 2014), and changing the health-related behavior of pregnant women (Torche and Villarreal 2014).

[1] In the US, the homicide rate for African Americans between 10 and 24 years of age was 0.3 per 1,000 in 2010 (CDC 2013).

Using the case of Mexico, I evaluate the effect of local homicide rates on fertility for teenage women, between 15 and 19 years of age. There are several reasons why teenage women are a subpopulation of interest. Adolescence is a critical period for the transition to adulthood in Mexico. In 2009, about 50% of women had had their first sexual intercourse and entered their first union[2], either marriage or cohabitation, by age 18, and the probability of having their first child[3] before turning 20 was about 31% (CONAPO 2011). Teenage women in Mexico often abandon school in order to join the labor force or start a family. As a consequence, up to 65% of women aged 15-19 do not accumulate more than 9 years of education (OECD 2014), and over 30% of women aged 18-19 were employed in 2009 (CONAPO 2010). Especially in developing countries, childbearing during adolescence has important implications for the health, wellbeing, and future opportunities of women and their babies (Arceo-Gomez and Campos-Vazquez 2014). Thus, exploring the relationship between an epidemic phenomenon such as homicide and teenage fertility is key to understand how local violence may impact the reproduction of inequality.

Early childbearing and union formation among young women are likely to be influenced by local violence, particularly among the most disadvantaged. Less advantaged young men are disproportionately likely to be crime victims or perpetrators (UNODC 2013), and may be more vulnerable to unemployment after violence-driven economic decline (Scarpetta, Sonnet, and Manfredi 2010). This can alter local marriage market conditions for teenage women. Any change in the desirability and availability of young male partners at the local level is likely to affect

[2] For women born between 1975 and 1984.

[3] For women born between 1980 and 1984.

teenage women's fertility. In addition, local economic decline per se is likely to impact women's fertility decisions, regardless of their SES level.

In Mexico, the dramatic increase in violence was mainly driven by a change in drug-enforcement policy in 2006 (Calderón et al. 2015), and was not brought about by changes in common correlates of crime, such as unemployment, poverty, or inequality. This quasi-exogenous nature of the increase in homicide in the last decade makes of Mexico a very useful case to assess the impact of local violence on fertility. I assess the effects of violence on local birth rates using fixed-effects models and aggregate official records at the local level, assembled in a yearly panel that encompasses years 2000 to 2010. I find that for less educated teenage women, exposure to local violence increases birth rates within three years of exposure. Among the less educated, my analyses suggest that violence-driven deterioration in the local marriage market conditions could encourage women to engage in more premarital sex in order to secure a partner, which may contribute to the increase in teenage birth rates. Increasing birth rates may also be driven by psychological responses to violence, because less educated women may see family formation as a source of emotional comfort in the face of hardship, in a context in which they are unlikely to have a stable job to forego. In general, my findings suggest that less educated women suffer the strongest effects of exposure to violence, and are vulnerable to be affected through multiple, complex pathways. In contrast, my analyses suggest that local violence reduces birth rates for more educated women within four years of exposure. This is consistent with a response to violence-driven economic decline, assuming more educated women have higher opportunity costs of childbearing and better access to contraception. In contrast to disadvantaged women, the marriage market conditions for more educated women do not seem to be as strongly affected by local violence.

Shedding light on the demographic consequences of rampant homicide rates, in particular its effects on young women and their children, is critical to devise strategies that protect them from any potentially pernicious effects. This is particularly relevant if we remember that the most disadvantaged population is disproportionately exposed to violent crime. Assessing the impact of violence on fertility is crucial to understanding its implications for future generations. Evaluating the impacts of violent crime on births is central to understanding how violence can shape children's development and future opportunities, as well as how it relates to the intergenerational reproduction of inequality.

2. Theoretical Background

Although a substantial body of literature in criminology has focused on how demographic phenomena impact crime, sociology has rarely evaluated violent crime as a cause of change in fertility (South and Messner 2000). A small and recent body of literature has assessed the demographic effects of violence with special attention to causal inference, but they have focused on war or internal conflict events, such as World War II (Abramitzky, Delavande, and Vasconcelos 2011), the Rwanda genocide (Staveteigh 2011) or the Tajikistan armed conflict (Shemyakina 2013). These episodes are of a rare nature, and occur in social and political contexts that are not directly comparable to those that bring about homicide as a form of everyday violent crime.

So far there is no comprehensive theoretical framework to understand the relation between homicide and fertility. However, the existing literature does discuss and evaluate causal mechanisms that could potentially link community violence to the foresaid outcomes. In this

section, I review their findings and theoretical implications, and explain why we would expect local violence to affect fertility. According to existing literature, environmental violence may impact women's likelihood of having a birth through at least four channels: economic decline, marriage market conditions, migration, and psychological factors.

Economic Decline. An expected consequence of environmental violence is economic uncertainty and decline. In the case of Mexico, Ajzenman, Galiani and Seira (2014) found that increases in homicide rates led to sizeable decreases in housing prices, which were concentrated among poor populations. Evidence from countries with violent conflicts has shown fertility can drop due to economic uncertainty (Guha-Sapir and D'Aoust 2010). However, there are reasons to expect that the effect of economic uncertainty on fertility would vary according to women's education level and economic vulnerability (Friedman, Hechter, and Kanazawa 1994). According to evidence from Germany after the dissolution of the Soviet Union, less educated women often increased their fertility in the face of economic uncertainty, while more educated women would reduce it (Kreyenfeld 2009). Similarly, in post-Cold War Russia, women who experienced greater labor market uncertainty at the household level were more likely to increase their fertility than those who did not (Kohler and Kohler 2002).

These differential responses to economic uncertainty are consistent with a scenario in which less educated women face greater employment instability than their more educated counterparts in the midst of local economic decline. Thus, their opportunity costs of childbearing drop more sharply, and motherhood becomes a feasible strategy to structure their lives and to gain certainty about what their future will look like (Sobotka, Skirberkk, and Philipov 2011, Scarpetta, Sonnet, and Manfredi 2010, Friedman, Hechter, and Kanazawa 1994). In contrast, in the face of economic decline, more educated women, who usually have higher opportunity costs of

childbearing than their less educated counterparts, may face even greater incentives to remain in school or to maintain their jobs instead of having a child. Because potential earnings become more valuable in a context of economic decline, we would expect more educated women to decrease or postpone childbearing (Friedman, Hechter, and Kanazawa 1994, Sobotka, Skirberkk, and Philipov 2011).

Marriage Market. Another plausible consequence of acute violence is the shrinkage of the pool of available or desirable partners for women, particularly within disadvantaged groups, due to the disproportionate male composition of homicide victims and perpetrators (Guha-Sapir and D'Aoust 2010). Sex ratios are defined as the ratio of males to females in a population. Jones and Ferguson (2006), in what is probably the closest study to this paper's question, found that persistently high male homicide rates are predictive of a decrease in the ratio of males to females in Colombia's departmental[4] marriage markets. Although Jones and Ferguson discuss theories about the consequences of lower sex ratios, they do not evaluate them empirically, and thus offer no evidence related to the effects of violent crime on fertility.

Although homicide rates would need to be very high for prolonged periods in order to cause significant changes in sex ratios, growing violent crime could rapidly reduce the *desirability* of potential male partners, since most crime perpetrators happen to be young men (South and Messner 2000, UNODC 2013). In the US, disadvantaged women often mention their partners' continuous involvement in illegal activities as one of the main reasons for dissolving their unions (Edin and Reed 2005), and union dissolution could potentially decrease fertility. In addition, male unemployment, caused by the negative economic shocks following a violence spike, would

[4] Colombia's smallest political unit is departments.

also represent a reduction in the pool of desirable partners that could decrease marriage rates, and fertility as a consequence. But a lower pool of desirable potential partners may also induce sex out of a union as a strategy to attract a man in a context of scarcity (South and Lloyd 1992). Women in a relationship could seek pregnancy as a way to increase their partner's commitment (Friedman, Hechter, and Kanazawa 1994). Both of these behaviors may result in higher fertility, mostly among unmarried women. In sum, the effect of a decrease of available or desirable male partners on fertility is theoretically uncertain.

Migration. A third path through which increasing homicide rates may impact the outcomes of interest is migration (Jones and Ferguson 2006). Recent estimates for Mexico indicate that between 2005 and 2010, more than 250,000 people have moved out of their municipality[5] to avoid organized crime activities, such as homicide and extortion (Ríos 2014). However, evidence shows that not all demographic groups are equally likely to out-migrate as a reaction to local violence. Recent evidence from the US suggests that increases in local crime cause migration out of the county, primarily among the white population (Foote 2015). In the case of Colombia, populations with smaller portions of land were more likely to migrate as a response to violence (Engel and Ibanez 2007). For Latin America in general, Wood et al. (2010) found that men were somewhat more likely to consider migrating to the US as a response to crime victimization of themselves or a relative. This is consistent with a social context in which male migration has higher social acceptance than female migration (Massey, Fischer, and Capoferro 2006). If people migrate selectively to avoid violence exposure, this could change the socioeconomic composition of the remaining population and eventually impact fertility for women who stay. Out-migration

[5] Municipalities can be thought of as the equivalent of counties in the US.

may bring about economic deprivation and changes in sex ratios, which could impact fertility in the ways discussed above.

Psychological Factors. Economic hardship, the weakening of social capital, and the perception of a hostile community environment caused by increased violence, could make disadvantaged women rush into family formation as a source of positive meaning and self-fulfillment (Edin and Kefalas 2011, Nobles, Frankenberg, and Thomas 2015). Past research has also found that women who witness excessive mortality in their communities respond by increasing their fertility as a compensation strategy (Nobles, Frankenberg, and Thomas 2015). Similarly, women affected by local violent conflict in rural areas may increase their fertility as an "insurance" against an uncertain future (Guha-Sapir and D'Aoust 2010, Friedman, Hechter, and Kanazawa 1994).

On the other hand, people may try to abstain from having children because raising them in a violent context is not desirable (McGinn 2000). Violence may weaken support networks that mothers could rely upon to raise their offspring, and would likely raise the cost of childbearing, since more monitoring and parenting efforts would be needed to keep children safe (Grady, Klepinger, and Billy 1993, Harding 2010, Caudillo and Torche 2014). In addition, previous evidence has shown that violence in Mexico produces anxiety and negatively affects mental health for the exposed population (Michaelsen 2012), which could make women avoid the responsibilities of parenting.

Despite their utility in illuminating the effects of economic shocks, decreasing sex ratios, migration, and psychological factors on fertility, none of these studies asks the specific question of how local violence affects young women's fertility. In most cases, evidence and theory provide mixed predictions regarding the direction of the effects after exposure to violence. One

of the goals of this paper is to advance the current theoretical notions of how and under what circumstances violent crime may affect demographic outcomes such as young women's fertility.

Based on the theories and empirical findings discussed in this section, I hypothesize that the effects of violence on fertility could vary across SES levels, but I expect the largest and more complex impacts to be concentrated among less educated women. As will be discussed in the next section, disadvantaged young men are disproportionately affected by local violence (UNODC 2013), which would make young women in this social stratum more vulnerable to indirect effects. In addition, less educated young men are often more likely to face job instability after violence-driven economic shocks (Scarpetta, Sonnet, and Manfredi 2010). For these reasons, less educated women could be specially affected by declines in the desirability of potential long-term partners in their local marriage market, originated by increasing violence. The scarcity of desirable long-term partners could lead to greater participation in premarital sex and increased rates of premarital fertility, as part of a strategy to increase a partner's commitment (South and Lloyd 1992, Friedman, Hechter, and Kanazawa 1994).

Finally, violence-driven economic shocks are likely to affect fertility as well, although theory indicates they may have different impacts on more- and less-educated women, depending on what economic decline implies for their opportunity costs of childbearing. More educated women are expected to reduce their fertility in times of local economic decline, but less educated women may increase their fertility if they face greater employment instability, in such a way that the opportunity costs of having a child are significantly reduced. Although there are other potential mechanisms linking violence to fertility, such as psychological factors, I will concentrate on local economic decline and marriage market conditions, because they can be

measured by the available aggregate official data. However, I will speculate about how unobserved causal mechanisms could be contributing to my findings in Section 4.

3. The "War on Drugs," Violence, and Birth Rates in Mexico

The "war on drugs" in Mexico was a strategy launched in 2006 by President Felipe Calderón. This new drug-enforcement policy entailed two main goals: capturing or killing drug-trade organization (DTO) leaders, and using military troops to fight organized crime in civilian population centers (Ríos 2013). Within a few months of its inception, this strategy resulted in numerous armed confrontations between police forces, military troops, and organized crime members, which occurred in previously safe public spaces and densely populated areas (Osorio 2015). As a consequence, the previously declining homicide rate grew from 0.08 (per 1,000) in 2007 to 0.22 in 2012. To place these numbers in context, the US homicide rate in the most violent years of the crack epidemic did not surpass 0.10 homicides per 1,000 residents (FBI 2014).

The beheading of DTOs by military troops has multiplied their number and increased their incentives to geographically expand their illegal activities (Guerrero-Gutiérrez 2011). In addition, because of the need of greater resources to finance the war against the military and rival organizations, DTOs have recently diversified their activities into extortion, kidnapping for ransom, and human trafficking, in which the civilian population is often the main target (Ríos 2013, Guerrero-Gutiérrez 2011). In addition to generalized terror, this scenario has implied intensification in the recruitment strategies of DTOs, which continuously and aggressively approach young, disadvantaged men to offer them a role in the organization, ranging from

informant and dealer to *sicario* (hitman) (Gómez and Almanza 2016). Even when not directly involved with any of the parties in conflict, young, disadvantaged men are often disproportionately vulnerable to victimization or forced recruitment into DTO's (Ibid).

In 2010, more than 90% of homicide victims and homicide perpetrators were men (México-Evalúa 2012). Homicide victims in México are predominantly unmarried males with less than 9 years of education (Ibid.). After 2006, the rate grew disproportionately for this demographic group, and surpassed the 0.7 homicides per 1,000 people in 2010, which represents an increase of about 300% from 2006 to 2010. In addition, after 2006, the homicide rate markedly increased for cohabiting and non-cohabiting unmarried men in contrast to married, divorced, and widowed men (200% from 2006 to 2010) (Ibid.). Women, in comparison, face homicide rates that, although increasing, have remained below 0.1 per 1,000 people since the early 1990s (Ibid.). According to official records of the criminal justice system in Mexico, perpetrators are more likely to pertain to a demographic group that overlaps with that of their victims: men between 18 and 29 years of age, with less than 9 years of education[6] (México-Evalúa 2012).

Figure 1 shows the homicide rate (per 1,000) in Mexico between 2000 and 2010, along with the proportion of homicide victims who were men of ages 15 to 34 years of age. Across the period, this proportion was consistently over 0.4, and it has increased to 0.5 as overall homicide rate does, which means that victims are even more disproportionately drawn from this demographic group during violence upsurges. Similar to the case of Colombia, high homicide rates in Mexico are likely to cause a shortage of available and desirable partners among disadvantaged women

[6] Statistics about perpetrators should be interpreted with caution, since they pertain only to those criminals captured by the Mexican authorities. In 2010, about 84% of homicides were not solved (México Evalúa 2012).

(Jones and Ferguson 2006), because of the higher likelihood of criminal involvement and victimization in this social stratum. As mentioned before, one of the mechanisms through which violent crime could impact fertility is by reducing the pool of desirable potential male partners, which in turn can be affected by crime involvement, selective migration, violence-driven male unemployment, and selective mortality. Alternative causal mechanisms that may not act through changes in the pool of available and desirable men are generalized economic hardship and psychological responses.

Figures 2 shows teenage birth rates (per 1,000) in Mexico, from 2000 to 2010, for all women, all teenage women, less educated teenage women (with 9 or less years of education), and more educated women teenage women (with more than 9 years of education). Although overall birth rates in Mexico have declined during the past decade, birth rates for teenage women have been an exception. For women between 15 and 19 years of age, the birth rate stopped declining, and actually started to increase after 2006. As will be seen below, this can be partially explained by exposure to local violence among less educated women. Other possible explanations are the decreasing out-migration of young males from Mexico to the US due to lower labor demand in industry (Villarreal 2014). In Mexico, communities with a high rate of male out-migration have lower sex ratios and lower marriage rates, which has in turn led to lower fertility rates (White and Potter 2013 , Raphael 2013). Thus, a reduction in out-migration among young males might be positively associated with marriage and fertility rates for recent cohorts of young women. These trends highlight the importance of controlling for international and domestic migration rates, as well as age-specific sex ratios in the analysis.

4. Data and Methods

My analysis illuminates the effect of changes in homicide rates on changes in birth rates at the local level using a yearly municipality-level panel for 2,442 municipalities.[7] Municipalities are the smallest political unit in Mexico, and are the smallest geographical unit for which homicide rates are available. Homicides are measured yearly at the municipality level for the period of interest, 2000 to 2010 (INEGI 2014b). To capture exposure to violence, I calculate homicide rates measured in municipality *i* and year *y*. I used municipality-level yearly statistics on births to calculate local birth rates per year. The source for birth data is the Mexican Civil Registry, and my data spans from 2000 to 2010. A birth is registered in this data set when parents take a child to their local Civil Registry Office to officially certify her birth. This is a mandatory process for parents in Mexico, and a child will require the birth certificate issued by the Civil Registry Office in order to be enrolled in school, and to obtain any form of government-issued identification. All of these data are systematized and published by the National Institute of Statistics and Geography (INEGI 2014b).

I restrict the calculation of birth rates to births that were registered within three years after they occurred. This covers about 96% of all births that occurred in a year. Rates are calculated per 1,000 women from 15 to 19 years of age. To test the effect of exposure to violence on women of different SES levels, I calculate birth rates within two population groups: women with 9 or less years of education, and women with more than 9 years of education. Thus, birth rates were obtained by dividing the number of births to teenage women of educational category *e*, in municipality *i* and year *y*, by the total number of teenage women of educational category *e,*

[7] Although there were 2,456 municipalities in Mexico in 2010, I excluded 14 of these from the analysis because they had incomplete data for most years in the series.

residing in municipality i on year y. Denominators were obtained from censuses conducted in 2000 and 2010, and a population count in 2005. The 2005 population count used a shorter version of the census questionnaire, but aimed to interview the entire population, as a census would. Unmeasured years in-between were interpolated. Denominators for homicide rates were similarly obtained, but were defined as the total population in municipality i and year y.

According to the Mexican school system, by age 15, all women should have attained at least 9 years of education (*secundaria* or lower secondary school). However, up to 65% of women of ages 15-19 do not accumulate more than 9 years of education, because they leave school in order to either join the labor force or to start a family (OECD 2014). Thus, women older than 15 with no more than 9 years of education are more frequently from disadvantaged backgrounds than those with more than 9 completed school years (Marteleto, Carvalhaes, and Hubert 2012). Similarly, homicide victimization and perpetration are concentrated among males with up to 9 years of education. Since women in Mexico usually seek partners among men near their own educational level (Torche 2010), women with up to 9 years of education are more likely to be disproportionately exposed to, and affected by, local violence. For these reasons, the proposed educational dichotomy is a useful SES classification for the present analysis.

To assess the effect of exposure to violence on local birth rates, I estimate the fixed-effects model described by Equation 1. Fixed-effects models eliminate the municipality-level time-invariant component α_{ie} by time-demeaning the data. This technique is also known as the "within transformation," and implies subtracting the municipality-level mean value for the entire period from each municipality-year value. This implies that the models are not able to estimate the effects of any time-invariant covariates, since these are absorbed by α_{ie}, but they are capable of estimating coefficients for time-varying covariates in terms of deviations from the period

mean. The appeal of the "within transformation" is that parameter estimates for time-variant covariates would not be biased if the unobserved fixed component α_{ie} were correlated with them. The models include year dummy variables, and interactions between four categories of local economic development[8] and year dummies. While year dummies capture national unmeasured trends in birth rates, interactions capture unobserved trends specific to local development levels, without assuming a particular functional relation with time. Because fixed-effects models are still prone to bias due to unobserved time-varying confounders, I include a series of relevant municipality- and state-level time-varying covariates that capture factors likely related to both homicide and birth rates.

(Eq. 1)

$$BirthRate_{iey} = \beta_0 + \beta_1 Homicide_{iy-2} + \beta_2 Homicide_{iy-3} + \beta_3 Homicide_{iy-4} + \beta_4(\boldsymbol{MUNIC})_{iy-5} + \beta_5(\boldsymbol{YEAR})_y + \beta_6(\boldsymbol{SES} * \boldsymbol{YEAR})_{iy} + \alpha_{ie} + u_{iey}$$

All models control for municipality- and state-level time-varying socioeconomic indicators, made available by the National Institute of Statistics and Geography (INEGI 2014b) and the National Population Council (CONAPO 2012). Municipality-level indicators are intended to capture changes in the socioeconomic composition of the local population, and changes in its sex and age structure that could be induced by pre-existing trends in migration, fertility, and mortality. These controls include population size in thousands, age-specific sex-ratios, as well as

[8] I created four local economic development categories, based on quartiles from an index. The index was constructed using the first factor in a principal component analysis of a series of socioeconomic indicators measured in the 2000 census: percentages of illiterate population; population without elementary school; employed population earning less than twice the minimum wage; inhabitants living in households without drain network, without plumbing, without electricity, with dirt floor, with overcrowding; and population living in localities with fewer than 5,000 inhabitants.

the percentages of local population that are illiterate, that hold no elementary school degree, that have no sewer system, tubed water, or electricity in their residences, that earn less than two minimum wages, that live in a residence with dirt floor, and that live in communities of less than 5,000 people (see Table A-1 for detailed description of covariates). These variables were measured every year a Census or Population Count was conducted (2000, 2005, and 2010), and values for years in-between were interpolated. State-level variables include domestic and international migration, and unemployment rates, measured yearly by Mexican officials. Table 1 shows descriptive statistics for all of the variables used in the analysis in two different points in time: 2000 and 2010.

The predictors of interest in these models are three lagged homicide rate indicators for years *y-2, y-3,* and *y-4*. I include these lagged indicators in order to capture both immediate and delayed effects of violence. I omit an indicator for homicide rates in year *y-1* in order to account for gestation time. Since homicide rates can be both a cause and an effect of socioeconomic conditions, migration, age and sex composition of the population, all time-varying covariates are lagged by one year relative to the oldest homicides indicator. In other words, they are measured in year *y-5*. This way, they can be conceptualized as controls for change in local conditions preceding change in homicide rates, and not subject to reverse causation. Municipality and year fixed effects combined with time-varying controls address potential bias introduced by unobserved variables simultaneously related to homicide and the outcomes of interest.

About 6% of all municipality-years have missing education values for the mother in more than 15% of birth certificates. When the educational attainment of the mother is missing in a certificate, the birth cannot contribute to the calculation of education-specific rates. In order to account for this factor, all of the education-specific models explaining outcomes computed from

official certificates include a control that captures the percentage of births that had missing maternal education values in that municipality-year. All models weight observations by local population size in 2000, and apply standard errors robust to heteroskedasticity and serial correlation[9] (Hoechle 2007).

5. Results

Table 2 presents results from fixed-effects aggregate models estimating the impact of increases in violence on local birth rates for teenage women. Regressions are presented separately for more and less educated women. According to these models, the homicide rate in year *y-3* has a positive and significant effect on birth rates for less educated women ($p<0.05$). An increase of 1 in the homicide rate (per 1,000) in *y-3* leads to an increase of 2.8 births per 1,000 women among disadvantaged teenagers. In contrast, the homicide rate in year *y-4* has a negative and significant effect on birth rates for the more educated ($p<0.01$). An increase in the homicide rate in *y-4* leads to a decrease of 2.4 births per 1,000 women among more educated teenagers. These effects are significant even though models include lagged time-varying controls for socioeconomic conditions and sex-age composition at the local level, plus migration and unemployment rates at the state level, year fixed effects and their interactions with local development levels.

These changes in fertility are consistent with a number of competing theories that link violence to demographic outcomes, as described in Section 2. However, the relevant causal mechanisms are likely different for more and less educated women, given the differences in exposure to violence discussed in Section 3, and the greater vulnerability of disadvantaged population to

[9] This is accomplished by using the option *cluster* in Stata 13.

economic decline (Skoufias and Quisumbing 2007) caused by violence. I hypothesized that one of the causal mechanisms linking local violence and fertility among the less educated would be changes in the conditions of the local marriage market. Local violence may cause disproportionate involvement in crime, out-migration, and mortality among young males, which could reduce the pool of available and desirable partners for young women. Violence-driven economic decline can also decrease the quality of potential partners by making it harder for young males to find a stable job. Because less educated young men are more likely to be directly exposed to violence, and because their employment prospects could be more vulnerable to negative shocks in the local economy, we would expect changes in the local marriage market to be more relevant for the disadvantaged population. According to marriage markets theory, a reduction in the pool of available and/or desirable potential male partners would make marriage harder for disadvantaged women, and would decrease their marriage rates. In turn, a local environment in which suitable long-term partners are hard to find may encourage disadvantaged women to increase pre-marital sex in order to secure a partner (South and Messner 2000). Finally, more premarital sex may lead to higher birth rates among unmarried, less educated women.

In order to test whether violence affects marriage market conditions for young women, I estimated fixed-effects models like that in Equation 1 to predict changes in the quality of potential male partners and changes in local marriage rates. It is hard to assess changes in the desirability of the pool of potential male partners, because there are many unobserved characteristics that women may value in long-term partners. As a crude approximation of male "quality," I estimate a measure of the number of employed men of ages 15-24, in educational category *e*, in municipality *i* and year *y*, per 1,000 women of ages 15-19, in educational category

e, residing in municipality *i* on year *y.* I include men in a wider age range because women tend to seek slightly older men as relationship partners (Catanzarite and Ortiz 2002). This crude measure of the quality of potential partners may be related to several causal mechanisms. For instance, young men with higher likelihood of finding a job may also be more likely to out-migrate as a response to violence, which would decrease this ratio. This measure may also be reflecting violence-driven local economic recession and, to a much lesser extent, selective mortality of young males. This outcome was directly measured only in 2000 and 2010, and the corresponding models are restricted to these years. Because I expect employment conditions would respond to violence outbreaks faster than birth rates, these models include an indicator for homicide rate in the immediately previous year, *y*-1, in addition to those for years *y*-2, *y*-3, and *y*-4.

Results for this analysis are shown in Table 3, with separate models for more and less educated women. According to these fixed-effects models, an increase in local violence has a negative impact on the number of employed men per resident women. As regressions for separate education groups show, this effect is driven by the less educated population. Among the less educated, an increase of 1 in the local homicide rate reduces the number of employed men per 1,000 women by about -46 in *y-1* ($p<0.05$), and about -70 in *y-2* ($p<0.01$). In contrast, effects for the more educated population are smaller and do not reach significance at the 95% confidence level. These results are consistent with worsening quality of potential male partners, particularly among the disadvantaged population in municipalities affected by violence.

If violence really impacts marriage market conditions for the disadvantaged, we would also expect to see changes in local marriage rates. In order to test this hypothesis, I use the model in Equation 1 to estimate the impact of local violence on marriage rates. Similarly to birth rates, I calculate yearly marriage rates between 2000 and 2010 using marriage certificates collected by

the Mexican Civil Registry. Marriage rates were obtained by dividing the number of marriages occurring to teenage women of educational category *e*, in municipality *i* and year *y*, by the total number of never married[10] teenage women of educational category *e,* residing in municipality *i* on year *y*. Denominators were estimated by interpolating data from censuses conducted in 2000 and 2010, and a population count in 2005. Emulating models for birth rates, I omitted the homicide rate indicator for the immediately previous year, *y*-1, because the decision to get married and the planning of the event is often done with months of anticipation. As in models for birth rates, I include an indicator that captures the percentage of marriages for which the wife's education was missing in the certificate.[11]

Table 4 shows estimates from fixed effects models predicting marriage rates. Again, models are presented separately by education level. As expected, for less educated women, the models suggest that the homicide rate in years *y-3* and *y-4* has a negative and significant impact on marriage rates. An increase of 1 in the local homicide rate (per 1,000) in years *y-3* or *y-4* leads to about 2 less marriages per 1,000 women ($p<0.05$). In contrast, there are no significant effects of homicide rates on marriage rates for the more educated. These findings are consistent with the negative effect of violence on the number of employed men per women among the less educated—but not among the more educated.

If the effects of violence on fertility among the less educated are driven by worsening marriage market conditions and premarital sexual activity, we would expect fertility increases to be concentrated among unmarried women. Table 5 shows estimates from fixed effects models

[10] The census questionnaires include separate categories for divorced, separated, and widowed women. Thus, I assume the category "single," used to define the denominators, captures never married women.

[11] Only 9% of municipality-years had missing education values for more than 15% of occurred marriages.

predicting the effect of violence on the percentage of births to women of different marital statuses, as reported in the birth certificates: married, cohabiting, or unpartnered. I show separate results by education level. According to Table 5, exposure to violence decreases the percentage of births to married women among the less educated. An increase of 1 in the local homicide rate (per 1,000) in years *y-3* or *y-4* leads to a decrease of about -1.5 in the percentage of births to married women ($p<0.01$). In contrast, the same increase in violence in years *y-3* or *y-4* leads to an increase of about 2 in the percentage of births to cohabiting women ($p<0.05$). These findings suggest that the increase in birth rates for disadvantaged young women is driven by increased fertility among unmarried teenagers. This is consistent with a scenario in which young women engage in more premarital sex in order to secure a partner in a context of economic uncertainty and scarcity of desirable men. Births to unmarried women may be an unintended consequence of increased cohabitation and premarital sex, or a strategy to try to increase a partner's commitment.

Marriage market conditions are not the only pathway through which economic decline could impact birth rates. The effect of economic uncertainty on fertility has been found to vary across women's SES, with more educated women reducing their fertility, and less educated women increasing it after experiencing a negative economic shock (Sobotka, Skirberkk, and Philipov 2011). The more educated, who usually face higher opportunity costs of childbearing than the less educated, are even more likely to reduce their fertility in the midst of economic decline. In the face of economic uncertainty, more educated teenagers may prefer to stay in school or keep their jobs instead of having a baby, because their future earnings are more promising than those of their less educated counterparts. In contrast, the stability of the jobs available for the less educated may be particularly vulnerable to economic decline, which may drastically reduce their

opportunity cost of having children (Sobotka, Skirberkk, and Philipov 2011). In order to test whether local economic decline could be a relevant causal mechanism, I use two municipality-level indicators to evaluate the impact of local violence on the economic wellbeing of the population: percentage that earns less than two times the minimum wage (about $8.4 dollars per day in 2016), and percentage that lives in overcrowded housing. These outcomes were directly measured only in 2000, 2005 and 2010, and the models are restricted to these years. Just as in the models explaining changes in employed men per women, these models also include an indicator for homicide rate in the immediately previous year, *y*-1, because I expect local economic conditions to respond to violence outbreaks faster than birth or marriage rates.

As expected, an increase in homicide rates has a positive and significant effect on the share of workers with low wages in a municipality (See Table 6). An increase of 1 in the local homicide rate in years *y-1* and *y-2* is linked to an increase of at least 2 percentage points ($p<0.05$) in the share of workers with low wage. The second model in Table 6 predicts the percentage of the local population living in a residence with overcrowding. According to this model, an increase of 1 in the homicide rate in year *y-3* causes an increase of about 0.6 in the percentage of population living in overcrowding. These models suggest that violence deteriorates the local economy. Such negative economic effects of violence are consistent with the study by Ajzenman, Galiani and Seira (2014), who found that increases in violence reduce property values in affected areas in Mexico.

If increasing violence causes local economic decline, findings on birth rates among the more educated are consistent with past studies, which have found that economic downturns are associated with fertility declines among this demographic group (Sobotka, Skirberkk, and Philipov 2011). Exposure to violence could also affect these women's fertility preferences, by

making it undesirable to give birth in a context of heightened stress and tragedy (McGinn 2000). Violence may weaken support networks that mothers may rely upon to raise their offspring, and would likely raise the cost of childbearing, since more monitoring and parenting efforts would be needed to keep children safe (Grady, Klepinger, and Billy 1993, Harding 2010, Caudillo and Torche 2014). In contrast to their disadvantaged counterparts, more educated women often have better access to medical services and contraception. This may be a key mediator between women's fertility intentions and their capacity to realize them (Torche and Villarreal 2014). In addition, my findings suggest that in contrast to less educated women, the more educated do not face drastically worsening marriage market conditions, and thus may not have increasing incentives to engage in premarital sexual activity or to seek premarital pregnancies. Consistently, Table 5 shows that decreasing fertility for more educated women is driven by lower birth rates among unmarried women.

Although there is evidence that violence outbreaks have substantial psychological impacts on the affected population (Michaelsen 2012), data availability prevents me from testing this mechanism directly. However, it is possible that there are also psychological factors behind the fertility increase among less educated women. As discussed in Section 3, past research has found that low-SES women may see motherhood as a source of positive meaning and self-fulfillment amidst a hostile environment (Edin and Kefalas 2011). Similarly, witnessing excessive mortality in their neighborhoods may motivate less educated young women to increase their fertility (Nobles, Frankenberg, and Thomas 2015). For poor women in rural contexts, having a child could also be used as an insurance strategy in the face of economic uncertainty (Guha-Sapir and D'Aoust 2010), which is one of the byproducts of violence.

In sum, evidence suggests that exposure to violence results in higher birth rates for les educated teenage women, and lower birth rates among the more educated. My findings are consistent with the presence of interrelated mechanisms that could link local violence to changes in birth rates: less favorable marriage market conditions for less educated women, which may increase their premarital fertility, and overall local economic decline, which has differential implications across SES levels. However, it is possible there are other unmeasured mechanisms in operation, such as psychological factors, although testing them is beyond the scope of this paper.

Finally, I conducted the following robustness checks for the previous findings. In order to test the sensitivity of results to missing educational attainment data, I re-estimated Tables 2, 4, and 5, but restricted to those municipality-years where less than 15% of births or marriages had missing education values. As an additional robustness check regarding the interpolation of denominators in birth and marriage rates, which assumes linear population change in-between observed values, I reproduced Tables 2, 4, and 5 using only years 2000, 2005, and 2010, when local population was directly measured. In all of these checks, results were virtually the same as those reported in the main analysis, which suggests my findings are robust to missing values and interpolation assumptions. Finally, I reproduced Table 2, 4, and 5 using shorter lag structures. When only homicide rate in year *y*-2 is in the model, and controls are measured in year *y*-3, the homicide rate is never significant in any model. This suggests the responses in terms of fertility and marriage are more delayed than *y*-2, as shown in the main models. When homicide rates in years *y*-2 and *y*-3 are included, and controls are measured in year *y*-4, results are essentially the same than in the main models, with the exception of birth rates for more educated women, which do not reach conventional significance levels. This is expected, however, because according to

Table 2, the fertility response among these women appears later, in *y*-4. Overall, these robustness checks indicate the findings in this study are fairly stable across different lag structures.

6. Discussion

There is a well-established body of literature that assesses the impact of demographic phenomena and family characteristics on crime. However, social scientists have rarely assessed the inverse relationship: how exposure to local violence may impact demographic outcomes such as fertility. Similarly, there is no comprehensive theory that explains the relationship between violence and fertility or related outcomes, such as marriage and cohabitation. In this paper, I have combined theoretical approaches from different subfields of sociology and economics to investigate the pathways through which high homicide rates could affect young women's fertility, with particular attention to differences between the more and less educated. Mexico is a particularly useful case to assess the impact of local violence on fertility and other demographic outcomes because it has experienced a drastic and quasi-exogenous increase in homicide rates after 2006. This was mainly driven by a change in drug-enforcement policy, and was not originated by changes in usual correlates of crime, such as unemployment, poverty, or inequality.

My findings suggest that the effects of violence on fertility are different across SES levels, although the impacts for disadvantaged women are stronger and more complex. For less educated women, my models suggest that exposure to local violence increases birth rates within three years of exposure. Among the less educated, my analyses also suggest that exposure to violence decreases the quality of potential male partners, reduces marriage rates, increases the percentage of births to cohabiting women, and decreases the percentage of births to married

women. Even after accounting for pre-existing trends in migration, economic conditions, and age, sex, and socioeconomic composition of local populations, exposure to violence has important implications for the fertility of young women, and for family formation in general.

These findings are consistent with a scenario in which, after exposure to increasing violence, less educated women face less favorable marriage market conditions. A key insight in this paper is that exposure to violence, crime victimization, and involvement in criminal activities are disproportionately concentrated among less educated young men. In addition, the stability of the jobs available for the less educated may be more vulnerable to violence-driven negative economic shocks. In violence-ridden communities, this could make less educated young men more prone to unemployment. Together, these factors could reduce the quality of potential long-term partners for disadvantaged young women. Such deterioration in the local marriage market could encourage women to engage in more premarital sex in order to secure a partner, which may contribute to the increase in teenage birth rates.

Increasing birth rates among the less educated may also be driven by psychological responses to violence, since disadvantaged women may see family formation as a source of emotional comfort in the face of hardship, or as a compensation for perceived excessive mortality in their communities. In addition, I find evidence of generalized economic decline in municipalities affected by increasing homicide rates. For poor women, economic decline may incentivize increased fertility, because their job prospects are likely to suffer, and their opportunity costs of childbearing may decrease. In general, my findings suggest that less educated women suffer stronger effects of exposure to violence, and are vulnerable to be affected through multiple, complex pathways.

In contrast, my analyses suggest that local violence reduces birth rates for more educated teenage women within four years of exposure. This is consistent with delaying childbearing as a response to violence-driven economic decline. Assuming that more educated young women have more promising future earnings and are less vulnerable to employment instability than their less educated counterparts, they may prefer to stay in school and/or stay employed instead of having children in times of economic hardship. In addition, more educated women usually have better access to contraception, which may increase their ability to reduce their fertility as a response to negative economic shocks. In contrast with disadvantaged women, marriage market conditions for more educated women do not seem to be affected by local violence.

Overall, the evidence in this paper suggests that the war on drugs is potentially catalyzing certain aspects of the Second Demographic Transition among less educated women in Mexico, by increasing the share of births to unmarried women and reducing their marriage rates (Lesthaeghe 2014). Local violence could also be actively reinforcing socioeconomic inequality in affected communities by increasing disadvantaged women's barriers to marriage and propensity to nonmarital fertility. The reason for this is that, compared to cohabitation and single motherhood, marriage is correlated with better economic and health outcomes for women and children. This is possibly attributable to the stability that marriage generally brings to family structures (McLanahan and Percheski 2008, Schmeer 2013, Brown 2010).

In addition, the evidence presented in this paper suggests that exposure to violence has been one of the factors behind the increasing teenage fertility rates that Mexico has witnessed in the past ten years. Although recent studies have questioned the nature and durability of the effects of teenage pregnancy on mothers and children in the United States (Lee 2010), existing research suggests that there are detrimental consequences of teenage pregnancy for women in Latin

America and other developing regions. In developing countries, teenage pregnancy is associated with permanent decreases in educational attainment, work hours, and household income (Arceo-Gomez and Campos-Vazquez 2014), and numerous health risks for both the mother and her child (Conde-Agudelo, Belizán, and Lammers 2005, Mahavarkar, Madhu, and Mule 2008, Nour 2009, Raj et al. 2010).

In sum, the implications of exposure to violence for teenage fertility and marriage are inherently intergenerational. The children who have been born in affected communities during the Mexican war on drugs will likely grow up in families that may be substantially more unstable and disadvantaged than those of children born in unaffected areas, or born a generation before. Thus, their economic prospects and life opportunities will probably be quite different from those of unaffected children. For women who transitioned to adulthood after the onset of the war, the meaning of marriage may be shifting more rapidly than among other groups. In addition, in the face of suddenly increased barriers to marriage, women who may not had considered cohabitation as an appropriate context for childrearing may begin to do so. And such changes in behaviors and meanings could contribute to accelerate processes that were already underway in Mexico, such as the retreat from marriage and the rise of cohabitation as a context for childrearing. Thus, the findings presented in this dissertation should be interpreted as only the "tip of the iceberg" among the intergenerational consequences of the exposure to community violence.

This paper has several limitations. First, the aggregate measures of fertility and marriage used in this analysis are somewhat crude, because they do not capture the history of pregnancy and unions at the individual level. However, they provide an unusually long span of observation that includes a period of high variation in violence: decreasing homicide rates in the early 2000's, and

dramatic increases between 2006 and 2010. Second, the birth and marriage rates used in the analyses rely on interpolated denominators, which assume population change behaves linearly. This may introduce some bias in estimates in the presence of more complex migration patterns in-between Census and Population Count years. Third, the causal mechanisms explored in this paper are likely only partially responsible for the diverging demographic responses between more and less educated women. Further research and better data are needed to explore other mechanisms, as well as the effect of exposure to violence on the order and timing of births, marriage, and cohabitation. Whether the effects of violence on birth rates reflect changes in the timing of births or changes in total fertility is a question that can be better answered with individual-level data.

In contrast with marriage and births, cohabitation formation is not registered by official yearly data, and is thus not directly analyzed in this paper. Traditionally, cohabitation has been a frequent type of union among the less educated population in Mexico, and it has become an increasingly common coresidential arrangement across socioeconomic strata. The analysis in this paper is consistent with an increase in the prevalence of cohabitation among less advantaged women in violence-ridden communities, which deserves further examination. In a context of violence-induced uncertainty, cohabitation may be used as an adaptive strategy among those who face the highest barriers to marriage. Thus, future research should carefully evaluate the way in which local violence affects the likelihood of cohabitation among young women.

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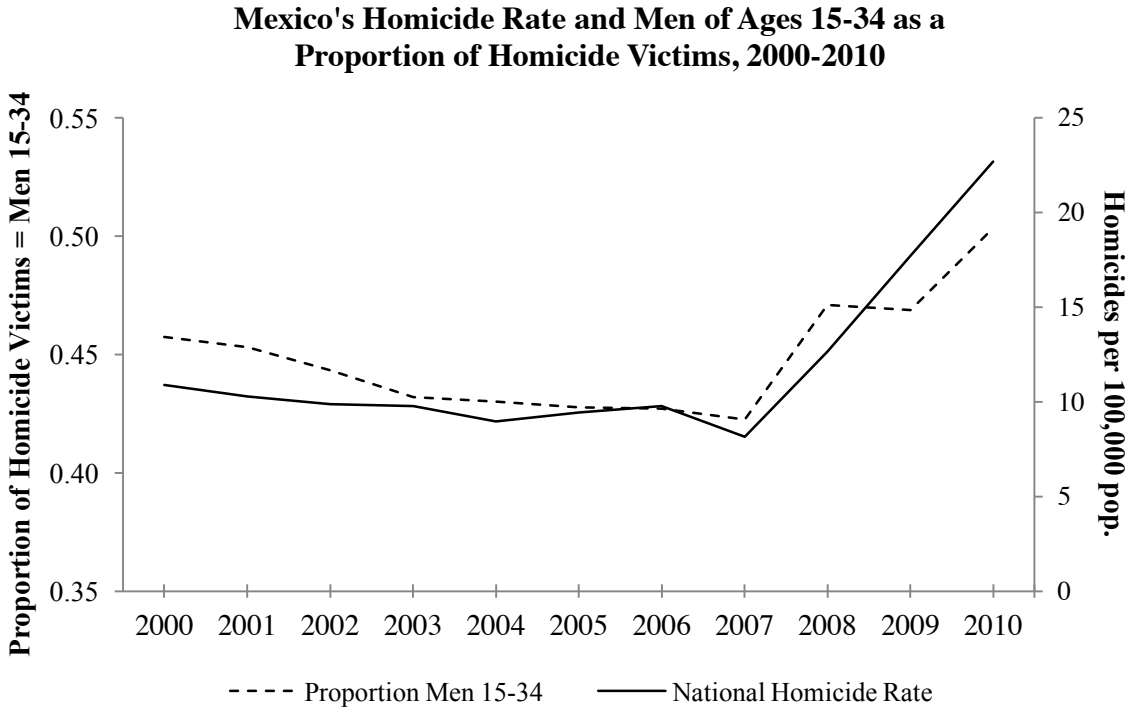
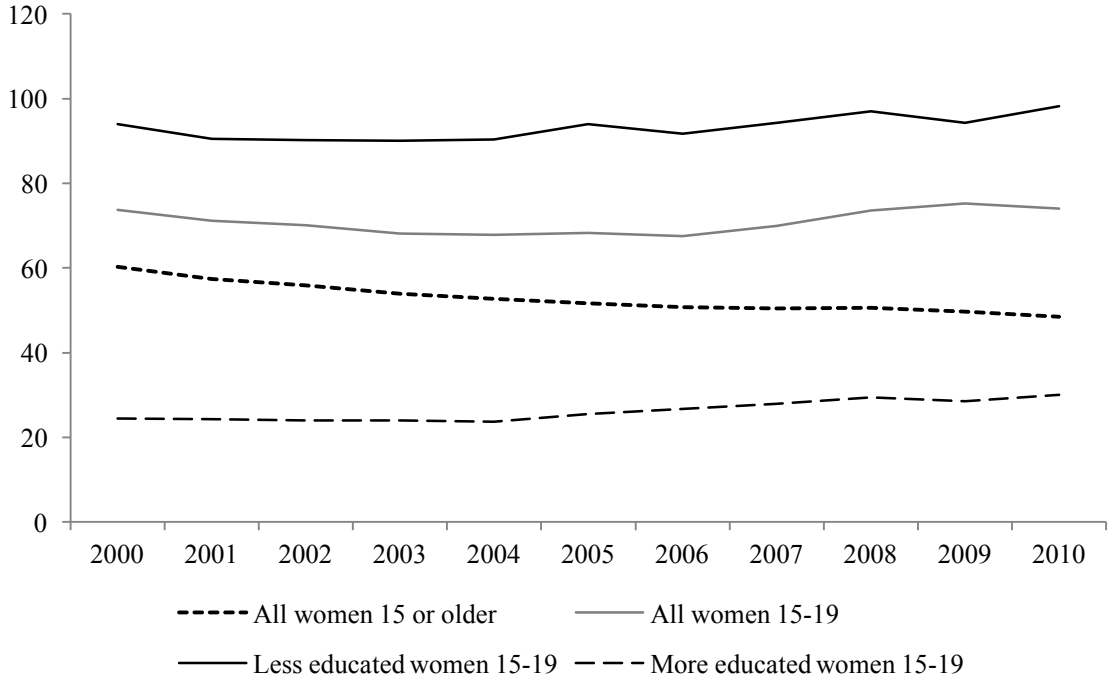
Figure 1



Source: Author's calculations with data from the National Institute of Statistics and Geography (INEGI 2014b).

Figure 2

Birth Rate per 1,000 Women by Educational Attainment, Mexico, 2000-2010



Source: Mexican Civil Registry data, as published by INEGI (2014a). Total births for each year were estimated by adding up the births that were registered within three years of the event, using the procedure detailed in Section 4. Birth rates for "all women" refer to women of age 15 or older. Teenage birth rates were constrained to women of ages 15 to 19.

Table 1. Descriptive Statistics for Mexican Municipalities in 2000 and 2010

	2000		2010	
	Mean	SD	Mean	SD
Homicide rate (per 1,000)	0.13	0.25	0.20	0.51
Less educated women				
Birth rate women 15-19 (per 1,000)	94.64	40.99	96.19	38.34
Marriage rate women 15-19 (per 1,000)	46.86	27.26	27.05	23.60
% births to married women	43.92	24.83	24.36	20.79
% births to cohabiting women	39.34	24.13	58.56	21.81
% births to unpartnered women	16.75	14.71	17.08	15.21
Employed men 15-24 per 1,000 women 15-19	1165.55	330.07	1141.38	295.18
More educated women				
Birth rate women 15-19 (per 1,000)	23.65	32.98	30.60	26.14
Marriage rate women 15-19 (per 1,000)	21.36	23.76	15.90	18.62
% births to married women	51.00	32.56	28.22	26.21
% births to cohabiting women	31.38	29.63	52.31	28.48
% births to unpartnered women	17.62	23.46	19.47	21.66
Employed men 15-24 per 1,000 women 15-19	793.41	608.11	712.33	298.32
Overall municipality				
Population	39.92	119.45	45.88	133.16
% Illiterate	18.42	12.02	14.02	9.61
% No elementary school	46.40	15.39	34.12	12.91
% No sewer system	19.47	16.57	6.80	9.05
% No electricity	10.02	12.54	4.03	6.21
% No water	18.88	20.50	14.62	17.76
% Living in overcrowded residences	56.17	13.92	44.67	12.42
% Dirt floor	31.49	25.31	12.69	11.82
% Rural	74.09	34.25	71.95	34.73
% Low wage	73.02	16.63	61.74	19.53
Unemployment	2.07	0.71	4.26	1.74
Net international migration rate	-75.32	37.77	-25.70	19.63
Net national migration rate	-14.29	41.98	-1.29	26.53
Sex ratio 10-14	1721.42	303.83	1767.53	336.24
Sex ratio 15-19	1630.11	322.06	1676.98	289.99
Sex ratio 20-24	1675.84	273.63	1761.35	284.91
Sex ratio 25-29	1722.64	242.12	1766.08	265.71
Sex ratio 30-34	1681.43	248.05	1712.05	328.81
N	2442			

Source: National Institute of Statistics and Geography (INEGI 2014b) and National Population Council (CONAPO 2015). Sex ratios and number of employed men per women are calculated according to the age structures defined in Table A-1.

Table 2. Fixed-Effects Models Estimating the Effect of Exposure to Homicide Rates on LOCAL BIRTH RATES, Women of Ages 15 to 19, Period 2000-2010

	All	Less Educated	More Educated
Homicide Rate (y-2)	0.435	2.17	0.263
Homicide Rate (y-3)	1.467+	**2.788***	-1.024
Homicide Rate (y-4)	0.334	0.824	**-2.427****
Population in thousands (y-5)	-0.000+	0.000	0.000
% Illiterate (y-5)	0.435+	0.741*	0.575**
% No elementary school (y-5)	0.603**	0.449+	-0.007
% No sewer system (y-5)	0.057*	0.056	0.001
% No electricity (y-5)	-0.019	0.022	0.023
% No water (y-5)	0.06	0.064	0.028
% Living in overcrowded residences (y-5)	-0.359*	-0.591*	0.025
% Dirt floor (y-5)	0.07	0.06	-0.170**
% Rural (y-5)	-0.051	-0.007	-0.03
% Low wage (y-5)	0.260**	0.462**	-0.074
Unemployment rate (y-5)	0.448**	0.31	0.339**
Net international migration rate (y-5)	0.078**	0.111**	-0.014
Net domestic migration rate (y-5)	0.022	-0.035	0.066**
Sex ratio 15-19 (y-5)	0.003	0.003	0.001
Sex ratio 20-24 (y-5)	-0.002	-0.004	-0.001
Sex ratio 25-29 (y-5)	-0.002	-0.001	-0.004*
Sex ratio 30-34 (y-5)	-0.002	0.001	0.003
Sex ratio 35-39 (y-5)	0.001	-0.001	-0.002
% Births with missing mother's education (y)		-1.063**	-0.296**
Constant	60.481**	91.576**	35.199**
N (municipality-years)	26832	26827	26672

+ $p<0.10$, * $p<0.05$, ** $p<0.01$. Controls not shown: Year fixed effects, and their interactions with local development.

Table 3. Fixed-Effects Models Estimating the Effect of Exposure to Homicide Rates on Number of Employed Men (Ages 15-24) per 1,000 Women (Ages 15-19), Period 2000-2010

	All	Less Educated	More Educated
Homicide Rate (y-1)	**-45.675***	**-76.722***	-26.295
Homicide Rate (y-2)	**-69.958****	**-85.119***	-77.038+
Homicide Rate (y-3)	-13.311	-37.687	6.17
Homicide Rate (y-4)	17.795	20.888	-59.462
Population in thousands (y-5)	-0.421**	-0.497**	-0.184*
% Illiterate (y-5)	-0.542	-0.619	9.909
% No elementary school (y-5)	0.095	-3.738+	0.401
% No sewer system (y-5)	0.794**	0.155	0.414
% No electricity (y-5)	0.973*	0.91	2.640+
% No water (y-5)	-0.17	0.083	-0.816
% Living in overcrowded residences (y-5)	-4.170**	-7.612**	-9.481**
% Dirt floor (y-5)	2.971**	5.172**	2.191
% Rural (y-5)	-0.408	0.177	-0.639
% Low wage (y-5)	3.212**	5.613**	-1.771
Unemployment rate (y-5)	-7.819*	9.435	-29.744**
Net international migration rate (y-5)	1.338**	2.309**	0.641**
Net domestic migration rate (y-5)	0.413*	0.136	0.545**
Sex ratio 15-19 (y-5)	0.168**	0.378**	0.366**
Sex ratio 20-24 (y-5)	-0.162**	-0.436**	-0.251**
Sex ratio 25-29 (y-5)	-0.103**	-0.137**	-0.123*
Sex ratio 30-34 (y-5)	0.009	0.066+	0.039
Sex ratio 35-39 (y-5)	-0.068**	-0.213**	0.004
Constant	1590.610**	2011.986**	1473.104**
N (municipality-years)	7325	4882	4805

+ $p<0.10$, * $p<0.05$, ** $p<0.01$. Controls not shown: Year fixed effects, and their interactions with local development.

Table 4. Fixed-Effects Models Estimating the Effect of Exposure to Homicide Rates on LOCAL MARRIAGE RATES, Women of Ages 15 to 19, Period 2000-2010

	All	Less Educated	More Educated
Homicide Rate (y-2)	0.078	-0.914	-0.524
Homicide Rate (y-3)	-0.786	**-1.854***	-0.469
Homicide Rate (y-4)	**-1.118***	**-1.628***	-0.678
Population in thousands (y-5)	0.000	0.000	0.000
% Illiterate (y-5)	0.153	0.312+	0.223
% No elementary school (y-5)	0.913**	0.667**	0.068
% No sewer system (y-5)	0.066**	0.046*	0.021
% No electricity (y-5)	-0.080*	-0.105*	0.086*
% No water (y-5)	-0.012	-0.028	0.001
% Living in overcrowded residences (y-5)	-0.065	-0.133	-0.065
% Dirt floor (y-5)	-0.114*	-0.038	-0.05
% Rural (y-5)	-0.014	0.006	-0.012
% Low wage (y-5)	0.196**	0.258**	-0.023
Unemployment rate (y-5)	-0.03	0.114	0.323**
Net international migration rate (y-5)	-0.059**	-0.040*	-0.036**
Net domestic migration rate (y-5)	0.008	-0.021	0.034**
Sex ratio 15-19 (y-5)	0.003+	0.003	0.001
Sex ratio 20-24 (y-5)	-0.001	-0.002	-0.002
Sex ratio 25-29 (y-5)	-0.001	-0.001	0.001
Sex ratio 30-34 (y-5)	-0.002	-0.003	-0.004*
Sex ratio 35-39 (y-5)	0.001	-0.001	-0.001
% Marriages with missing wife's education (y)		-0.305**	-0.162**
Constant	2.595	20.249+	23.537**
N (municipality-years)	26781	26713	26553

+ p<0.10, * p<0.05, ** p<0.01. Controls not shown: Year fixed effects, and their interactions with local development.

Table 5. Fixed-Effects Models Estimating the Effect of Exposure to Homicide Rates on Percentage of Births to Women of Different Marital Statuses, Ages 15 to 19, Period 2000-2010

	Less Educated			*More Educated*		
	Married	Cohabiting	Unpartnered	Married	Cohabiting	Unpartnered
Homicide Rate (y-2)	-0.079	-0.973	1.052	2.201+	-2.363	0.162
Homicide Rate (y-3)	**-1.465****	**2.361****	-0.896+	**2.899***	-0.041	**-2.858***
Homicide Rate (y-4)	**-1.423****	**1.996***	-0.573	-1.601	2.426	-0.825
Population in thousands (y-5)	-0.000	-0.000	0.000	-0.000	0.000	0.000
% Illiterate (y-5)	-0.055	0.290+	-0.235*	-0.044	0.211	-0.166
% No elementary school (y-5)	0.769**	-0.640**	-0.129	0.348*	-0.237	-0.110
% No sewer system (y-5)	-0.027+	-0.017	0.044**	-0.015	-0.048+	0.064**
% No electricity (y-5)	-0.053	0.019	0.034	0.040	-0.011	-0.029
% No water (y-5)	0.019	-0.052	0.033+	0.017	-0.075	0.059
% Living in overcrowded residences (y-5)	-0.076	0.219	-0.143	-0.126	0.211	-0.085
% Dirt floor (y-5)	-0.221**	0.162*	0.059	-0.159*	0.023	0.136+
% Rural (y-5)	-0.042	0.009	0.034	-0.021	-0.010	0.031
% Low wage (y-5)	-0.088+	0.132*	-0.043	0.077	-0.034	-0.043
Unemployment rate (y-5)	-0.544**	0.434**	0.110	-0.113	-0.086	0.199
Net international migration rate (y-5)	-0.093**	0.079**	0.013	-0.061**	0.035*	0.026+
Net domestic migration rate (y-5)	-0.016	0.057**	-0.041*	-0.008	0.039+	-0.031
Sex ratio 15-19 (y-5)	0.003	0.003	-0.006**	0.001	0.002	-0.003
Sex ratio 20-24 (y-5)	0.000	-0.005*	0.005**	-0.003	-0.003	0.005+
Sex ratio 25-29 (y-5)	-0.001	0.000	0.001	0.000	-0.004	0.004
Sex ratio 30-34 (y-5)	-0.004*	0.004+	-0.000	-0.007*	0.004	0.003
Sex ratio 35-39 (y-5)	0.003+	-0.003	-0.000	-0.001	-0.000	0.001
% Births with missing mother's education (y)	-0.039**	-0.142**	0.181**	-0.059**	-0.148**	0.207**
Constant	27.254**	45.061*	27.685*	63.802**	31.097	5.101
N (municipality-years)	26309	26309	26309	20507	20507	20507

+ p<0.10, * p<0.05, ** p<0.01. Controls not shown: Year fixed effects, and their interactions with local development.

Table 6. Fixed-Effects Models Estimating the Effect of Local Homicide Rates on Percentage of Low-Wage Workers, and Population Living in Overcrowded Residences, Period 2000-2010

	% Earning Low Wage	% Living in Overcrowded Residences
Homicide Rate (y-1)	**2.142***	0.05
Homicide Rate (y-2)	**3.791****	-0.263
Homicide Rate (y-3)	-0.007	**0.576***
Homicide Rate (y-4)	-0.778	0.219
Population in thousands (y-5)	0.006	-0.002
% Illiterate (y-5)	-0.025	-0.164**
% No elementary school (y-5)	0.259**	0.226**
% No sewer system (y-5)	-0.006	-0.004
% No electricity (y-5)	-0.074**	-0.038**
% No water (y-5)	0.048**	0.002
% Living in overcrowded residences (y-5)	0.356**	
% Dirt floor (y-5)	0.048	0.061**
% Rural (y-5)	-0.009	-0.007
% Low wage (y-5)		0.008
Unemployment rate (y-5)	-0.276	-0.169*
Net international migration rate (y-5)	0.413*	0.136
Net domestic migration rate (y-5)	0.168**	0.378**
Sex ratio 15-19 (y-5)	-0.003*	0.002**
Sex ratio 20-24 (y-5)	-0.005**	0.001
Sex ratio 25-29 (y-5)	0.001	0.001*
Sex ratio 30-34 (y-5)	0.003**	0.001*
Sex ratio 35-39 (y-5)	0.000	0.001**
Constant	29.201**	32.830**
N (municipality-years)	7325	7325

+ p<0.10, * p<0.05, ** p<0.01. Controls not shown: Year fixed effects, and their interactions with local development.

Table A-1. Details on Time-Varying Municipality-Level Controls

Variable name	Definition	Level of observation	Frequency of measurement
Local development index	Four categories of local development that identify quartiles of an index. The index was obtained using the first factor in a principal components analysis of the following variables, measured in the 2000 census: percentages of illiterate population; population without elementary school; employed population earning less than twice the minimum wage; inhabitants living in households without drain network, without plumbing, without electricity, with dirt floor, with overcrowding; and population living in localities with fewer than 5,000 inhabitants.	Municipality	Every 5 years, in, 2000, 2005, and 2010. Interpolated for years in between.
Population	Total population in thousands.		
% Illiterate	Percentage of population age 15 or older that are illiterate.		
% No elementary school	Percentage of population age 15 or older with no elementary school degree.		
% No sewer system	Percentage of population with no sewer system in their residences.		
% No water	Percentage of population with no connection to centralized water system in their residences.		
% No electricity	Percentage of population with no electricity in their residences.		
% Overcrowding	Percentage of population living in overcrowded residences.		
% Dirt floor	Percentage of population living in residences with dirt floor.		
% Low wage	Percentage of employed population earning less than 2 minimum wages.		
% Rural	Percentage of population living in communities of less than 5,000 population.		
Sex ratio 10-14	Men of age 15-19 per 1000 women of age 10-14.		
Sex ratio 15-19	Men of age 20-24 per 1000 women of age 15-19.		
Sex ratio 20-24	Men of age 25-29 per 1000 women of age 20-24.		
Sex ratio 25-29	Men of age 30-34 per 1000 women of age 25-29.		
Sex ratio 30-34	Men of age 35-39 per 1000 women of age 30-34.		
Net domestic migration rate	Migration is defined as number of people who out-migrate subtracted from number of people who immigrate (per 1,000 population).	State	Yearly
Net international migration rate	Migration is defined as number of people who out-migrate subtracted from number of people who immigrate (per 1,000 population).		
Unemployment rate	Percentage of economically active population without a job.		