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The effect of violent crime on the human capital accumulation of young adults☆

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ABSTRACT

This paper estimates the effect of an unprecedented increase of drug-related violence in Mexico on the educational outcomes and employment behavior of young adults. The panel nature and the timing of the Mexican Family Life Survey allows for unique gains in this literature, as we can compare pre- and post-violence outcomes of the same individual, and control for migratory response. The results suggest that young adults exposed to increased local violence attained significantly less years of education, were less likely to complete compulsory schooling, and were more likely to be employed. This change in behavior is driven by household financial hardship rather than fear, as it is unrelated to the parents' perceptions of potential victimization and is strongest for those with parents that are self-employed, the employment group most adversely economically impacted by the Mexican War on Drugs.

1. Introduction

The economic, political, and social consequences of civil wars and violent conflicts have been widely studied in the social science literature. Work in this field has been especially active given both the salience of the topic, as a large number of developing countries currently deal with violent civil conflict, and the many ways in which high levels of violence can have long-term consequences on the civilian population. One group that has been found to be particularly vulnerable to conflict exposure is children and young adults. Exposure to violence during this important developmental period may lead to educational deficits that can have long-term consequences on their future well-being, and potentially on the long run growth of the economy as a whole (Akresh and de Walque, 2011; Leon, 2012; Shemyakina, 2011). Accurately measuring the adverse effects of violence on educational attainment and employment behavior of young adults is key to fully understanding the long run and persistent economic costs of violence. This paper adds to this literature by exploring the impact of the sudden, unanticipated, and geographically heterogeneous surge in drug-related crime in Mexico during the late 2000s on schooling and labor decisions of young adults (age 14–17) with the goal of assessing the extent to which a violent environment may alter these important human capital outcomes.

The recent escalation of drug related crime in Mexico provides a unique setting to investigate the effects of violence on human capital accumulation. In the mid 2000s the Mexican government changed the focus of their battle against the powerful drug cartels, from crop eradication to actively seeking to capture cartel leadership. The new strategy bore some early success, but also resulted in an unfortunate and unanticipated consequence. As high-ranking cartels members were captured or killed, the organized crime groups fragmented, multiplied, and began fighting each other for territorial control. Thus, after almost a decade of stable rates of violent crime, homicides per capita nearly tripled within just three years (2007–2010). Moreover, this intensification of violence was not limited to a few regions or only to places that had previously been insecure, but rather spread over large portions of the country including areas that had little to no prior exposure to drug cartel related violence (Guerrero-Gutiérrez, 2011; Guerrero-Gutiérrez, 2012a; Molzahn, et al., 2012).

A novel feature of the outbreak of violence in Mexico, in the context of the economics literature on violence and educational outcomes, is that it represents a setting that is neither a civil war nor an internal armed conflict. In the Mexican case, the violent actor is not striving for territorial independence or confronting the government for political reasons. Moreover, while this is not a case of an internal armed conflict, the violence in Mexico has been so intense in the last few years that it

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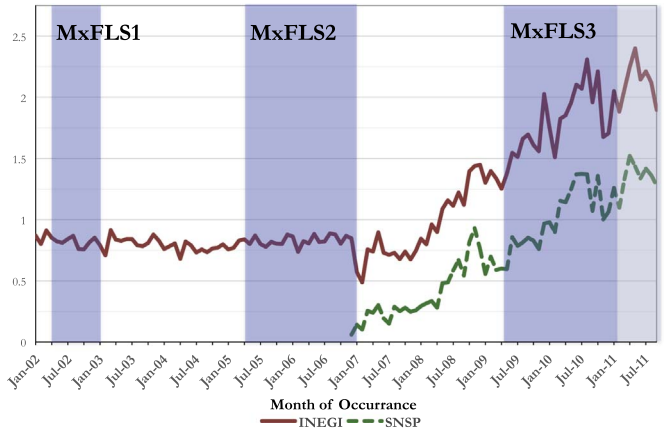

Fig. 1. INEGI and National Public Security System -Monthly Homicide Rate (per 100,000 Inhabitants).

has surpassed the levels found in war torn countries such as Afghanistan and Iraq.[1,2]

Developing analyses that can quantify the impact of violence and conflict on the educational attainment and labor market behaviors of exposed youths, though, imposes some major identification challenges including the typically non-random nature of the location of the violence and systematic behavior responses to crime. Most of the current literature that specifically examines the impact of violence on educational outcomes has relied on cross-sectional data. This type of analysis, though, is quite limited in that it has to rely on variation between localities in rates of violence, which may in fact be correlated with other unobserved or omitted factors that differ between the regions and directly affect the outcomes of interest.

By using a fortuitously timed and rich data source to examine a plausibly unanticipated and large change in a country's violence environment, this study is able to make a contribution both to the literature on the educational consequences of violence, in general, as well as, on the effects of the Mexican drug war, specifically. First, unlike any other analysis of this topic, by using longitudinal data that has information on the same individuals before and during the surge in crime we can estimate individual fixed effects models that account for unobserved time-invariant heterogeneity. Second, using panel data designed to follow migrants, we are uniquely able to directly analyze migration as a behavioral response to violence and, given the presence of selective migration, we are able to shield our estimates from its bias in our identification strategy. Third, by looking not only at schooling, but also labor market outcomes and home production of young adults we can provide a more comprehensive analysis of the potential long-term consequences of violence. Fourth, due to the rich individual and family information in our dataset, we can explore if certain sectors of the population have been more severely impacted by the recent events in Mexico, providing information on the likely channels through which the high levels of violent crime are affecting the human capital accumulation of the exposed young adults. Lastly, as mentioned previously, the Mexican setting we are examining is unique to this literature as it is not a civil war or an internal armed conflict and there is little to no infrastructure damage, rather this is an environment of violence, victimization, and fear perpetrated by local criminal actors.

The next section describes the violent crime context in Mexico in general, and its potential relationship to the educational attainment of young adults, specifically. Section 3 provides an overview of the homicide and individual data used in our analysis. Section 4 details the empirical strategy and in Section 5 we discuss its results. Finally, Section 6 addresses the remaining threats to identification and Section 7 concludes.

2. Background

The violent crime and conflict environment in Mexico has radically changed over the last few years. According to official data on homicides reported by the National Institute of Statistics and Geography (INEGI), the homicide rate in Mexico had been stable and declining from the mid 1990s until 2007, but between 2007 and 2010 the homicide rate per 100,000 people rapidly increased by almost 200%, from an annual average of 8.5 in 2007 to 24.4 in 2011 (Fig. 1 provides monthly homicide rates in Mexico from 2000 to 2011 with a solid red). Moreover, when specifically examining drug related violent crime, it becomes evident that most of the increase in the homicide rate found in the INEGI data is a consequence of a recent surge in drug-related violence in Mexico (the monthly drug-related homicide rate is shown in Fig. 1 with a green dashed line).[3]

While the magnitude of the violence has risen significantly in the last few years across Mexico, the level of the change across municipalities varies a great deal. For example, between 2005 and 2009 the range of growth rates in homicides between municipalities was as much as a 30-fold increase in one area to an 80% *decrease* in another (Fig. 2 displays maps of municipality homicide rates in Mexico in 2002, 2005, 2007, and 2009). Thus, along with the temporal variation in violence, this analysis will also be able to exploit the large degree of heterogeneity in the geographic distribution of violent crime exposure across municipalities.

Many academics and journalists have been drawn to studying this interesting case of a rapid and unexpected increase in violent crime in order to determine its impetus (Castillo et al., 2014; Dell, 2015; Guerrero-Gutiérrez, 2011; Guerrero-Gutiérrez, 2012b; Molzahn et al, 2012; Rios and Shirk, 2011; and Rios, 2013). The most widely accepted hypothesis maintains that the violence is a byproduct of the military strategy of direct confrontation against leaders of the Organized Crime Groups (OCGs) in Mexico implemented by Felipe Calderón days after his Presidential election. By focusing directly on the killing or capture of cartel leaders, Calderón's strategy led to a fragmentation of the existing OCGs, increasing their number from 6 in 2007 to 16 in 2010 (Guerrero-Gutiérrez, 2012a). With the removal of cartel leadership, violence between factions within OCGs to gain control of the cartel escalated. As the number of OCGs grew, the territory used for drug trafficking activities, and thus exposed to drug-related violence, grew substantially. Thus, many municipalities within Mexico that previously had very low levels of violent crime and no cartel presence had now become important drug trade route battlegrounds. The confrontations within cartels and with new emerging split-off OCGs not only amplified the number of homicides but also changed the nature of these crimes, as conspicuous displays of violence, such as narco-messages attached to dead corpses, began to be widely used to establish territorial control. Moreover, as the level of violence escalated and the need for additional

[1] An armed conflict is a contested incompatibility which concerns government and/or territory where the use of armed force between two parties, of which at least one is the government of a state, results in at least 25 battle-related deaths (Wallensteen and Sollenberg, 2001).

[2] Newspapers reports state that according to the most updated dataset of the National Public Security System (SNSP), between January and November of 2013 there were 31,532 homicides in the country including 16,736 labeled as "intentional" murder. In the same period there were approximately 8000 homicides in Iraq. Taking into account their different population sizes, a comparable rate of murders in Mexico would account for a total of 27,000 homicides (Mora, 2013). The levels of violence in Ciudad Juarez have been particularly high. In 2010, Ciudad Juarez was the city with the highest murder rate in the world (3622 homicides in 2010, with a homicide rate of 272 per 100,000 residents.) That accounts for a higher number of the total number of civilians' deaths in Afghanistan during the same period and more than double the number of U.S. troops killed in the entire Iraq war (Rosenberg and Cardona, 2011).

[3] Drug-related homicide data was compiled and made publicly available by the National Public Security System (SNSP) starting in 2007. However, during the administration of President Peña Nieto online access to this information was discontinued.

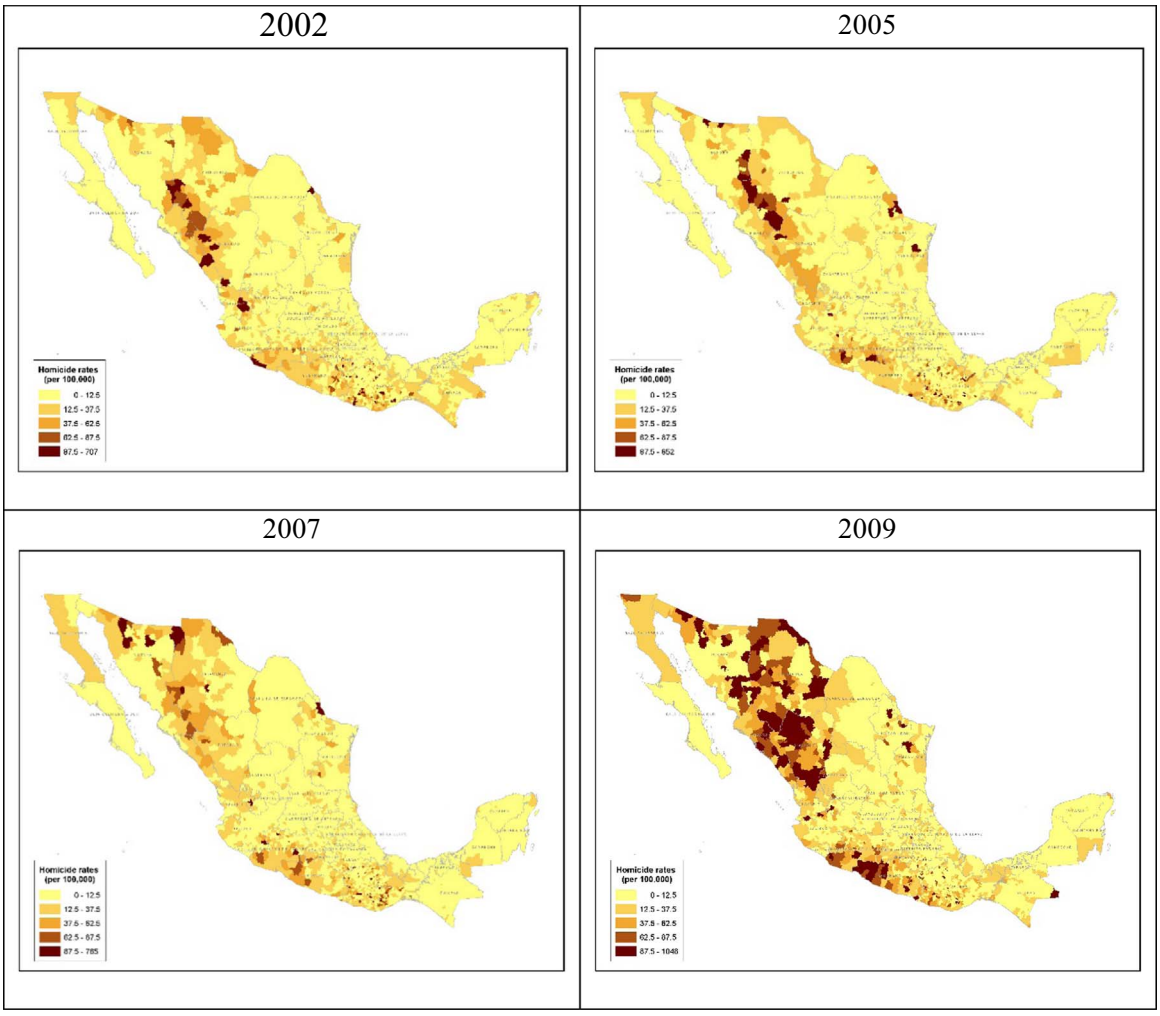

Fig. 2. Annual Homicide Rates at the municipality level (per 100,000 Inhabitants).

revenue to help in the fight for territorial control grew, non-drug related crimes such as kidnappings, extortions, assault, and car theft, also increased (Guerrero-Gutiérrez, 2012a; Rios, 2013).

The consequences of these changes in Mexico's violence environment have generated many potential pathways through which the educational and labor market outcomes of young adults may be negatively impacted. One major change in Mexico as a result of the increase in drug-related violence was a severe and swift decrease in perceived physical safety.[4] This suggests that the fear of bodily harm, kidnapping, extortion, and/or sexual assault is one mechanism that may lead families to avoid sending their children to school. Reports from a government-supported NGO, Youth: Work Mexico (International Youth Foundation), lend support to this type of mechanism. These reports explain that a common reason children in their program are not progressing in school is because, while each local area had a primary school, they did not all have secondary schools and parents were willing to forfeit the child's compulsory, higher education in order to shield them from the increased exposure to potential victimization of public transportation (Jones, 2013).[5]

Additionally, the economic consequences of the Mexican drug war may spillover into education investment decisions in the household. Several studies have explored the relationship between increased local violence in Mexico and individual economic outcomes (BenYishay and Pearlman, 2013; Robles et al., 2013; Dell, 2015; and Velásquez, 2015). In each case the analysis found that the recent violence in Mexico significantly and substantially reduced Mexican workers' labor market participation and earnings. Specifically, the self-employed (e.g. shop keepers, street vendors, personal service providers), who are particularly financially sensitive to people avoiding public thoroughfares and, due to the direct interaction needed with potential clientele, have the least ability to avoid contact with local OCG members and the "protection" or "security" service fees they demand, are the most adversely affected (Miglierini, 2011; Díaz-Cayeros et al., 2012; Velásquez, 2015). This decline in the earnings or labor market opportunities of the main household income earners, not to mention the potential death of a head of household, may induce children and particularly young adults to discontinue their education, and enter the labor market sooner than expected in order to help provide for the family.

Moreover, as household budgets are constricting due to local violence, the alternative option to school is becoming more appealing financially for some young men. Since the election of Felipe Calderón, the cartels have been confronted with both increased resistance from government authorities and more vigorous competition for territory and power from newly formed OCGs. As a response anecdotal reports suggest that cartels have increased their effort to recruit children and

[4] Panel A of Appendix Table A1 shows that Mexican citizens living in municipalities that suffered larger increases in the homicide rate between 2005 and 2009 were significantly more likely to report having a lot/some fear of an assault/attack in the day and at night, as well as, feeling less safe than 5 years ago.

[5] Alternatively, if parents believe schools provide a safer environment with better supervision and access to school does not substantially increase potential victimization, the increased fear from local violence may induce families to keep children in school longer.

young adults as "expendable foot soldiers" and that one reason over 30,000 children and young adults are estimated to have joined these organized crime groups is out of economic necessity (Booth and Fainaru, 2009; Montalvo, 2012).

A last potential set of pathways by which local violent conflict may impact schooling decisions is through supply side channels. For example, recent work by Monterio and Rocha (2015) have shown that in the context of drug violence in Brazil, schools in violent areas experienced increased teacher absenteeism, less stability in the administration, and were more likely to temporarily close. In the Mexican context though, due to the nature and combatants of the violence, there has minimal reported damage to the infrastructure necessary to provide educational services (i.e. schools, roads, public transportation services) (Márquez-Padilla et al., 2015).[6] Alternatively a supply side pathway that may be present in the Mexican case is a reduction in the quantity or quality of willing instructors.

In order to rigorously explore the relationship between local violence and the educational and labor outcomes of young adults, this paper exploits a national representative longitudinal data set that provides the relevant outcomes for the same individual observed both before and after the substantial escalation of violence in Mexico. We also utilize the rich set of information about the young adult's family characteristics and perceptions of violence to provide suggestive evidence of the most relevant channels.

3. Data

The data used in this paper is a match of the INEGI monthly homicide reports at the municipal level with the Mexican Family Life Survey (MxFLS). The INEGI data provides information on all official reports of intentional homicides. These reports are available from 1990 to 2011, which allows us to fully exploit the temporal variation in homicide rates in Mexico and the panel nature of the MxFLS.

The use of homicide rates as the measure of violence, though, is not intended to rule out the effect of other types of crime that also increased as a result of the Mexican war on drugs. Homicides are used as the measure of violence in this study as they act as the most accurate and best proxy for the crime environment in Mexico. The reason many conflict studies focus on homicides is that, given the stark nature of the crime, they are less sensitive to systematic misreporting. Moreover, the INEGI homicide data's geographic and temporal heterogeneity has been vetted and confirmed through other data sources, including newspaper reports, and the trend generated by the homicide rate matches those of other important crime groups such as extortions, kidnappings, and car thefts (Heinle et al., 2014 and Guerrero-Gutiérrez, 2011). Lastly, as mentioned previously, individuals living in Mexican municipalities in which the INEGI reported higher homicide rate increases were more likely to report feeling less safe than 5 years ago and more scared of being attacked (Appendix Table A1, Panel A).

The individual level data we will utilize comes from the MxFLS, which is a longitudinal study that is representative at the national, urban, rural, and regional level of the population living in Mexico in 2002, when the baseline was conducted. It includes information on approximately 8,440 households and 35,600 individuals from 136 municipalities and 16 states throughout Mexico.[7,8] The second wave, MxFLS2, started in 2005 and the third wave, MxFLS3, started in 2009. One of the great successes of the MxFLS has been its ability to keep quite low levels of attrition, with over 89% of the original panel respondents being re-interviewed in both MxFLS2 and MxFLS3.[9]

The MxFLS is ideally suited to investigate the impact of the increasing levels of violence in Mexico on human capital accumulation and labor market outcomes of children and young adults. One particularly valuable aspect of the MxFLS, for the purposes of this study, is the fact that the timing of the survey waves provides a useful snap shot of Mexico before and during the major rise in violence. The first follow-up was conducted between 2005 and 2006, a period of low levels of violence, and the vast majority of the second follow-up was performed from 2009 to 2010[10], during times of extremely elevated violence (Fig. 1 displays the timing of the surveys as it relates to homicide rates in Mexico). The timing of the survey, paired with its panel design, allows outcomes of the same individual during periods of low and high levels of violence to be compared, which removes all time-invariant unobserved heterogeneity at the individual level. Moreover, by using panel data, the very serious potential biases from selective and endogenous migratory patterns can be examined and accounted for in the econometric models.

Another advantage of the MxFLS is that the survey contains information on young adults not typically explored in this literature including, how they spend their non-school time, labor market participation, and non-verbal cognitive assessments (the Raven's Progressive Colored Matrices test).[11] Information about the amount of time spent on home production and other leisure activities can provide a sense of how the violence has impacted the child's daily behaviors, as this may contribute to schooling achievement and enrollment decisions. Additionally, information on employment behavior allows us to evaluate the manner in which violence exposure has changed the labor market activities of adolescents.

4. Empirical strategy

4.1. Selective migration

Drawing from a longitudinal household survey the main empirical strategy used in this paper is an individual fixed effect model. Given the intensity of the violence faced by citizens living in municipalities suffering from the recent escalation of drug violence in Mexico, it is reasonable to think that certain types of individuals/families will

[6] Further evidence for a lack of infrastructure change is provided by the fact that the change in the number of schools (primary, secondary, or high school) in a municipality between MxFLS2 and MxFLS3, as measured by the MxFLS community survey, is not negatively related to the change or level of the municipal homicide rate. These results are found in Appendix Table A2.

[7] The 16 states included in the baseline MxFLS survey are Baja California Sur, Coahuila, Distrito Federal, Durango, Guanajuato, Jalisco, México, Michoacán, Morelos, Nuevo León, Oaxaca, Puebla, Sinaloa, Sonora, Veracruz, Yucatán.

[8] While the MxFLS is a nationally representative survey of the Mexican population, it is also important to examine its geographic representativeness of the increase in violent

(*footnote continued*)
crime being studied in this paper. The average change in the homicide rate in Mexico between 2005 and 2010 nationally is 13 per 100,000, with MxFLS baseline municipalities experiencing a 14.6 per 100,000 change and non-MxFLS baseline municipalities experiencing a change of 12.8 per 100,000. We test the significance of this difference in column 1 of Appendix Table A3, as well as alternatively comparing MxFLS2 municipalities instead of MxFLS baseline municipalities (column 2). In addition we conducted the same analysis using the change in the homicide rate between 2005 and 2009 (columns 3 and 4). There is no evidence in any of the specifications that the MxFLS baseline or MxFLS2 municipalities capture a significantly different change in the violent crime environment than found at the national level. In addition, Appendix Fig. A1 from Nobles et al. (2016) provides a map of the change in the homicide rate between the pre-escalation of violence period, 2000-2007, and 2008-2009 by municipality, with MxFLS baseline municipalities outlined in gold.

[9] Even with a low attrition rate and the use of a methodology based on individual comparisons if respondents exposed to higher levels of violence were more likely to attrite from the survey this would cause our estimates to lose some external validity. In order to address this issue, among our sample of interest, we explore the relationship between the change in a respondent's level of local violence and the probability that they attrite from the survey. This analysis is found in Appendix Table A4 and provides evidence that there is no statistically significant relationship between local violence and attrition. These results imply that potential exposure to conflict was not a determining factor of attrition from the MxFLS3 sample by school age respondents.

[10] 6% interviewed between 2011 and 2012.

[11] Raven (1958), and Raven (2000) provide a background on the Raven's Progressive Matrices (SPM) test.

choose to migrate away from these dangerous areas. If the characteristics of these movers are significantly different than non-movers and are related to educational outcomes, ignoring this behavioral response would bias our results.

To estimate the relationship between migration and potential exposure to violence, we examine if young adults (14–17 years old) living in a municipality in 2005 that would experience a larger increase in violence by 2009, were more likely to migrate. In order to test for this behavioral response as rigorously as possible, the analysis also controls for various individual and household characteristics measured in MxFLS2 (maternal characteristics: education, marital status, physical wellbeing, mental health, family members in the U.S, earnings, and employment; household characteristics: rural status, household size, and household per capita expenditure; as well as the age and gender of the child), MxFLS2 state of residence fixed effects, and year and month of the MxFLS2 interview fixed effects.

$$y_{ij} = \gamma + \delta_1 \Delta HOM_j + \beta' X_i + \lambda_{YOI05} + \Upsilon_{MOI05} + \sigma_{STATE05} + u_{ij} \quad (1)$$

This specification is represented in Eq. 1, where y is an indicator equal to 1 if individual i, who lived in municipality, j, in MxFLS2 resided in a different municipality in MxFLS3. ΔHOM_j captures the change in the homicide rate between 2005 and 2009 in municipality j, X_i is a vector of maternal, household, and individual characteristics measured in MxFLS2, λ_{YOI05} are indicators for the year of interview in MxFLS2, Υ_{MOI05} are indicators for the month of interview in MxFLS2, and $\sigma_{STATE05}$ are indicators for the state of residence in MxFLS2.

Moreover, to explore the important question of whether the violence related migration was selective, analyses similar to Eq. 1 are run where we also interact the homicide measure with pre-violence individual/household characteristics. The coefficients on these variables will tell us whether particular types of individuals were more likely to migrate due to violence.

In Table 1 we present the results from estimating Eq. 1. The findings from this analysis suggest that while migration in general was not driven by violence intensity (column 1), amongst certain types of individuals, specifically those with more educated or with non-married mothers, exposure to violence made migration significantly more likely (column 2). Given these findings, and the fact that it is very difficult with any analysis to completely rule out violence-related migration based on unobserved characteristics, our identification strategy makes an effort to shield the estimates from this bias, by using an intent-to-treat approach.[12]

Specifically, exposure intensity will be assigned based on the homicide rate in the respondent's MxFLS2 municipality of residence, rather than the current municipality of residence. By fixing the respondent to their pre-violence location, any migration brought on by or correlated with changes in the violence environment will not impact their assigned exposure level. While this approach may attenuate the estimate of the impact of local violence on education outcomes, it alleviates concerns that migration behavior is driving the results.

4.2. Individual fixed-effects methodology

Omitted variable bias is ever-present in studies of the impact of crime and violence on individual outcomes. To address this concern, this study will employ a strategy of within-individual comparisons. By making comparisons within a respondent over time, time-invariant characteristics (e.g. early-life parental characteristics, resources, and environment) or preferences of the individual and their parents are controlled. Moreover, the richness of the MxFLS allows us to additionally control for many time-varying parental (education, cognitive score, marital status, physical wellbeing, mental health, family members in the U.S, earnings, and employment status for both the mother and father) and household characteristics (rural status, household size, and household per capita expenditure).[13] Standard temporal and seasonal (month of interview and year of interview) fixed effects are also included to control for any spurious relationship between the date of interview and the educational outcome, which is unrelated to violence exposure.

The individual fixed effect strategy, which uses the MxFLS2 and MxFLS3 surveys, can be generalized in the following regression

Table 1
Relationship Between Migration and Homicide Rate for Respondents 14-17 Years Old in MxFLS3.

Dependent variable is a dummy equal to 1 if respondent was interviewed in a different municipality between MxFLS2 and MxFLS3		
	(1)	**(2)**
Δ in Municipal Homicide Rate between 2009 & 2005	0.012%	-0.216%
	(0.015)	(0.973)
Δ Homicide Rate between 2009 & 2005 interacted with MxFLS2 characteristics:		
Mother's Mental Health Score		0.000%
		(0.001)
Mother's Years of Education		0.011%*
		(0.006)
Household Per Capita Expenditure		0.000%
		(0.000)
Household Size		-0.004%
		(0.005)
Mother is Employed		-0.001%
		(0.034)
Mother Self-Employed		0.047%
		(0.049)
Mother is Married		-0.093%**
		(0.045)
Mother is Obese (BMI > 30)		0.014%
		(0.028)
Mother in Bad Health (Self-Reported)		0.002%
		(0.053)
Mother has Relative Living in U.S.		0.005%
		(0.015)
Mother Lives in Rural Locality		0.061%
		(0.043)
Respondent is Female		-0.016%
		(0.023)
Age of Respondent		0.037%
		(0.169)
Age of Respondent Squared		-0.002%
		(0.007)
Observations	2425	2425
Mean of Dependent Variable	3.3%	3.3%

Notes: Standard errors clustered at the MxFLS2 municipality of residence level in parentheses.
All regressions also include maternal, household, and individual characteristics, state fixed effects, and date of interview fixed effects.
***p < 0.01.
**p < 0.05.
*p < 0.1.

[12] Even if this analysis had not revealed endogenous migration, it would still be difficult to rule out that this type of behavior exists. For example, even if violent crime intensity did not change the decision to migrate, it is possible it changed the destination choice. If this was the case and migration location decisions were related to unobserved characteristics, it would lead to endogenous violence intensity exposure that could bias an analysis that did not use an "intent-to-treat" approach.

[13] Since MxFLS3 parental and household characteristics may be affected by violence exposure, these background trends are assigned based on values in the previous wave. Thus, an observation in MxFLS3 is assigned the household and parent characteristics as measured in MxFLS2 and an observation in the MxFLS2 is assigned the household and parent characteristics as measured in MxFLS1. This technique is used to ensure we control for household characteristic trends without including endogenously determined explanatory variables to the regression. The dummy variable adjustment method was used for missing values and the results are not sensitive to alternatively using case-wise deletion or removing the variable from the model.

framework:

$$y_{ijt} = \gamma + \pi_1 (homrate)_{jt} + \theta_i + \kappa_{YOIt} + \lambda_{MOIt} + \beta' X_{it} + u_{ijt} \quad (2)$$

Where y is the outcome of individual i, living in municipality j in MxFLS2, at time t. The measure of violence is captured in the variable $(homrate)_{jt}$ which is the quartic root of the homicide rate per 100,000 people in municipality, j; θ_i is an individual fixed effects, κ_{YOIt} are indicators of the year of interview, λ_{MOIt} are indicators of the month of interview, and X_{it} is a vector of time varying parental/household characteristics.[14] With this specification, π_1 is our coefficient of interest.

Eq. 2 will be used to analyze both sticky (years of educational attainment, employment behavior, home production, and leisure activities), as well as, more flexible (school attendance and cognitive scores) outcomes. Given the more fixed nature of attained years of education and employment, when examining these outcomes the homicide measure, $(homrate)_{jt}$, will represent the quartic root of the homicide rate over the 12 months prior to interview, while a more proximate violence measure, the quartic root of the homicide rate in the month prior to interview will be used for the more transitory outcomes.

In these analyses we focus on young adults age 14–17 at the time of their MxFLS3 interview. The impact on educational attainment for this group is particularly important in Mexico, as these are the individuals that are just approaching or just exiting the compulsory school phase of their education. In Mexico, students are required to complete schooling through the ninth grade (a grade level usually reached at the age of 14 to15). This is thus the age level at which there is the most freedom to change educational attainment choices and thus the age at highest risk of either having an adverse reaction to violence exposure or experiencing the largest change in the opportunity cost of attending school.

While Eq. 2 forms the base model used in the analysis, in order to investigate the heterogeneity and mechanisms of the impact of local violence on human capital accumulation, specifications of Eq. 2 that add an interaction between certain respondent characteristics and the homicide rate will also be examined.[15]

For example, young adult men and young adult women are likely to experience differential effects of violence on their educational and labor outcomes. One reason there is likely to be gender heterogeneity is that each sex has experienced different amounts and types of victimization during this recent escalation of violence. While men have been much more likely to have been killed over this time period, the violence against women has been much more personal. For instance, for men the most likely instrument of their homicide is a firearm, while for women suffocation and stabbing are the most common ways for them to be slain (United, Nations, 2011). Moreover, sexual violence is much more likely to be against women and the recent escalation of violence in Mexico has triggered unprecedented levels of this type of crime in Mexico (Pantaleo, 2010).

As well as differences in the type and likelihood of victimization they face, the financial opportunities that result from increased cartel violence vary by gender as well. As mentioned previously, multiple studies have shown that the recent outbreak of violence due to the Mexican Drug War has adversely impacted employment and earnings outcomes (BenYishay and Pearlman, 2013; Robles et al., 2013; Dell, 2015; Velásquez, 2015). Since in Mexico, young adult males are more likely to take on the economic burden of the family, a loss in household income may spur young men to leave school and enter the labor force. Moreover, the opportunity cost of school has also been differentially impacted as the change in the violence environment in Mexico has increased the demand for gang members/cartel soldiers, who are typically young men.

An additional reason to explore the heterogeneity of the effect of violence on the education and labor market outcomes of young adults is it can provide insight into the mechanism driving the relationship. In the case of Mexico, the two main factors that would cause increased violence to impact schooling and employment behavior are fear of victimization and financial need/opportunity.[16] To explore these two competing forces we examine if the adverse impact on schooling behavior is exaggerated for young adults facing increased household financial pressure and/or increased household fear of victimization.

Specifically, Velásquez (2015) provides evidence that self-employed men and women experienced the largest negative economic impact from exposure to local violence. Moreover, while these families are suffering the most financially from local violence, they are not reporting differential levels of fear.[17,18] Thus, since families with self-employed breadwinners are facing the largest reductions in resources, if economic factors are what is driving the relationship between violence and educational outcomes, it is likely young adults in these households are the most at risk of leaving school to enter the labor force. This will be explored using a version of Eq. 2, which includes the homicide rate interacted with an indicator for whether the young adult has a parent that was self-employed in MxFLS2.[19]

In order to explore whether concerns about safety are having an impact on the educational and employment outcomes of the young adults, we will investigate whether the human capital accumulation of individuals from families in which a parent expresses heightened fear of victimization is more sensitive to increased local violence. Specifically, we will perform two versions of Eq. 2, which either includes the homicide rate interacted with an indicator for whether the young adult has a parent that reports some/lots of fear of victimization during the day in MxFLS3 or the homicide rate interacted with an indicator for whether the young adult has a parent that reports some/lots of fear of victimization during the night in MxFLS3.

Lastly, we examine if the mechanism driving the relationship is related to supply side channels such as a reduction in the number or quality of willing instructors. To do this we look at the relationship between local violence and the educational outcomes of younger respondents (10-13), who should be impacted by supply side changes to education resources but are unlikely to be pulled from school as income generators for the family or because they are attracting interest from cartel recruiters.

4.3. Difference-in-differences/triple difference methodology

An additional marker of educational achievement for young adults in Mexico is the completion of primary schooling, which corresponds to *primaria* (grades 1-6) and *secundaria* (grades 7-9). While finishing primary schooling is compulsory, only around 70% of Mexicans aged 20-30 years old in MxFLS3 had completed ninth grade. Moreover, graduating from ninth grade is associated with a larger boost in average monthly earning (over 1000 pesos) in MxFLS3 for 20 to 30 year olds.

[14] Quartic root of the homicide rate is used to proxy for the log transformation, in order to avoid dropping observations from municipalities that have a homicide rate equal to zero. The quartic root behaves similarly to a logarithmic transformation for positive numbers (Ashraf et al., 2015, Tarozzi et al., 2014, Thomas et al., 2006 and Tukey, 1957).

[15] Interacted models also include interacted controls for year of interview FEs, month of interview FEs, and parental characteristic trends.

[16] As mentioned previously, Mexico has not suffered significant infrastructure damage, which rules out this mechanism as the driver of the relationship between violence and the educational and employment outcomes of young adults. In addition, research has shown that the violence has not adversely changed the student-teacher ratio or the quality, as measured by their level of education, of the teachers in Mexico (Romano, 2015).

[17] These results are found in Appendix Table A1, Panel B.

[18] Looking specifically at the economic outcomes of the parents of our sample of interest, respondents aged 14-17 in MxFLS3, we find results in line with Velásquez (2015). The analysis, in Appendix Table A5, provides suggestive evidence (p-value=.16) that parents exposed to more municipal violence have lower earnings and the effect is most pronounced for the self-employed (p-value=.08).

[19] MxFLS2 employment status of the parents is used in order to avoid bias from endogenous occupation type changes that may result from exposure to violence.

This suggests that passing the compulsory schooling bar may be an important determinant of economic success in Mexico. As such, we analyze whether students in the cohorts most likely to have their compulsory graduation affected by violence, were less likely to pass ninth grade if they were exposed to higher levels of conflict. Since this important decision is typically made during the ages of 14 to 15, we look at the sample aged 15 to 16 at interview, because for these cohorts the violence they faced in the year prior to the interview is most salient to the compulsory schooling completion choice.

Since the entire sample of interest for this analysis (15–16 year olds in MxFLS3) had not passed compulsory school in MxFLS2 there will be no variation in our dependent variable in the first period in an individual fixed effects model, and thus this identification strategy will not be appropriate for this particular analysis. In order to test the effect of violence on compulsory school graduation we conduct two additional analyses. First, we estimate a simple difference in differences model, where we compare our at risk cohort (15–16 year olds) with an older cohort that is similar in age but whose compulsory schooling decision should be mostly unaffected by the previous year's violence exposure (18–19 year olds).

The difference in differences strategy, which utilizes the MxFLS3 survey, can be generalized in the following regression framework:

$$c_{ijt} = \gamma + \pi_1 (homrate\ last\ 12\ months)_{jt} + \pi_2 (homrate\ last\ 12\ months)_{jt} *I(Age\ 15-16)_i + \lambda_a + \kappa_{YOI} + \lambda_{MOI} + \beta' X_i + u_{ijt} \quad (3)$$

Where c is an indicator equal to 1 if individual i, living in municipality j in MxFLS2, had graduated from compulsory schooling at the time of the MxFLS3 interview, t. The measure of violence, $(homrate\ last 12 months)_{jt}$, is the quartic root of the homicide rate per 100,000 people over the 12 months prior to interview in municipality, j and to identify the difference in difference effect we add the interaction between the measure of violence and an indicator for being in our at risk cohort (aged of 15 and 16). Additionally we control for age fixed effects, λ_a,indicators for the year of interview, κ_{YOI}, indicators for the month of interview, λ_{MOI}, and a vector of pre-violence (MxFLS2) parental and household characteristics, X_i. Using this specification, π_2 is our coefficient of interest.

One potential concern with this difference in difference strategy is that levels of compulsory school graduation between cohorts in municipalities that experience higher or lower levels of violence may be on different trends. This parallel trends assumption can easily be tested by simply re-estimating Eq. 3, utilizing only cohorts whose compulsory schooling decision should be unaffected by violence, (e.g. 18–19 year olds versus 21–22 year olds). This falsification test is conducted and reported in Section 6.

A second potential concern with this strategy is that it is possible that a different educational gap between the affected (15–16 year olds) and unaffected (18–19 year olds) cohorts in high violence versus low violence areas already existed before the surge in violence. If this is the case, the simple difference-in-differences estimator will incorrectly treat this difference as the effect of violence. We can address this by adding into our analysis information from the previous wave of the MxFLS survey. By including respondents that were 15–16 year olds and 18–19 years olds in MxFLS2, but assigning them the exposure level from the period of increased violence (i.e. in MxFLS3) they serve as a proxy for the educational gap that naturally exists between these cohorts in high violence versus low violence areas. This analysis is conducted using the following triple difference specification:

$$c_{ijt} = \gamma + \pi_1 (homrate\ last\ 12\ months)_{jt} + \pi_2 I(MxFLS3)_i + \pi_3 (homrate\ last\ 12\ months)_{jt} *I(Age\ 15-16)_i + \pi_4 I(homrate\ last\ 12\ months)_{jt} *I(MxFLS3)_i + \pi_5 I(MxFLS3)_i *I(Age\ 15-16)_i + \pi_6 I(homrate\ last\ 12\ months)_{jt} *I(MxFLS3)_i *I(Age\ 15-16)_i + \lambda_a + \kappa_{YOI} + \kappa_{MOI} + \beta' X_i + u_{ijt} \quad (4)$$

Table 2
Impact of Homicide Rates on Achieved Education for Respondents 14-17 Years Old in MxFLS3.

Individual Fixed Effects comparing same individual in MxFLS2 and MxFLS3					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
$^4\sqrt{}$Homicide Rate Over the 12 Months Prior to Interview	-0.054	0.061	0.069	-0.069	-0.101
	[0.061]	[0.070]	[0.070]	[0.084]	[0.097]
$^4\sqrt{}$Homicide Rate Over the 12 Months Prior to Interview*I(Male=1)		-0.209**			
		[0.087]			
$^4\sqrt{}$Homicide Rate Over the 12 Months Prior to Interview*I(Self-Employed Parent in MxFLS2=1)			-0.282***		
			[0.104]		
$^4\sqrt{}$Homicide Rate Over the 12 Months Prior to Interview*I(Parent Reports Some/Lots of Fear During the Day in MxFLS3=1)				0.113	
				[0.102]	
$^4\sqrt{}$Homicide Rate Over the 12 Months Prior to Interview*I(Parent Reports Some/Lots of Fear at Night in MxFLS3=1)					0.200*
					[0.114]
P-value for F-Test (Homicide Rate+Homicide Rate Interaction=0):		0.08	0.02	0.68	0.21
Observations	5666	5666	4338	3784	3842
Number of Individuals	2833	2833	2169	1892	1921

Notes: Standard errors clustered at the MxFLS2 municipality of residence level in brackets.
All regressions utilize individual fixed effects (FEs) and control for year of interview FEs, month of interview FEs, and parental characteristic trends.
Interacted models include interacted controls for year of interview FEs, month of interview FEs, and parental characteristic trends.
***p < 0.01.
**p < 0.05.
*p < 0.1.

Where the interpretation of the notation from Eq. (3) still applies and $I(MxFLS3)_i$ represents an indicator for being an observation from the MxFLS3 survey. In this equation all observations are assigned the average homicide rate from the 12 months prior to their MxFLS3 interview. Thus, for the MxFLS2 observations, they did not actually experience that level of violence when they made their schooling decisions. Using this triple difference model, π_6 is the estimate of interest.

5. Results

5.1. Years of attained education

Table 2 provides results for the individual fixed effect model from Eq. 2, as well, as extended versions that explore the heterogeneity of the effect by adding an interacted homicide rate term using attained years of schooling as the outcome variable. The estimates in Table 2 show us that while there is no evidence of an increase in the local homicide rate leading to a reduction in years of schooling for young adults in general (column 1), elevated levels of the local homicide rate did have a significant negative effect on the years of schooling attained for young adult males (column 2). Specifically, the result suggests that a young male living in a municipality that had no violence exposure at the time of the MxFLS2 survey (20% of MxFLS2 municipalities) and then experienced the average annual homicide rate rise between 2005 and 2009 amongst those municipalities (approximately 15 in 100,000)

would have attained around 0.3 fewer years of schooling or 3.5% less than the sample's average in MxFLS3.[20] To give perspective to the magnitude of this negative finding from the development economics literature on education, Duflo (2011) examination of a large-scale school construction project in Indonesia finds 1 extra primary school per 1000 children leads to a .12 to .19 increase in years of attained education.[21] For young women though, the results in Table 2 suggest there was no change in schooling attainment for those more exposed to increased homicides.

When exploring heterogeneity that may provide information about the mechanism driving the adverse relationship between local violence and educational attainment we find that it is those young adults with parents that are self-employed, the employment group that has experienced the largest decline in their labor market outcomes, that are most adversely impacted (column 3). Young adults with a self-employed parent are significantly more likely to reduce their years of attained schooling when exposed to higher levels of violence (using the same example as above we would expect to find an effect of 0.42 fewer years of schooling attainment for children with self-employed parents).

In addition, the results from Table 2 suggest that parental fear is not leading to reductions in education attainment. The estimates in column 4 and 5 indicate that young adults with parents that expressed more fear of potential victimization did not change their educational attainment in any significant way. In fact, while not statistically significant, if anything, it appears that fearful parents may have seen school as a safe haven and were more likely to keep their kids in school longer.

Lastly, to address the potential for supply side mechanisms we explore the relationship between the municipal homicide rate and educational progress of younger respondents (10-13 years old in MxFLS3). If supply side channels are a factor in the adverse impact of local violence on educational attainment, this younger group should also be negatively affected. In addition this younger group is less attractive to OCG recruiters and, due to lower earnings potential, they should not be as susceptible to the demands of providing income for the family. The estimates of analysis focused on these younger cohorts are found in Appendix Table A6 and provide no support for potential supply side mechanisms that would impact school age children broadly. Taking these results together, the estimates suggest that the adverse relationship between education and violence in Mexico is related to financial factors rather than increased fear or a reduction in the quality or quantity of educational resources available.

5.2. Completion of compulsory schooling

As mentioned previously, it may be that achieving a certain educational milestone is a more important factor for later life economic success in Mexico than total years of education attained. To get an idea of the impact of the Mexican drug war on this type of outcome, Table 3, column 1 provides the results of the difference in differences (D-i-D) model from Eq. 3 for compulsory level educational attainment. The estimate on the non-interacted homicide rate suggests that the average rate of compulsory school graduation was actually higher in areas more exposed to violence, and thus it is essential to remove this initial difference to get the true impact of the rise in violence on finishing 9th grade. The estimate on the homicide rate interacted with the indicator for being in the at-risk cohort provides evidence that the likelihood of compulsory school graduation is significantly and strongly negatively impacted by increased exposure to violence. This result predicts that an individual in the at-risk cohorts living in a municipality with no exposure to violence at the time of the MxFLS2 survey, which subsequently experience the average increase in the annual homicide rate (15 in 100,000), was 8 percentage points less likely to graduate from 9th grade. As seen in the years of education results, this effect is related to the behavioral change of young men and not young women. While young women's likelihood of finishing compulsory schooling was unaffected by increased local violence (column 3), young men significantly decreased their completion of primary school, with the average increase in the annual homicide rate (15 in 100,000) causing a 12 percentage point decrease in the male 9th grade graduation rate (column 2).

It is possible though that the result in columns 1-3 in Table 3 are driven by naturally occurring differences in the educational gap between our at-risk and older cohort in high violence versus low violence areas. To adjust for this potential bias, columns 4–6 of Table 3 presents the estimates from the triple difference model detailed in Eq. 4. These results suggest that, if anything, the pre-existing differences in the educational cohort gaps that existed before the rise in violence of the Mexican drug war for places that would later suffer more versus less escalation of conflict were biasing the simple D-i-D towards 0. If we evaluate the negative and statistically significant triple difference result, it suggests that a 15–16 year old individual living in a municipality with no exposure to violence at the time of the MxFLS2 survey, which subsequently experience the average increase in the annual homicide rate (15 in 100,000), was 15 percentage points less likely to graduate from 9th grade. Columns 5 and 6 further support the finding that it is young men's education that is being cut short due to increased violence.[22]

5.3. Attendance

A more sensitive measure of educational behavior than years of attained education or completion of a certain level of education is whether the individual is currently attending school. Table 4 provides the results of the individual fixed effects strategy on the outcome of currently attending school. These results support the notion that increasing levels of violence in Mexico is significantly hindering males' educational outcomes. Specifically, the results suggest that a young adult male living in a municipality that had no homicides in the month prior to his MxFLS2 interview that subsequently experienced a marginal increase of 1 in 100,000 homicides per person in the month prior to his MxFLS3 interview is 4.5 percentage points less likely to currently be attending school.

5.4. Cognitive scores

In order to delve deeper into the impact of violence on the lives of these young adults, we also looked at the effects of violence on a measure of cognitive ability contained in the MxFLS, the Raven's Progressive Colored Matrices score. Work by Patrick Sharkey has shown that children in Chicago exposed to recent violence near their home perform significantly worse than unexposed children on cognitive assessment tests (Sharkey, 2010). Sharkey's posits that it is the anxiety of the violent events, which triggers acute stress disorder, and leads to poor performance on cognitive tests. Table 5 provides our

[20] This is calculated as (0.061−0.209)*(15^1/4)=−0.29. Similar examples in the rest of the paper are calculated using this method.

[21] This magnitude is also in line with previous research on the effect of civil conflict or genocide on educational attainment as Leon (2012) finds exposure to the Peruvian civil war reduced educational attainment by 0.31 years and Akresh and de Walque (2011) indicate the 1994 Rwandan genocide caused an average decline of 0.5 years on children's schooling outcomes.

[22] In Appendix Table A7 we explore the heterogeneity of the male graduation effect by looking at four subsamples of young men: at least one self-employed parent, both parents are self-employed, at least one parent that fears victimization at night, and both parents are fearful of victimization at night. While imprecisely estimated due to a small sample size, these results provide suggestive evidence that it is those young males that come from the families in which both parents are self-employed (column 2), and thus most adversely financially affected by violence, that are most likely to drop out of school before completing their compulsory education.

Table 3
Impact of Homicide Rates on Completing Compulsory Education.

Comparison of 15-16 Year Olds and 18-19 Year Olds						
	Using MxFLS3 Survey Data			Using MxFLS2 and MxFLS3 Survey Data		
	All	Males	Females	All	Males	Females
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
$^4\sqrt{}$Homicide Rate Over the 12 Months Prior to the MxFLS3 Interview	0.034**	0.038	0.024	-0.002	-0.003	0.000
	[0.016]	[0.024]	[0.022]	[0.019]	[0.027]	[0.023]
$^4\sqrt{}$Homicide Rate Interacted with the 15-16 Age Group	-0.041**	-0.059**	-0.019	0.037	0.049	0.024
	[0.016]	[0.025]	[0.022]	[0.024]	[0.032]	[0.039]
$^4\sqrt{}$Homicide Rate Interacted with MxFLS3 Survey Wave Indicator				0.033*	0.044	0.022
				[0.019]	[0.029]	[0.027]
$^4\sqrt{}$Homicide Rate Interacted with the 15-16 Age Group and MxFLS3 Survey Wave Indicator				-0.076***	-0.109***	-0.039
				[0.026]	[0.041]	[0.044]
Observations	2921	1439	1482	5721	2780	2941

Notes: Standard errors clustered at the MxFLS2 municipality of residence level in brackets.
All regressions control for year of interview fixed effects(FEs), month of interview FEs, Age FEs, and parental characteristics in MxFLS2.
Columns 4-6 also include indicators for being an MxFLS3 observation and for being both in the 15-16 age group and in the MxFLS3 survey wave.
***p < 0.01.
**p < 0.05.
*p < 0.1.

Table 4
Impact of Homicide Rates on Attending School for Respondents 14-17 Years Old in MxFLS3.

Individual Fixed Effects comparing same individual in MxFLS2 and MxFLS3					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
4√Homicide Rate the Month Prior to Interview					
	-0.025	-0.003	-0.030	-0.008	-0.024
	[0.022]	[0.024]	[0.023]	[0.023]	[0.023]
$^4\sqrt{}$Homicide Rate the Month Prior to Interview*I(Male=1)					
		-0.042*			
		[0.024]			
$^4\sqrt{}$Homicide Rate the Month Prior to Interview*I(Self-Employed Parent in MxFLS2=1)					
			0.028		
			[0.029]		
$^4\sqrt{}$Homicide Rate the Month Prior to Interview*I(Parent Reports Some/Lots of Fear During the Day in MxFLS3=1)					
				-0.033	
				[0.031]	
$^4\sqrt{}$Homicide Rate the Month Prior to Interview*I(Parent Reports Some/Lots of Fear at Night in MxFLS3=1)					
					0.038
					[0.031]
P-value for F-Test (Homicide Rate+Homicide Rate Interaction=0):		0.08	0.94	0.24	0.63
Observations	4838	4838	3840	3436	3464
Number of Individuals	2419	2419	1920	1718	1732

Notes: Standard errors clustered at the MxFLS2 municipality of residence level in brackets. ***p < 0.01, **p < 0.05.
All regressions utilize individual fixed effects (FEs) and control for year of interview FEs, month of interview FEs, and parental characteristic trends.
Interacted models include interacted controls for year of interview FEs, month of interview FEs, and parental characteristic trends.

Table 5
Impact of Homicide Rates on Raven's Matrices Test Score for Respondents 14-17 Years Old in MxFLS3.

Individual Fixed Effects comparing same individual in MxFLS2 and MxFLS3					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
$^4\sqrt{}$Homicide Rate the Month Prior to Interview					
	0.022	0.011	0.026	0.035	0.021
	[0.037]	[0.050]	[0.048]	[0.047]	[0.054]
$^4\sqrt{}$Homicide Rate the Month Prior to Interview*I(Male=1)					
		0.030			
		[0.070]			
$^4\sqrt{}$Homicide Rate the Month Prior to Interview*I(Self-Employed Parent in MxFLS2=1)					
			-0.084		
			[0.076]		
$^4\sqrt{}$Homicide Rate the Month Prior to Interview*I(Parent Reports Some/Lots of Fear During the Day in MxFLS3=1)					
				-0.015	
				[0.103]	
$^4\sqrt{}$Homicide Rate the Month Prior to Interview*I(Parent Reports Some/Lots of Fear at Night in MxFLS3=1)					
					0.046
					[0.089]
P-value for F-Test (Homicide Rate+Homicide Rate Interaction=0):		0.45	0.35	0.82	0.34
Observations	4682	4682	3728	3350	3378
Number of Individuals	2341	2341	1864	1675	1689

Notes: Standard errors clustered at the MxFLS2 municipality of residence level in brackets.
All regressions utilize individual fixed effects (FEs) and control for year of interview FEs, month of interview FEs, and parental characteristic trends.
Interacted models include interacted controls for year of interview FEs, month of interview FEs, and parental characteristic trends.
***p < 0.01.
**p < 0.05.
*p < 0.1.

Table 6
Impact of Homicide Rates on Employment for Respondents 14-17 Years Old in MxFLS3.

Individual Fixed Effects comparing same individual in MxFLS2 and MxFLS3					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
$^4\sqrt{}$Homicide Rate Over the 12 Months Prior to Interview	0.028	-0.009	0.004	0.041	0.038
	[0.019]	[0.015]	[0.024]	[0.026]	[0.025]
$^4\sqrt{}$Homicide Rate Over the 12 Months Prior to Interview*I(Male=1)		0.070**			
		[0.027]			
$^4\sqrt{}$Homicide Rate Over the 12 Months Prior to Interview*I(Self-Employed Parent in MxFLS2=1)			0.070**		
			[0.034]		
$^4\sqrt{}$Homicide Rate Over the 12 Months Prior to Interview*I(Parent Reports Some/Lots of Fear During the Day in MxFLS3=1)				-0.009	
				[0.044]	
$^4\sqrt{}$Homicide Rate Over the 12 Months Prior to Interview*I(Parent Reports Some/Lots of Fear at Night in MxFLS3=1)					-0.009
					[0.033]
P-value for F-Test (Homicide Rate+Homicide Rate Interaction=0):	0.04	0.01	0.26	0.23	
Observations	5,212	5,212	4,106	3,618	3,662
Number of Individuals	2,606	2,606	2,053	1,809	1,831

Notes: Standard errors clustered at the MxFLS2 municipality of residence level in brackets.
All regressions utilize individual fixed effects (FEs) and control for year of interview FEs, month of interview FEs, and parental characteristic trends.
Interacted models include interacted controls for year of interview FEs, month of interview FEs, and parental characteristic trends.
***p < 0.01.
**p < 0.05.
*p < 0.1.

analysis of this issue with respect to the drug violence in Mexico and Raven's scores. We find no evidence of an effect of exposure to local violence on this measure of cognitive ability. The non-results are not completely unexpected given that Sharkey's finds that the adverse impact on performance is strongest if the assessment is within a week after the violent event. This suggests that our measure of exposure (homicide rate over the last month) may not be precise enough to pick up this effect even if it is present.

5.5. Employment

The adverse relationship found between local violence and the educational outcomes of young adults, suggests that these adolescents might be substituting time in school with increased participation in some other non-school activities. Specifically, since the mechanism driving this relationship seems to be financial in nature, we would expect the young adults in our sample whose schooling choices were most reactive to an elevated homicide rate (males and children of the self-employed) will significantly increase their participation in the labor market.

Table 6 displays the results of analyzing the impact of local homicides on the labor market participation of young adults. As seen in columns 2 and 3, similar to the results from the education analysis, it is the male respondents and young adults with self-employed parents whose behavior is most sensitive to increased conflict. Specifically, we find that almost half of the young men in our sample that our now in the labor market have either taken jobs in construction (17%) or agriculture (30%). The engagement in farm activities is also apparent in Appendix Table B1, which shows that young males exposed to violence are significantly increasing their time spent on agricultural endeavors. These findings reinforce the idea that the mechanism through which violence is acting on schooling attainment is the pull to join the labor force at earlier ages.[23]

6. Threats to identification

The major threat to our empirical strategy providing causal identification is that some other unobserved municipality level trend is correlated with local homicide rates and it is the influence of this factor that is being picked up in our estimates rather than the impact of violence.

In order to explore if the effect being estimated in the main analysis is biased by unobserved linear trends correlated with the location of the violence and the outcomes of young adults we examine whether current levels of violence are related to the pre-Mexican drug war outcomes of young adults. Specifically, we estimate the same model from Eq. 2, but using observations from the 2005 (MxFLS2) and 2002 (MxFLS1) surveys for individuals that were 14–17 years old in MxFLS2, while assigning the levels of municipality violence from MxFLS2 and MxFLS3 to these observations, respectively. If it is the case that the change in the homicide rate in Mexican municipalities was not a result of underlying linear economic or educational trends, no adverse effects should be observed for the measure of violence in this specification, as future homicide rate changes between MxFLS2 and MxFLS3 should not predict poorer educational behavior for young adults between 2002 and 2005. Conducting these placebo analyses (Appendix Tables C1-C4) on years of schooling, attendance, Raven's score, and employment behavior neither the general effect nor the total impact on specific subgroups is ever both in the same direction as in the main set of tables and statistically significant.[24] In Appendix Table C1, which represents the placebo tests on educational attainment, the sign on the impact of current violence on past schooling outcomes is negative for young men and children of self-employed parents. These negative estimates though are not approaching statistical significance (p-value of .33 and .70 respectively) and are between 40-85% smaller than the related estimate in Table 2.[25]

With regard to our difference in differences and triple difference models, we can use a commonly employed falsification test, where instead of comparing our group at risk of not graduating compulsory education due to recent violence exposure (15–16 year olds) to a group not at risk (18 to 19 year olds), we compare two cohorts in which neither should have their compulsory schooling decision impacted by contemporary violence exposure. If the homicide rates were correlated with some underlying trend in educational attainment, we would find a significant relationship between violence and compulsory graduation even between these two groups that have already passed compulsory schooling age. Table 7 provides the results from conducting the difference in differences and triple difference on two cohorts that have little risk of conflict exposure affecting their compulsory schooling attainment (18-19 year olds compared to 21–22 year olds). The

[23] In addition, we can analyze the effect of local violence exposure on the amount of time allocated to home production activities, such as caregiving within the household or in the form of chores/domestic work, as well as, reading, engaging in entertainment/culture outside the home, watching TV, using the internet, and helping a household member study. These results, which appear in Appendix Tables B2-B8, provide no strong evidence of a relationship between increased violent crime and time spent on these activities.

[24] While young men may be less likely to attend school than young women, the large p-value (.60) of the F-test in column 2 of Appendix Table C2 shows that men living in places that would become violent were no less likely to attend school than men living in places that would not become violent.

[25] The estimates in column 2 of Appendix Table C1 and column 2 of Table 2 are not estimated precisely enough to statistically distinguish them.

Table 7
Impact of Homicide Rates on Completing Compulsory Education.

Comparison of 18-19 Year Olds and 21-22 Year Olds						
	Using MxFLS3 Survey Data			Using MxFLS2 and MxFLS3 Survey Data		
	All	Males	Females	All	Males	Females
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
$\sqrt[4]{}$Homicide Rate Over the 12 Months	0.003	-0.013	0.015	0.010	-0.029	0.044
Prior to the MxFLS3 Interview	[0.018]	[0.029]	[0.029]	[0.019]	[0.025]	[0.028]
$\sqrt[4]{}$Homicide Rate Interacted with	0.032	0.053	0.009	-0.008	0.027	-0.039
the 18-19 Age Group	[0.021]	[0.043]	[0.035]	[0.028]	[0.036]	[0.037]
$\sqrt[4]{}$Homicide Rate Interacted with				-0.010	0.021	-0.038
MxFLS3 Survey Wave Indicator				[0.022]	[0.036]	[0.046]
$\sqrt[4]{}$Homicide Rate Interacted with				0.040	0.022	0.055
the 18-19 Age Group				[0.031]	[0.050]	[0.060]
and MxFLS3 Survey Wave Indicator						
Observations	2896	1395	1474	5512	2664	2848

Notes: Standard errors clustered at the MxFLS2 municipality of residence level in brackets.
All regressions control for year of interview fixed effects(FEs), month of interview FEs, Age FEs, and parental characteristics in MxFLS2.
Columns 4–6 also include indicators for being an MxFLS3 observation and for being both in the 18-19 age group and in the MxFLS3 survey wave.
***p < 0.01.
**p < 0.05.
*p < 0.1.

findings from this analysis support the validity of the results from Table 3, as they indicate that the municipality homicide rates were not picking up an underlying negative educational trend.[26]

These tests, though, can only provide reassurance that there are not linear unobserved municipal trends that are correlated with both the change in the homicide rate and the educational and employment behavior of young adults, and can not rule out non-linear municipal characteristic changes that occurred simultaneously or closely in time to the escalation of violence. Thus, our results can only be interpreted as casual conditional on this type of unobserved factor not being present. Specifically the remaining type of omitted trend or unobserved event that could bias our results would need to be on a similar non-linear temporal path as seen in Fig. 1, have diverse geographic heterogeneity consistent with the significant variation in violence found in Fig. 2, and to specifically impact only the educational attainment and employment behavior of 14-17 year old males and those with self-employed parents, as Table 7 and Appendix Table A6 show that the educational outcomes of surrounding cohorts in violent municipalities are not affected.

One potential confounder that could fit this description is the Great Recession. If differential municipality experience of the Great Recession were correlated with the geographic heterogeneity in crime and predominately impacted the education and economic behavior of 14–17 year old males and children of the self-employed it would be difficult to separate the two events. Two studies have explored the relationship between the temporal and geographic variation in violence in Mexico and the heterogeneity in the economic impact of the Great Recession directly and found no evidence of a connection (Ajzenman et al., 2015 and Velásquez 2015). In order to provide some direct evidence regarding whether our results are driven by differential experience of the Great Recession we have conducted two additional analyses.

First, we augment Eqs. 2, 3, and 4, with controls for the local economic environment. Local economic condition controls that are included are: municipality-year level electricity use (kWh), manufacturing industry and retail sector characteristics (# of establishments, # of employees, gross total production, total value added) for each municipality in 2004 (assigned to MxFLS2 observations) and 2009 (assigned to MxFLS3 observations), and state-year level GDP.[27] The results displayed in Appendix Tables D1, D2, and D3 confirm the findings of Tables 2, 3, and 6, respectively.

The second approach to this concern is to remove respondents that live in regions that are likely to be most sensitive to the Great Recession from the sample. Since, Mexico's experience of the Great Recession is linked to its close economic relationship to the United States, and that this economic relationship, particularly after the North American Free Trade Agreement, is likely strongest along the U.S.-Mexico border, we re-estimate our main results from Tables 2, 3, and 6, excluding respondents from states along the northern border with the U.S. These results are found in Appendix Tables D4, D5, and D6 and are qualitatively and quantitatively equivalent to the original estimates, with the primary difference being less precision due to a loss of sample size.

7. Conclusion

The results of this paper provide important evidence of the negative externalities from living in a violent environment on human capital accumulation. The nature of the data and the event offer an opportunity for significant gains in the conflict and education literature by allowing the use of comparisons of the same individual before and during a plausibly exogenous rise in violence, while being able to shield the estimates from endogenous migration, control for time-varying household characteristics, and explore the underlying mechanisms. Moreover, the adverse relationship between educational attainment and exposure to violence provided by the individual fixed effects strategy is corroborated using the alternative empirical techniques of difference-in-differences and triple difference.

Specifically, this paper finds that exposure to the Mexican war on drugs significantly reduced the years of educational attainment and

[26] Similar analyses using alternative groupings of older cohorts from 19-29 years old all confirm the non-result from Table 7. Additionally, a D-i-D following the placebo procedure of assigning future homicide rates to young adults from MxFLS2, also provides evidence that the municipalities that later experienced more violence were not on differentially negative education trends.

[27] This analysis should be viewed with caution as these economic controls are potentially endogenous in a way that would bias our estimates towards zero, as previous research has documented the negative economic impact of the War on Drugs in Mexico (BenYishay and Pearlman, 2013; Robles et al., 2013; Dell, 2015; and Velásquez, 2015) and this is likely part of the causal channel that influences the educational and economic outcomes of young adults exposed to local violence.

compulsory graduation rates of young adult males and children with parents working in self-employment, the employment group in Mexico most economically impacted by local violence. Moreover, these two groups were also significantly more likely to be participating in the labor market if they had experienced higher levels of conflict in their municipality. These findings, along with the fact that more fearful parents were not more likely to alter their child's educational attainment and supply side channels do not seem to be prevalent, suggest that the important mechanism driving the adverse relationship between violence and human capital for young adults in Mexico is financial. Thus, a realistic pathway for this relationship could be local violence restricting economic activity, reducing a household's resources, and motivating the early entry of young male adults into the labor market to provide additional income for the family.

In summary, this paper illuminates the hidden impact the violence from the Mexican drug war is having on the human capital development of a generation of young adults, which suggests this conflict's adverse effect on the Mexican economy may persist even after the killing stops.

Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.jdeveco.2017.02.004.

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