The Effect of Violent Conflict 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 attainment, cognitive ability, time allocation, and employment behavior of young adults between the ages of 14 and 17. The panel nature and the timing of the second (2005) and third wave (2009) of the Mexican Family Life Survey allows for some unique gains in the conflict literature, as we are able to compare pre and post violence outcomes, assess migratory behavioral response, and control for time invariant person-specific characteristics through individual fixed effects models. Preliminary results suggest children exposed to local violence have achieved lower levels of education, have reduced cognitive alertness, and are more likely to work. These effects are strongest for males and children of parents that work in occupations most adversely effected by the Mexican drug war.

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 health and educational deficits that can have long term consequences on their future well-being, and potentially on the longrun growth of the economy as a whole (Rodriguez and Sanchez, 2012; Akresh and DeWalque, 2008; 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. 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 1990's 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 (Figure 1 provides monthly homicide rates in Mexico from 2000 to 2011 in red). Moreover, when specifically examining the homicide rate of drug related violence, it becomes evident that most of the increase in violence found in the INEGI data is a consequence of a recent surge in drug-related conflict in Mexico (the monthly drug-related homicide rate is shown in Figure 1 with a green dashed line)[1].

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., 2013; Dell, 2011; Guerrero, 2011a; Guerrero, 2012b; Molzahn et al., 2012; Rios and Shirk, 2011; and Rios, 2012). The

[1] Drug-related homicide data was compiled by the National Public Security System (SNSP) starting in 2007.
[4] "An armed conflict is a contested incompatibility which concerns government and/or territory where the use of armed

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 (OCG's) 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, 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, have been widely used to establish territorial control. Moreover, as the conflict escalated and the need for additional revenue to help in the fight for territorial control grew, non-drug related crimes such as kidnappings, extortions, assault, and car theft, also increased (Rios, 2012; Guerrero, 2012a).

While the magnitude of the conflict 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 (Figure 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 conflict exposure across municipalities.

The Mexican case is unique to this literature in that it represents a setting that is neither a civil war nor an internal armed conflict as 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 has surpassed the levels found in war torn countries such as Afghanistan and Iraq.[4,5].

[4] "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).

[5] Newspapers reports state that according to the most updated dataset of the 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 violent deaths in Iraq surpassed the 8,000. Taking into account their different population sizes, a comparable rate of murders in

While the causes of conflict in Mexico are different from those that have previously been studied, the consequences of the change in Mexico's violence environment has generated many 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 conflict was a severe and swift decrease in perceived physical and financial safety (Brown, Montalva, Thomas, and Velasquez, 2015). Fear of bodily harm, kidnapping, extortion, and/or sexual assault has the potential to lead families to avoid sending their children to school and may adversely effect the performance of children exposed to the increased stress of conflict (Sharkey, 2010).

The economic implications of the conflict may also have a negative spillover into education decisions. Recently a few papers have examined the impact of the Mexican outbreak of violence on the income and earnings of the Mexican population (BenYishai and Pearlman, 2013,; Dell, 2011; Robles et al., 2013; and Velásquez, 2013). Each study, using different identification strategies, has found that the conflict has had negative and large impacts on the labor market participation and earnings of Mexican workers. This reduction 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.

Young men may also find that their earnings potential/outside option has increased due to the conflict. Since the election of Felipe Calderón, the cartels have been confronted with both increased resistance from government authorities and a fight for territory and power with newly formed OCGs. Thus, the cartels have a need for more and more soldiers/gang members to fight back against the government and consolidate power in their territorial enclaves. Intuitively, this increased "labor" demand of young men, may change the opportunity cost of staying in school and lead to more and earlier dropouts.

Developing analyses that can quantify the impact of violence and conflict on the educational attainment and labor market behaviors of exposed youths, though, must directly confront some major identification complications including the non-random nature of the location of the conflict and systematic behavior responses to crime. Most of the current literature that specifically analyzes the

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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 (3,622 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 (Reuters).

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. Furthermore, these studies, by using locations with fairly well established/constant levels of violence over time, are subject to conflating systematically taken behavioral responses such as residential sorting/migration with the actual impact of violence on human capital accumulation.

We are able to make a contribution both to the literature on the economic consequences of conflict and specifically on the effects of the recent increase of violence in Mexico in a number of ways. First, by using longitudinal data that has information on the same individuals before and after 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 able to directly analyze migration as a behavioral response to violence and account for it in our identification strategy. Third, by looking not only at schooling, but also labor market outcomes 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 and thus make statements about the likely channels through which the conflict is effecting the human capital accumulation of the exposed young adults. Lastly, we are able to test some of the assumptions of our models by conducting placebo tests on the impact of our violent crime measure on educational attainment for older cohorts that were not exposed to violence during prime schooling ages. If the conflict intensity measure is capturing a real change in the environment of the municipality, rather than some previous downward trend in other characteristics, we should find no effect of homicide rates on the outcomes of the older cohorts.

2. Data

The data used in this paper is a match of the INEGI monthly homicide data at the municipal level with the fortuitously timed and rich 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 our measure of conflict is not intended to rule out the effect of other types of crime that also increased due to this conflict. Homicides are used in this

study as they act as the most accurate and best proxy for the conflict environment in Mexico. The reason many conflict studies focus on homicides is that they are the crime least effected by underreporting/measurement error. Moreover, the INEGI 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 (Guerrero, 2011). Lastly, it has been shown in a previous study that 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 (Brown, Montalva, Thomas, and Velasquez, 2015).

The individual level data we will utilize comes from the MxFLS, which is an ongoing longitudinal data set that is representative 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 among 150 communities and 16 states throughout Mexico. 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 panel respondents being re-interviewed in MxFLS2 and 87% in MxFLS3.

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 conflict. 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[6], during times of extremely elevated violence (Figure 1 displays the timing of the surveys as it relates to homicide rates in Mexico). This feature of the timing paired with the panel nature of the household survey, 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 questions regarding education information on young adults not typically explored in this literature including, how they spend their

[6] 6% interviewed between 2011 and 2012.

non-school time, labor market participation, hours worked and earnings if they worked, and non-verbal cognitive assessments (the Raven's Progressive Colored Matrices test). Information about the amount of time spent on home production, reading, sleeping, and other 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. Information on their labor market participation allows us to evaluate the manner in which violence exposure has changed the labor market activities of the adolescents. Finally, analyzing Ravens' scores allow us to gauge whether cognitive aptitude is being hindered by exposure to Mexico's internal war.

3. Empirical Strategy

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 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. Previous studies on adult samples in Mexico have found evidence of endogenous migration as a response to violence (Brown 2014, Velásquez 2013), and a similar analysis for our sample supports this evidence.

To estimate the relationship between migration and potential exposure to violence, we examine if individuals 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, cognitive score, 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), MxFLS2 state of residence fixed effects, as well as, year and month of MxFLS3 interview fixed effects.

$$y_{ij} = \gamma + \delta_1 \mathbf{\Delta} HOM_j + \beta' X_i + \alpha_{YOI09} + \tau_{MOI09} + \boldsymbol{\lambda}_{YOI05} + \boldsymbol{\Upsilon}_{MOI05} + \sigma_{STATE} + u_{ij} \quad (1)$$

This specification is represented in equation 1, where *y* is the migration decision of individual *i*, that resides in MxFLS2 in municipality *j*, $\mathbf{\Delta} HOM_j$ captures the change in the homicide rate between 2005 and 2009 in municipality *j*, X_i is a vector of maternal and household characteristics measured in MxFLS2, α_{YOI09} are indicators for the year of interview in MxFLS3, τ_{MOI09} are indicators for the month of interview in MxFLS3, $\boldsymbol{\lambda}_{YOI05}$ are indicators for the year of interview in MxFLS2, $\boldsymbol{\Upsilon}_{MOI05}$ are

indicators for the month of interview in MxFLS2, and σ_{STATE} are indicators for the state of residence in MxFLS2.

Moreover, to explore the important question of whether the conflict related migration was systematic, we run analyses similar to equation 1 where we also interact the homicide measure with individual characteristics. The coefficients on these variables will tell us whether particular types of individuals were more likely to systematically migrate due to violence.

In Table 1 we present the results from estimating equation 1. The findings from this analysis suggest that while migration in general was not driven by conflict 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. Given these findings, and the fact that it is very difficult with any analysis to completely rule out conflict-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.[7]

Specifically, exposure intensity will be assigned based on the homicide rate in the respondent's MxFLS2 municipality of residence, rather than the municipality of residence during the conflict period (i.e. in the MxFLS3 wave). By fixing the respondent to their pre-violence location, any migration brought on by or correlated with changes in the conflict 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.

The issue of omitted variable bias is ever-present in studies of the impact of conflict on individual outcomes. The strategy that will be used in this study to address these concerns is the use of within-individual comparisons. By making comparisons within a respondent, time invariant characteristics or preferences of the individual are controlled. Moreover, we will also be able to 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)[8]. Standard temporal

[7] 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 conflict 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 conflict intensity exposure that could bias an analysis that did not use an "intent-to-treat" approach.

[8] 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

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 utilizes the MxFLS2 and MxFLS3 surveys, can be generalized in the following regression framework:

$$y_{ijt} = \gamma + \pi_1(homrate\ last\ 12\ months)_{jt} + \theta_i + \kappa_{YOI} + \kappa_{MOI} + \beta' X_{it} + + u_{ijt} \quad (2)$$

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 $(last\ 12\ months)_{jt}$ which is the quartic root of the homicide rate per 100,000 people in municipality, *j*, during the 12 months prior to the interview[9]; θ_i is an individual fixed effects, κ_{YOI} are indicators of the year of interview, κ_{MOI} are indicators of the month of interview, and X_{it} is a vector of time varying parental/household characteristics. Using this specification π_1 is our coefficient of interest.

In this analysis 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 to themselves and their families of attending to school.

Additionally, while finishing compulsory schooling is required, only around 70% of Mexicans aged 20-30 years old surveyed 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. This suggests that passing the compulsory schooling bar may be an important determinant of economic success in Mexico. As such, we want to analyze whether students in the cohorts most likely to have their compulsory graduation effected by violence, were less likely to pass ninth grade if they were exposed to higher levels of conflict. Since this important decision is typically

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characteristics as measured in MxFLS2. This technique is used to ensure we control for household characteristic trends without including endogenously determined explanatory variables to the regression.

[9] Quartic root of the homicide rate is used as the log transformation would drop municipalities that have a homicide rate equal to zero and the quartic root behaves similarly to a logarithmic transformation for positive numbers (Thomas et al. 2006).

made during the ages of 14 to 15, we look at the sample aged 15 to 16 at interview, as for these cohorts the violence they faced in the year prior to 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 the 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 to 19 year olds).

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

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

Where *c* is an indicator for passing compulsory schooling for individual *i*, living in municipality *j* in MxFLS2, at time *t.* The same measure of violence as the previous model is used $(last\ 12\ months)_{jt}$ and interacted with an indicator for being in our at risk cohort (aged of 15 and 16). Additionally we control for age fixed effects, λ_a, and, as before, indicators of the year of interview, κ_{YOI}, indicators of the month of interview, κ_{MOI}, and a vector of parental/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 equation 3, utilizing only cohorts that should be unaffected by violence, in terms of their compulsory schooling decision (e.g. 18 to 19 year olds versus 21 to 22 year olds). The difference-in-differences model proposed previously passes this falsification test and this result is reported in the "Placebo Tests" section.

A second potential concern with this difference in difference estimator is that the average difference in the outcome of the affected (15 to 16 year olds) and unaffected (18 to 19 year olds)

populations from high conflict areas would have differed from the average difference between the affected and unaffected populations in low conflict areas even if the rise in violence had not happened. We can address this by adding into our analysis information from the previous wave of the MxFLS survey. By including respondent's that were 15 to 16 year olds and 18 to 19 years olds in MxFLS2, but assigning them the exposure level they would receive in the conflict period (i.e. in MxFLS3) they serve as a proxy for the educational gap that naturally exist between these cohorts in high violence versus low violence areas. This analysis is conducted using the following triple difference specification:

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

Where the interpretation of the notation from equation (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 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 specification π_6 is the estimate of interest in the triple difference model.

The major remaining threat to identification in all of the analyses is that some other municipality level trend is correlated with homicide rates and it is this factor that is being picked up in our estimates rather than the impact of violence. While this is unlikely given the sharp temporal spike in violence, previous studies by the authors have explored whether any of over 30 pre-violence trends in a municipality's characteristics have any power to predict the change in a municipality's level of conflict between 2005 and 2009 and find no evidence to support this hypothesis (Brown, 2013 and Velásquez, 2013). Another potential concern may be that, differential municipality experience of the Great Recession is correlated with the geographic heterogeneity in crime and thus it is difficult to separate the two events. Given that we do not see any municipality characteristics that determine conflict levels, and these characteristics almost surely are related to a municipality's level of exposure to or insulation from recession, the idea of correlated geographic heterogeneity between the Mexican drug war on the Great Recession seems dubious. Moreover, two studies have explored this relationship directly and found no evidence of a connection (Ajzenman et al., 2014 and Velásquez 2013).

4. Preliminary Results

4.1. Impact on Human Capital

Tables 2-3 and 5-7 show preliminary results for the individual fixed effect model from equation 2. In these tables we provide results for the entire sample, as well as stratifications by gender, whether the individual has a parent that is self-employed in MxFLS2, and the mental health of the parents in MxFLS2.

The reason we stratify the sample by gender is that males and females are likely to face a different experience of the conflict and differential changes in the opportunity cost of school. For example, sexual assault is more likely to be directed at females, while males are more likely to take on the economic burden of the family and/or to be tempted into joining a cartel or gang.

We look specifically at the children of self-employed parents, as findings in Velásquez (2013) provide evidence that self-employed men and women suffered the largest negative impact on their economic outcomes from exposure to local conflict. If families with self-employed breadwinners are facing the largest reductions in resources, it is likely young adults in these households are most at risk of leaving school to enter the labor force.

Lastly, our interest in the mental health of the parent comes from the idea that individuals that are less mentally stable may be more vulnerable to the stress of conflict.[10] This increased parental anxiety has the potential to impact the educational and economic outcomes of the child in various ways such as: the child may have to have to take on a larger role in the economic wellbeing of the family, the child's school attendance may not be as well supervised, the anxiety of having an unwell parent may cause poorer performance, amongst several other potential pathways.

The results in Table 2 show that elevated levels of exposure to local violence in Mexico had a significant negative effect on the years of schooling attained for young adult males. Specifically, the result suggests that for a young male living in a municipality that had no violence exposure in 2005 (20% of MxFLS2 municipalities) and then experienced the the average homicide rate rise between 2005 and 2009 amongst those municipalities (approximately 15 in 100,000) they would have attained

[10] A widely used measure of mental well-being is based on the Short Form 36 (SF-36) Health Survey. Using questions from the MxFLS that are closest to the ones used in the SF-36 index and adapting its scoring system, we construct an index of emotional health. We then use our index to classify respondents into two groups: those who got the highest possible score (~30% of respondents) and those who did not (~70% of respondents).

around 0.3 fewer years of schooling.[11] Moreover, those living with self-employed parents are also significantly reducing their educational attainment when exposed to higher levels of conflict (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). Table 2 suggests that female's schooling attainment was not adversely effected by the violence and provides no evidence that if a child had parents with poorer mental wellbeing they would attain less schooling when exposed to conflict.

Another educational outcome that can be measured is whether the individual is currently attending school. While the negative results in Table 3 support the notion that males and children of self-employed parents are more vulnerable to conflict's effects on education, neither result is significant. Interestingly, these findings do provide some evidence that the parent's mental wellbeing may play a role in the effect of conflict on the human capital accumulation of young adults. In column 6, we see that having a father that expressed some level of depression in MxFLS2, makes a young adult exposed to conflict significantly less likely to be attending school in MxFLS3 (about 9% less likely using the prior example).

As mentioned previously, it may be achieving certain educational milestones that really have the most important impact on later life economic success. To get an idea of the impact of the Mexican drug war on this type of outcome, Table 4, Column 1 provides the results from our difference in differences (D-i-D) model from equation 3 for compulsory level educational attainment. The first column provides the result utilizing the simple D-i-D framework. The estimate on the non-interacted homicide rate suggests that the educational levels were actually higher on average in areas more exposed to violence, and thus that it is essential to remove this initial difference to get the true impact of conflict on compulsory school graduation. The estimate on the homicide rate interacted with the indicator for being in the at-risk cohort provides evidence that the likelihood of graduation is significantly and strongly negatively impacted by increased exposure to conflict. This result predicts that an individual in the at-risk cohorts living in a municipality with no exposure to violence in 2005, which subsequently experience the average increase in violence (15 in 100,000), was 8% less likely to graduate from 9th grade then individuals from the comparison cohorts.

It is possible though that this result is 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, Column 2 of Table 4 presents the estimates from the triple difference model detailed in

[11]This is calculated as .148*(15^^1/4)=.291. The following results are interpreted in the same way as in this example.

equation 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 to 16 year old individual living in a municipality with no exposure to violence in 2005, which subsequently experience the average increase in violence (15 in 100,000), was 15% less likely to graduate from 9th grade.

In addition to lower achieved education, higher levels of violence could also possibly affect an individual's schooling performance. Thus, while the exposed students may still be attending school and passing through the school system, their ability to process and retain the knowledge being delivered in school may be adversely impacted. While the MxFLS does not contain any information on grades or standardized achievement tests given in school, we explore the effect of increased conflict on two determinants of school performance: an individual's level of cognitive alertness (Eide and Showalter, 2012, Carrell et al. 2011, and Wolfson and Carskadon, 2003) and an individual's cognitive assessment score. Table 5 displays the results of an individual fixed effect model of the impact of exposure to local violent crime on cognitive alertness, which we proxy with the number of hours the individual slept per night. We find strong evidence that all young adults, and particularly females, children of self-employed parents, and children with a mother that is depressed, reduce their sleeping hours when violence increases. To give the result a magnitude it seems the effected groups are getting around a half and hour less sleep per night. If this lack of sleep hinders the individual's ability to process information and crystalize concepts from school it could lead to knowledge deficits and poorer evaluations that manifest into worsened later life economic outcomes.

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. Patrick Sharkey has found evidence that children in Chicago exposed to violence near their home perform significantly worse than unexposed children on cognitive assessment tests (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 6 provides our analysis of this issue with respect to the drug violence in Mexico and Raven's scores. We find very little evidence of an effect of exposure to local violence on this measure of cognitive ability, except for young adult's that have a father with some level of depression measured before the escalation of violence in Mexico. 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 12 months) is probably not precise enough to pick up this effect even if it is present. While the heterogeneous impact we are finding for children with father's that have expressed some level of depression, fits into an acute stress disorder story that says, having a parent who is more reactive to a stressful environment may exacerbates the level of unease the child feels and thus effect's their performance on a cognitive assessment test, there is not enough evidence or information for us to properly investigate this hypothesis.

Lastly, we explore the effect of local homicide rates on non-school activities for our young adult sample, including employment behavior and time allocation. Table 7 displays the results of analyzing the impact of local homicides on the labor market participation for young adults. As seen in Columns 2 and 4, 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. This suggests that one of the mechanisms through which violence is acting on schooling attainment is the pull to join the labor force at earlier ages. When analyzing the effect of local violence exposure on time allocation on activities such as caregiving within the household or home production in the form of choirs/domestic work, there appears to be no relationship.[12]

4.2. Placebo Tests

In general pinning down the effect of violent conflict on an individual outcome is quite challenging. In most cases, there are many reasons to believe that the level of local violence is actually either just capturing trends in other regional characteristics or reflecting unobserved demographic differences brought on by selected individuals systematically sorting into living in these violent areas. The advantage of this study is that we are using an event whose violence had a rapid and unanticipated onset, as well as, produced geographic heterogeneity that is unrelated to over 30 trends in observed municipality characteristics (Brown 2013, Velásquez 2013) and that we can remove the potential bias caused by endogenous migration through our intent-to-treat approach

Some doubt may still exist though, that the change in the homicide rate is simply a proxy for trends in other unobserved municipality attributes. In order to test whether our homicide rate measures are truly capturing crime exposure rather than some other underlying municipality trend, we analyze the

[12] Tables available upon request.

impact of future levels of violence on the outcomes of individuals that were 14 to 17 years old in the ***MxFLS2*** survey. Thus we estimate the same model from equation 2, but using observations from the 2005 (MxFLS2) and 2002 (MxFLS1) surveys for individuals that were 14 to 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 conflict in Mexican municipalities was not a result of underlying economic or educational trends, no significant effects should be observed for the measure of violence in this specification, as future homicide rate changes between MxFLS2 and MxFLS3 should not predict the educational changes for young adults between 2002 and 2005. For all outcome variables (years of schooling, attendance, hours slept, Raven's score, employment behavior) and all stratifications (male, female, self-employed parent's, having a mother that did not score perfectly on the mental health battery, and having a father that did not score perfectly on the mental health battery) future homicide rates never have a statistically significant relationship (at the 10% level) with prior education or employment behavior.[14] This set of findings strongly suggests that the educational outcomes of young adults living in municipalities that would later experience larger increases in conflict where not already on a differentially negative tract.

Lastly, 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 8 provides the results from conducting the difference in differences and triple difference on two cohorts that have little risk of conflict exposure effecting their compulsory schooling attainment (18-19 year olds compared to 21-22 year olds). The findings from this analysis support the validity of the results from Table 4, as they indicate that the municipality homicide rates where not picking up an underlying negative educational trend.[15]

[14] Tables available upon request and will be included in an appendix of any future versions of this paper.

[15] Similar analyses using alternative groupings of older cohorts from 19-29 years old all confirm the non-result from Table 8. 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.

4.3. Attrition

Another potential behavioral response that could bias our analysis would be if individuals exposed to violence were more likely to attrite from the survey. While attrition amongst respondents that would have potentially aged into our sample of interest was quite low (~5%), if that attrition was non-random amongst the exposed, we would be left with a selected sample. In order to address this issue we conduct analysis similar to that found in equation 1, replacing the measure of migration between MxFLS2 and MxFLS3, with a measure of whether the individual had left the survey between MxFLS2 and MxFLS3, and removing the MxFLS3 date of interview indicators. This is an important analysis to undertake as, while the overall attrition rate for this sample is very low, even low magnitudes of selective attrition can greatly bias results.[16]

Specifically, we conduct this analysis to see if there is selective attrition caused by violence exposure amongst respondents in MxFLS2 that would have potentially aged into our sample of interest (10 to 13 year olds in MxFLS2). Table 9 provides evidence that there is no statistically significant relationship, overall (column 1) or amongst certain subgroups of the population (column 2), between local violence and attrition.[17] These results strongly suggest that potential exposure to conflict was not a determining factor of attrition from the MxFLS3 sample by school age respondents.

5. Conclusion

In summary these preliminary results provide important evidence of the negative effects of exposure to violence on human capital attainment measures that can affect the long-term outcomes of young adults in Mexico. We will complement this preliminary analysis by continuing to explore different levels of heterogeneity of the effect, as they may give us insights into the casual pathways by which the conflict exposure is impacting these outcomes. For example, we will examine whether the effect of crime has been different depending on the socio-economic status of the household and risk preferences of the parents.

Without a deep understanding of the full economic costs of crime it is not possible to design and evaluate policies hoping to combat the negative externalities of conflict. The analysis presented in this paper makes a contribution to this discussion by shedding light on the effects of crime on the long-term

[16] Attrition was quite low amongst this group of respondents, 4.9%, and previous analysis has found no statistically significant relationship between violence and selective attrition in the MxFLS (Brown 2013, Velasquez 2013).
[17] In addition to all of the interacted terms being non-significant separately, a joint F-test of the coefficients on the interacted terms is also non-significant at the 10% level.

wellbeing of the next generation and on the potential mechanisms through which crime affects human capital accumulation of young adults.

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7. Tables and Figures

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

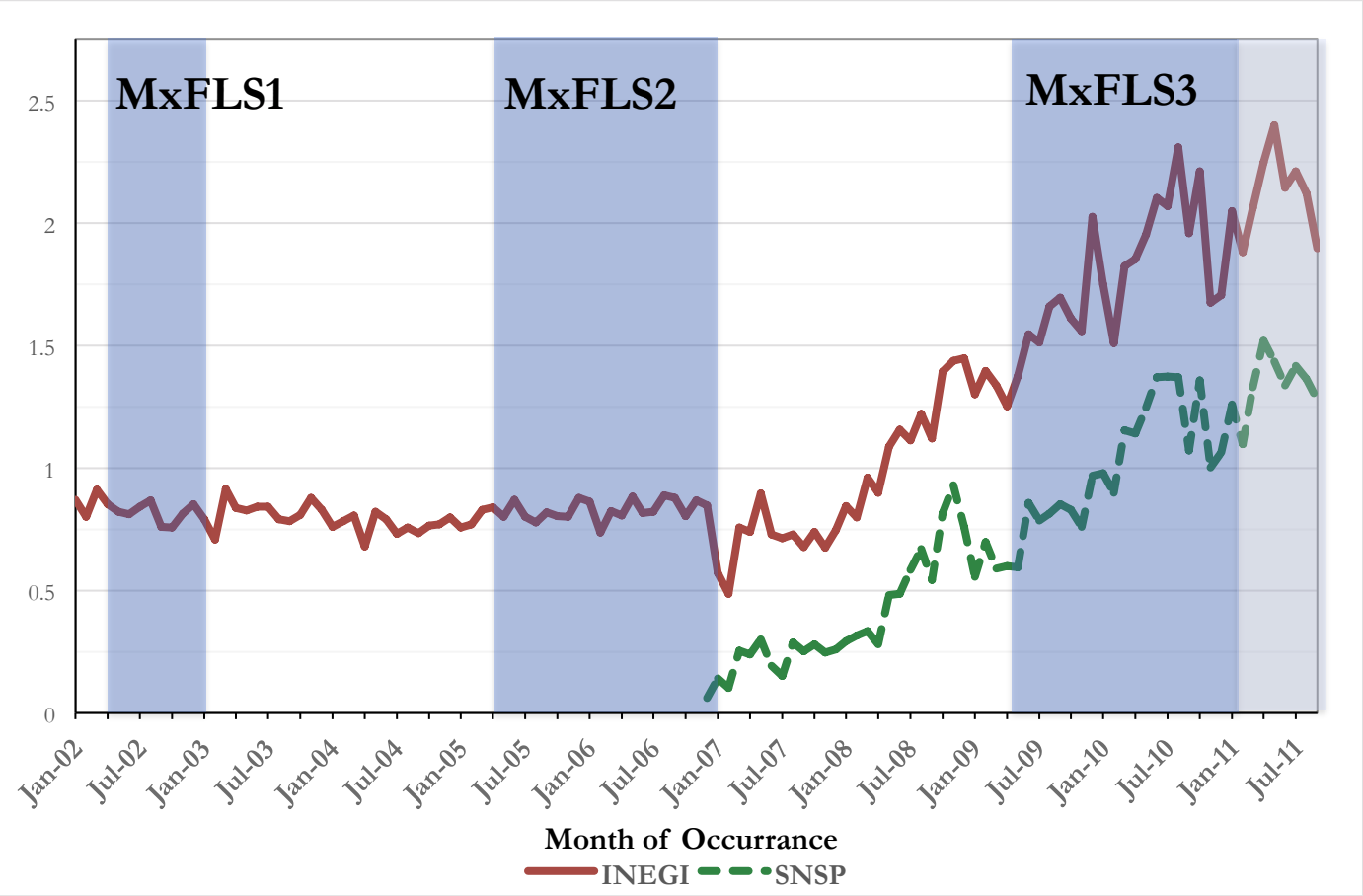

Figure 2: Annual Homicide Rates at the municipality level (per 100,000 Inhabitants)

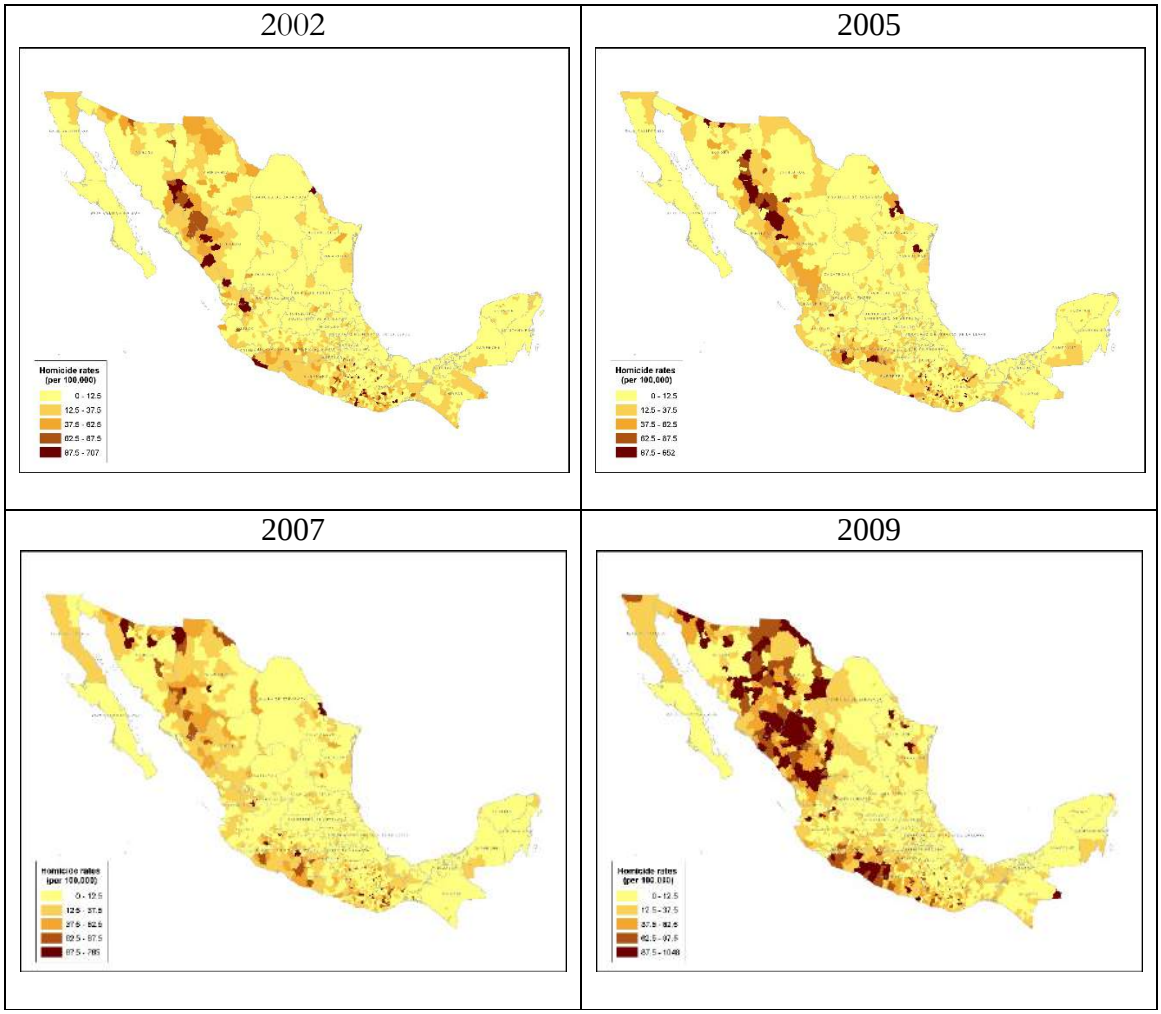

Table 1. Relationship Between Migration and Homicide Rate
for Respondents 14-17 Years Old in MxFLS3

Dependent variable is a dummy equal to 1 if respondent was interviewed in a different municipality between MxFLS2 and MxFLS3

	(1)	(2)
Δ Homicide Rate between 2009 & 2005	0.002%	-0.044%
	(0.019)	(0.057)
Δ Homicide Rate between 2009 & 2005 interacted with MxFLS2 characteristics:		
Mother's Mental Health Score		0.000%
		(0.001)
Mother's Raven's Score		0.008%
		(0.021)
Mother's Years of Education		0.011%*
		(0.006)
Household Per Capita Expenditure		0.000%
		(0.000)
Household Size		-0.002%
		(0.004)
Mother an Employee		-0.046%
		(0.030)
Mother Self-Employed		0.046%
		(0.030)
Mother is Married		-0.074%*
		(0.041)
Mother is Obese (BMI>30)		0.032%
		(0.024)
Mother in Bad Health (Self-Reported)		0.000%
		(0.000)
Mother has Relative Living in U.S.		0.007%
		(0.008)
Lives in Rural Locality		0.057%
		(0.038)
Sample size	2,920	2,920
Mean of Dependent Variable	3.7%	3.7%

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

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

	Subsamples					
	All	Male	Female	Self-Employed Parent	Mother's Mental Health: Below Highest Score	Father's Mental Health: Below Highest Score
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Quartic Root of the Homicide Rate Over the 12 Months Prior to Interview	-0.054 [0.061]	-0.148* [0.084]	0.061 [0.070]	-0.213** [0.089]	-0.046 [0.071]	-0.056 [0.086]
Observations	5,666	2,788	2,878	1,526	3,728	2,054
Sample size	2,833	1,394	1,439	763	1,864	1,027

Notes: Standard errors clustered at the MxFLS2 municipality of residence level in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

All regressions utilize individual fixed effects (FEs) and control for year of interview FEs, month of interview FEs, and parental characteristic trends.

Table 3. 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

	Subsamples					
	All	Male	Female	Self-Employed Parent	Mother's Mental Health: Below Highest Score	Father's Mental Health: Below Highest Score
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Quartic Root of the Homicide Rate Over the 12 Months Prior to Interview	-0.016 [0.020]	-0.029 [0.025]	0.003 [0.021]	-0.021 [0.027]	-0.012 [0.022]	-0.045** [0.023]
Observations	4,830	2,378	2,452	1,328	3,288	1,840
Sample size	2,415	1,189	1,226	664	1,644	920

Notes: Standard errors clustered at the MxFLS2 municipality of residence level in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

All regressions utilize individual fixed effects (FEs) and control for year of interview FEs, month of interview FEs, and parental characteristic trends.

Table 4. Impact of Homicide Rates on Completing Compulsory Education

Comparison of 15-16 Year Olds and 18-19 Year Olds

	Using only MxFLS3 Survey Data	Using MxFLS3 and MxFLS2 Survey Data
	(1)	**(2)**
Quartic Root of the Homicide Rate	0.034**	-0.002
Over the 12 Months Prior to the MxFLS3 Interview	[0.016]	[0.019]
Quartic Root of the Homicide Rate	-0.041**	0.037
Interacted with the 15-16 Age Group	[0.016]	[0.024]
Quartic Root of the Homicide Rate		0.033*
Interacted with MxFLS3 Survey Wave Indicator		[0.019]
Quartic Root of the Homicide Rate		-0.076***
Interacted with the 15-16 Age Group		[0.026]
and MxFLS3 Survey Wave Indicator		
Observations	2,921	5,721

Notes: Standard errors clustered at the MxFLS2 municipality of residence level in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

All regressions control for year of interview fixed effects(FEs), month of interview FEs, Age FEs, and parental characteristics in MxFLS2.

Column 2 also includes an indicator for being an MxFLS3 observation and an indicator for being both in the 15-16 age group and in the MxFLS3 survey wave.

Table 5. Impact of Homicide Rates on Number of Hours Slept per Day
for Respondents 14-17 Years Old in MxFLS3
Individual Fixed Effects comparing same individual in MxFLS2 and MxFLS3

	Subsamples					
	All	Male	Female	Self-Employed Parent	Mother's Mental Health: Below Highest Score	Father's Mental Health: Below Highest Score
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Quartic Root of the Homicide Rate	-0.142**	-0.114	-0.173*	-0.225***	-0.137*	-0.020
Over the 12 Months Prior to Interview	[0.068]	[0.071]	[0.092]	[0.081]	[0.080]	[0.094]
Observations	4,854	2,380	2,474	1,322	3,304	1,840
Sample size	2,427	1,190	1,237	661	1,652	920

Notes: Standard errors clustered at the MxFLS2 municipality of residence level in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

All regressions utilize individual fixed effects (FEs) and control for year of interview FEs, month of interview FEs, and parental characteristic trends.

Table 6. 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

	Subsamples					
	All	Male	Female	Self-Employed Parent	Mother's Mental Health: Below Highest Score	Father's Mental Health: Below Highest Score
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Quartic Root of the Homicide Rate Over the 12 Months Prior to Interview	0.059 [0.049]	0.008 [0.046]	0.128 [0.080]	-0.002 [0.065]	0.059 [0.049]	-0.102* [0.059]
Observations	4,682	2,280	2,402	1,286	3,218	1,790
Sample size	2,341	1,140	1,201	643	1,609	895

Standard errors clustered at the MxFLS2 municipality of residence level in brackets

*** p<0.01, ** p<0.05, * p<0.1

All regressions utilize individual fixed effects (FEs) and control for year of interview FEs, month of interview FEs, and parental characteristic trends.

Table 7. Impact of Homicide Rates on Employment
for Respondents 14-17 Years Old in MxFLS3
Individual Fixed Effects comparing same individual in MxFLS2 and MxFLS3

	Subsamples					
	All	Male	Female	Self-Employed Parent	Mother's Mental Health: Below Highest Score	Father's Mental Health: Below Highest Score
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Quartic Root of the Homicide Rate Over the 12 Months Prior to Interview	0.028	0.061**	-0.009	0.073***	0.021	0.031
	[0.019]	[0.029]	[0.015]	[0.028]	[0.019]	[0.025]
Observations	5,212	2,566	2,646	1,430	3,520	1,966
Sample size	2,606	1,283	1,323	715	1,760	983

Standard errors clustered at the MxFLS2 municipality of residence level in brackets

*** p<0.01, ** p<0.05, * p<0.1

All regressions utilize individual fixed effects (FEs) and control for year of interview FEs, month of interview FEs, and parental characteristic trends.

Table 8. Impact of Homicide Rates on Completing Compulsory Education

Comparison of 18-19 Year Olds and 21-22 Year Olds

	Using only MxFLS3 Survey Data	Using MxFLS3 and MxFLS2 Survey Data
	(1)	**(2)**
Quartic Root of the Homicide Rate Over the 12 Months Prior to the MxFLS3 Interview	0.003 [0.018]	0.010 [0.019]
Quartic Root of the Homicide Rate Interacted with the 18-19 Age Group	0.032 [0.021]	-0.008 [0.028]
Quartic Root of the Homicide Rate Interacted with MxFLS3 Survey Wave Indicator		-0.010 [0.022]
Quartic Root of the Homicide Rate Interacted with the 18-19 Age Group and MxFLS3 Survey Wave Indicator		0.040 [0.031]
Observations	2,896	5,512

Notes: Standard errors clustered at the MxFLS2 municipality of residence level in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

All regressions control for year of interview fixed effects(FEs), month of interview FEs, Age FEs, and parental characteristics in MxFLS2.

Column 2 also includes an indicator for being an MxFLS3 observation and an indicator for being both in the 18-19 age group and in the MxFLS3 survey wave.

Table 9. Relationship Between Attrition and Homicide Rate
for Respondents 10-13 Years Old in MxFLS2

Dependent variable is a dummy equal to 1 if respondent was interviewed in MxFLS2 but not interviewed in MxFLS3

	(1)	(2)
Δ Homicide Rate between 2009 & 2005	-0.006%	-0.024%
	(0.025)	(0.056)
Δ Homicide Rate between 2009 & 2005 interacted with MxFLS2 characteristics:		
Mother's Mental Health Score		-0.001%
		(0.001)
Mother's Raven's Score		-0.027%
		(0.019)
Mother's Years of Education		-0.002%
		(0.004)
Household Per Capita Expenditure		0.000%
		(0.000)
Household Size		0.005%
		(0.008)
Mother an Employee		0.026%
		(0.041)
Mother Self-Employed		-0.026%
		(0.041)
Mother is Married		-0.014%
		(0.043)
Mother is Obese (BMI>30)		0.055%
		(0.034)
Mother in Bad Health (Self-Reported)		0.000%
		(0.000)
Mother has Relative Living in U.S.		-0.023%
		(0.017)
Lives in Rural Locality		0.035%
		(0.039)
Sample size	3,135	3,135
Mean of Dependent Variable	4.9%	4.9%

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