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The Short-Term Impact of Crime on School Enrollment and School Choice: Evidence from El Salvador

ABSTRACT This paper employs variations in crime rates, attributed to an unprecedented country-wide truce between gangs in El Salvador in 2012, to evaluate the short-term impact of homicides and extortions on the education choices of Salvadoran households. Results reveal that the reduction in homicide rates due to the truce were associated with a migration within the education system, from public to private institutions, among boys aged fifteen to twenty-two years. The fluctuations in homicide rates were also associated with a lower school attendance for girls aged seven to fourteen years, especially due to a lower public school enrollment. No significant association between fluctuations in extortion rates and education choices was observed.

JEL Codes: D13, I24, I25

Keywords: Demand for schooling; school choice; crime; El Salvador

El Salvador is one of the most violent countries not at war in the world. More than 6,000 homicides were reported in 2015. With a homicide rate of close to 100 per 100,000 inhabitants, the capital city, San Salvador, was the seventh most violent city in the world in 2016.[1] El Salvador is thus experiencing levels of violence not seen since the end of its civil war, more than twenty years ago. Opinion surveys show that over 50 percent of the Salvadoran population considers violence and crime as the most important

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1. CCSPJP (2017).

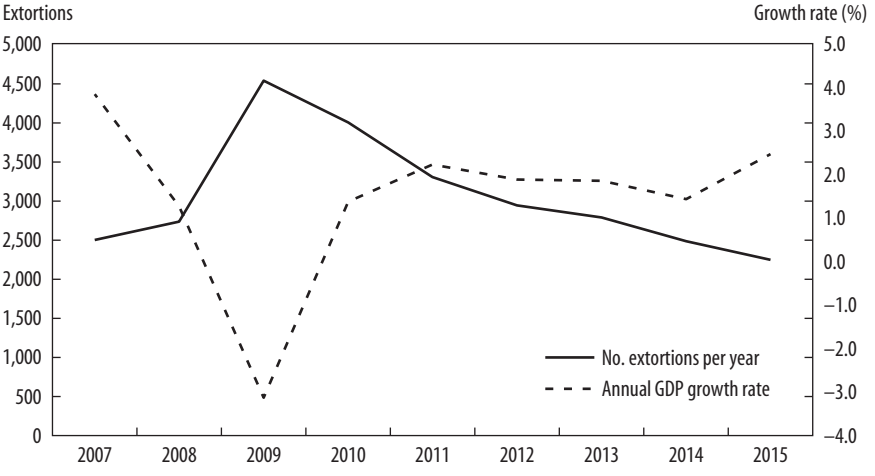
policy issue, while the cost of living and unemployment (the next-most-mentioned problems) combined represent only 25 percent of the responses.[2] The Central Bank of El Salvador estimates that the total cost associated with violence and crime, including additional expenditures on the provision of public services, and private sector losses was US$2.8 billion in 2015, which is equivalent to roughly 11 percent of the country's gross domestic product (GDP).[3] The accumulated welfare impact of violence through its effect on survival probabilities could be as large as 73 percent of El Salvador's GDP.[4]

Conflicts between street gangs in El Salvador produce considerable volatility in criminal activity, thus making it an interesting case study. It is estimated that there are roughly 54,000 official members of the three major gangs in Central America, located in Guatemala, Honduras, and El Salvador. Of these, roughly 20,000 are based in El Salvador, for a rate of 323 gangsters per 100,000 persons in 2012.[5] Gang members are mostly in the twelve- to twenty-four-year-old age bracket.[6] This demographic composition turns school-aged children, especially in poor urban areas, into a group at significant risk of recruitment and aggression. Violence and crime could thus have a significant impact on the academic performance of students and the incentives of households to invest in education, whether through a high victimization risk, the impact of crime on household budgets, or its effect on expectations about the future returns to education. The literature on education and crime has mostly concentrated on the impact of academic outcomes on future criminal behavior, while the body of literature that explores the relationship in the opposite direction is rather scarce. In El Salvador, there is little research on the impact of crime on the education of children, despite its relevance.

This paper contributes to the previous literature in several dimensions. First, it employs household survey microdata along with data on homicides and extortions, and investigates the impact of these types of crime on the probability of enrollment and on the likelihood of being enrolled in a public or private school for male and female Salvadorans between seven and twenty-two years of age. It employs variations in crime rates due to a countrywide truce between gangs in 2012 for identification. The results show that the 2012 truce induced a significant reduction in homicide rates that year, although

2. Observatorio de Seguridad Ciudadana (2013) and the 2011 Latinobarómetro survey (available online at www.latinobarometro.org).
3. FUSADES (2016).
4. Soares (2006).
5. UNODC (2012).
6. Seelke (2014).

FIGURE 1. Evolution of Extortion and Economic Growth



Source: Author's elaboration, based on data from the National Civil Police and the Central Bank of El Salvador.

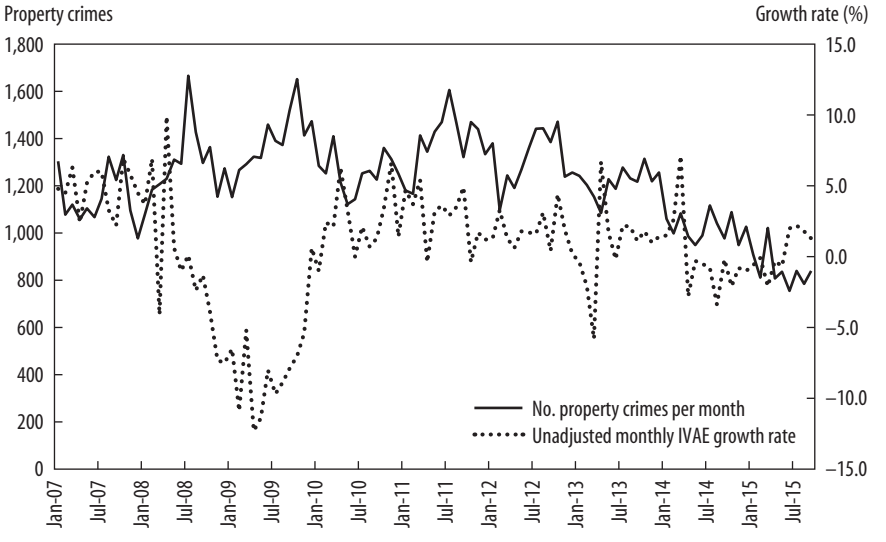
there was no significant change in extortion rates. Drops in homicide rates are associated with lower attendance at public schools for girls under fifteen years of age and migration from public to private schools for boys aged fifteen to twenty-two years.

The paper is organized as follows. The next section introduces background information on crime and education in El Salvador and discusses the relevance of this research in the context of previous literature. The paper then presents the data and introduces the empirical strategy, followed by the estimation results. The final section evaluates the robustness of the results to changes in the methodology and concludes.

Background Information and Literature Review

Figure 1 shows the number of cases of extortions reported by the National Civil Police of El Salvador, together with the real annual GDP growth rate from 2007 to 2014. Extortion of small businesses and transportation firms is a common activity of gangs and other criminal groups, through which they obtain resources for their operations. The number of extortions increased by 65 percent in 2009 compared to the previous year, from 2,729 cases to 4,528.

FIGURE 2. Evolution of Monthly Property Crimes and Economic Activity[a]



Source: Author's elaboration, based on data from the National Civil Police and the Central Bank of El Salvador.
a. Property crimes include thefts and robberies and exclude extortions.

After this peak, extortion decreased as the economy recovered. Figure 2 compares the recent evolution of the total monthly property crimes (thefts and robberies) and the evolution of the annual growth rate of the unadjusted Economic Activity Volume Index (IVAE).[7]

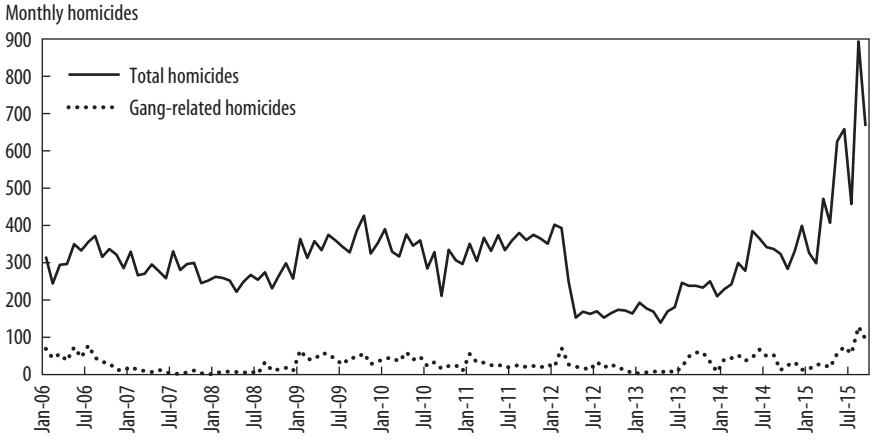
Homicides are strongly associated with gang activity. Roughly 88 percent of the total number of gang-related homicides in 2011 was attributed to the 18th Street gang and the MS-13 gang.[8] Both gangs originated in the United States, among young Latin American immigrants, and have had hostile relationships since 1989.[9] Gangsters were brought to Central America in the

7. Although extortions are typically considered property crimes, their strong association with the activities of gangs in El Salvador makes it necessary to isolate their effect. Therefore, only thefts and robberies are considered as property crimes in this study. The IVAE is a short-term indicator of economic activity calculated by the Central Bank of El Salvador.

8. The 18th Street gang recently divided into two factions owing to internal conflicts, effectively becoming two different gangs.

9. Ward (2013). See also Carlos Martínez and José Luis Sanz, "El origen del odio," digital newspaper *El Faro*, 6 August 2012 (available online at www.salanegra.elfaro.net/es/201208/cronicas/9301/).

FIGURE 3. Evolution of Monthly Homicides



Source: Author's elaboration, based on data from the National Civil Police of El Salvador.

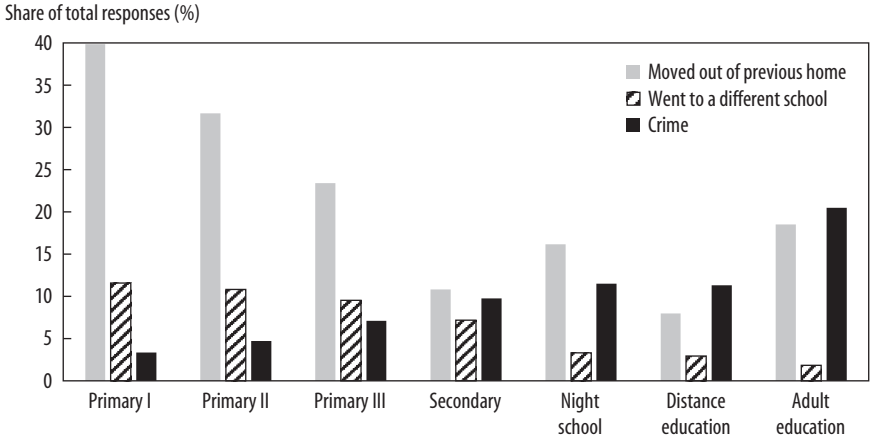
early 1990s through massive deportations and the enactment of the Illegal Immigrant Reform and Immigrant Responsibility Act (IIRIRA) in the United States in 1996.[10] The response of Salvadoran institutions to the rising number of gang-related crimes has led to an increase in the number of convictions in the past decade. The share of gangsters in jails increased from 16.2 to 31.2 percent of total inmates between 2002 and 2006.[11] These policies, along with the practice of separating members of conflicting gangs into different jails, increased their coordination capabilities.

Capitalizing on these conditions, a group of civilians coordinated a negotiation with the imprisoned leaders of the major gangs and consolidated a no-aggression agreement between gangs, which became effective in late February 2012.

In exchange, gangs would obtain better jail conditions and the possibility of further negotiations. No agreements were made regarding extortions, crimes against civilians, or the termination of gangs. Figure 3 presents the total monthly homicides and the number of homicides attributed to gangs in the last decade. From January 2006 to February 2012, there were typically just under 400 homicides per month. By March 2012, however, they had dropped

10. Seelke (2014).
11. Savenije (2009).

FIGURE 4. Reasons for Leaving School, 2010



Source: Author's elaboration, based on data from MINED (2010).

to under 260, and they stayed at that rate until March 2014. This drop in total homicides is not reflected in the number of gang-related homicides reported by the National Civil Police, which raises concerns about the accuracy of institutional statistics regarding offenses by gangs. The truce was terminated in 2014 after the presidential elections that year owing to the lack of support for the truce by the newly elected president.

The Relation between Crime and School Enrollment in El Salvador

Primary education in El Salvador is compulsory and consists of nine years of schooling grouped in three three-year cycles. Secondary education offers the choice of a general track and a technical track, which last two and three years, respectively. Both primary and secondary education are free when provided by the state. The public sector accommodates about 87 percent of primary students and close to 74 percent of secondary students.[12] Figure 4 shows the prevalence of the main reasons for dropping out of school, according to data from the Ministry of Education of El Salvador.[13] For primary students, moving

12. MINED (2014).
13. MINED (2010).

to a different neighborhood and changing schools are the major reasons for leaving school. However, crime accounts for a much larger share of school dropouts among older students: 10 percent for secondary students and 21 percent for people in adult education programs. One explanation for this pattern is differences in victimization risk across age groups. The Institute of Legal Medicine of El Salvador found that 37.2 percent of homicide victims in 2010 were in the fifteen- to twenty-four-year age bracket, while only 2.1 percent of the victims were younger than fifteen years.[14] Close to 85 percent of homicide victims are males.[15] This pattern is also commonly observed in other Latin American countries.[16]

Literature Review

Studies on the causal impact of crime on education outcomes are rather scarce, especially for Latin American countries, although many papers evaluate the cases of Mexico and Colombia. One study that is closely related to this research is by Orraca, who finds, based on panel data from Mexican schools, that increases of one homicide per 10,000 inhabitants can reduce average test scores by as much as 0.35 percent of a standard deviation.[17] The effect is larger for secondary school students and for crimes that occur close to examination dates, which he attributes to lower contact hours. In contrast, Márquez-Padilla, Pérez-Arce, and Rodríguez Castelán, who employ heterogeneous increases in crime rates due to Mexico's War on Drugs in a fixed-effects model with municipal-level data, show that fluctuations in total and drug-related homicide rates have only very small effects on aggregate enrollment.[18] Studies outside Latin America show that crime can exert a negative impact on education outcomes through peer effects and the involvement of parents in criminal activities.[19]

Because victimization risk tends to be strongly biased toward boys, it is important to question whether the response of households to fluctuations in crime rates leads to higher intra-household inequality in educational investment. The theoretical model in Becker and Tomes shows that parents can

14. Children become legally able to work in El Salvador at the age of fifteen, which is also when they finish the third primary education cycle.
15. Molina (2011).
16. Soares (2006).
17. Orraca (2015).
18. Márquez-Padilla, Pérez-Arce, and Rodríguez Castelán (2015).
19. Kristoffersen and others (2015); Rud and others (2014).

invest in their children in such a way that reinforces the original differences in children's endowments when the cost of investment is inversely proportional to the endowment of the child.[20] In the context of crime, this mechanism can arise if the risk of victimization is perceived by parents as a reduction in the child's endowment and if the risk increases the cost of investments in education. Consistent with this intuition, Gerardino shows for Colombia that an increase of one standard deviation in the male versus female homicide rate differential causes an increase of 1.1 percent in the secondary school enrollment gap in favor of girls.[21] Such a trend could be caused by the increase of the opportunity cost of attending school and to reductions in the returns to education.

Crime-induced income shocks can also affect education gaps. The literature shows that in the presence of increasing rates of return to schooling and liquidity restrictions, lower-income households tend to exhibit higher educational inequality among siblings in many Latin American countries.[22] Intrahousehold inequality can also arise from parents' desire to protect the mating value of their children, which can be determined by the relative scarcity of members of one gender, all of which can be affected by the victimization risk.[23]

This study is the first to explore the case of El Salvador using microdata, considering both homicide and extortion rates and several demographic segments, and considering migration within the education system.

Data and Methodology

This research employs data from the 2013 *Encuesta de Hogares de Propósitos Múltiples* (EHPM), a household survey collected and provided by the Salvadoran Department of Statistics and Censuses (DIGESTYC). The survey includes information on demographic variables, school enrollment, education attainment, health, labor force participation, income, and consumption for Salvadoran individuals and their households. It consists of a stratified sample of over 20,000 households, which provides a total sample size of over 85,000 individuals. For this analysis, the sample is restricted to individuals seven to twenty-two years old who reported being the sons or

20. Becker and Tomes (1976).
21. Gerardino (2014).
22. Dahan and Gaviria (2003).
23. Perilloux, Fleischman, and Buss (2008); Abramitzky, Delavande, and Vasconcelos (2011).

daughters of the head of household. The data on municipal-level homicides and extortions were provided by the National Civil Police. Crime rates were estimated employing municipal population projections provided by the DIGESTYC.[24]

Measuring the impact of gang crime on education choices is a difficult task, since it is doubtful whether official statistics provide an accurate measure of the prevalence of gang crime. Furthermore, owing to the lack of periodic data on the characteristics of Salvadoran municipalities, the incidence of gangs is likely to be associated with unobserved variables, making it especially difficult to avoid endogeneity in estimates of the impact of crime on education. The 2012 truce presents a unique opportunity for identifying the magnitude of gang crime and its impact on education choices, both because of its large impact on homicide rates and because its unexpected implementation makes it unlikely that citizens shaped their decisions in anticipation of the truce. The impact of the truce in gang crimes is likely not randomly allocated across municipalities, a result of the highly decentralized structure of gangs.[25] However, the variation in fluctuations of crime rates attributed to the truce are more likely to be associated with the difficulty of enforcing the truce, rather than with the traditional determinants of crime. Therefore, by controlling for the difficulty of enforcement, it is possible to avoid the sources of bias mentioned above.

Easier cooperation with and between gangs is likely to be found in what were called sanctuary cities, where gangs agreed to go beyond the content of the original truce and reduce their participation in all sorts of crimes. Municipal authorities and private enterprises would provide opportunities for facilitating access to the labor market for gangsters who decided to abandon their criminal organizations.[26] The required conditions for a municipality to become a sanctuary city were presented in a letter by the coordinators of the truce in November 2012, and the first municipalities began implementing the model in January 2013. Some conditions, such as voluntarily handing over weapons and allowing free movement of citizens and rival gangsters,

24. Ministry of Economic Affairs and others (2014).

25. Ward (2013).

26. Roberto Valencia, "Pronunciamiento a la nación de Raúl Mijango y Fabio Colindres," 23 November 2012 (available online at cronicasguanacas.blogspot.com/2012/11/pronunciamiento-la-nacion-de-raul.html) and "La Tregua redefinió el mapa de asesinatos de El Salvador," *El Faro*, 9 March 2015 (available online at www.salanegra.elfaro.net/es/201503/cronicas/16490/La-Tregua-redefini percentC3 percentB3-el-mapa-de-asesinatos-de-El-Salvador.htm).

TABLE 1. Changes in Mean Crime Rates by Sanctuary City Status
Per 100,000 inhabitants

City status and type of crime	*2011*	*2012*	*Change (%)*
Nonsanctuary ($N = 151$)			
Homicide rate	43.73	33.71	–22.9
Extortion rate	33.62	29.34	–12.7
Robbery rate	60.77	64.65	6.4
Theft rate	151.09	139.40	–7.7
Gang homicide rate	2.78	2.50	–10.2
Sanctuary ($N = 11$)			
Homicide rate	94.03	47.83	–49.1
Extortion rate	69.90	64.84	–7.2
Robbery rate	112.53	99.36	–11.7
Theft rate	177.22	167.71	–5.4
Gang homicide rate	7.71	7.31	–5.2

required a high level of commitment and strong leadership inside gangs that is not easily attainable.

It is possible that cities that acquired sanctuary status had preexisting conditions that allowed a higher degree of cooperation between gangs. If ease of commitment was a necessary factor for reducing gang violence as required by the truce in 2012, one would expect to see higher reductions in crimes during that year in sanctuary cities. Table 1 compares the changes in crime rates from 2011 to 2012 by sanctuary city status. The eleven cities that adopted this model saw a reduction in the mean homicide rate from 94 cases per 100,000 inhabitants in 2011 to 47.8 cases in 2012 (a reduction of 49 percent).[27] In comparison, nonsanctuary cities started with a considerably lower mean homicide rate of 43.7 in 2011, which was reduced to 33.7 in 2012 (a reduction of 22.9 percent). Other crimes experienced smaller drops in sanctuary cities than in other municipalities, except for the robbery rate. The sanctuary city regime began to be enforced in 2013, so these differences in the evolution of homicides are associated with preexisting characteristics of the municipalities and are not an effect of the sanctuary city status itself.

Two types of crime are especially linked to gangs' activities: homicides and extortions. To obtain a measure of the variation in homicides attributed

27. The eleven sanctuary cities are Apopa, Ciudad Delgado, Ilopango, La Libertad, Nueva Concepción, Puerto El Triunfo, Quezaltepeque, San Vicente, Santa Tecla, Sonsonate, and Zacatecoluca.

to the truce, I used a panel of the 262 municipalities in El Salvador from 2005 to 2011 to estimate the following model:

$$H_{i,t} = \rho_0^H + \sum_{k=1}^{4} \rho_k^H H_{i,t-k} + \rho_5^H R_{i,t-1} + \rho_6^H T_{i,t-1} + \rho_7^H E_{i,t-1} + \rho_8^H G_{i,t} + \rho_9^H \mathrm{POP}_{i,t} + \rho_{10}^H \mathrm{REC}_t + \varepsilon_{i,t}^H, \tag{1}$$

where $H_{i,t}$ represents the homicide rate for municipality i in year t, R is the robbery rate, T is the theft rate, E is the extortion rate, and G is the gang murder rate. All the rates are measured per 100,000 inhabitants in the corresponding municipality. POP represents the population of the municipality; REC is a dummy variable that takes the value of one in 2009, capturing the effect of the economic recession, and zero otherwise; and the rhos are regression coefficients.

Similarly, the following model is estimated for extortions:

$$E_{i,t} = \rho_0^E + \sum_{k=1}^{4} \rho_k^E E_{i,t-k} + \rho_5^E R_{i,t-1} + \rho_6^E T_{i,t-1} + \rho_7^E H_{i,t-1} + \rho_8^E G_{i,t} + \rho_9^E \mathrm{POP}_{i,t} + \varepsilon_{i,t}^H. \tag{2}$$

Results for both equations are presented in table 2. Estimates can be used to obtain the forecast $\hat{C}_{i,2012}$ of the homicide or extortion rate in 2012, which represents a rough measure of the level of homicides that was expected in the absence of the truce. An estimate of the effect of the truce on the crime measure, $C \in (H, E)$, is obtained as follows:

$$\hat{C}_{i,2012} - C_{i,2012} = -\hat{\varepsilon}_{i,2012}^C;$$

$$\mathrm{TRUCE\_EFFECT}_{i,t}^C = \frac{-\hat{\varepsilon}_{i,t}^C}{\sigma_{\hat{\varepsilon}^C}}.$$

For ease of interpretation, this variable is defined so that its sign is *positive* when the observed crime rate is *below* the predicted value. Table 3 shows the means for both truce effects by sanctuary city status. The truce effect on homicides is significantly different from zero in both types of municipality, and the mean for sanctuary cities is significantly larger at the one-percent

TABLE 2. Estimation of the Trend in Homicide and Extortion Rates, 2005–11

Homicide rate		*Extortion rate*	
Explanatory variable	*Coefficient*	*Explanatory variable*	*Coefficient*
Homicide rate (*t*–1)	0.31683***	Extortion rate (*t*–1)	0.34284***
	(0.04113)		(0.05221)
Homicide rate (*t*–2)	0.21198***	Extortion rate (*t*–2)	0.13661***
	(0.04140)		(0.03304)
Homicide rate (*t*–3)	0.19201***	Extortion rate (*t*–3)	–0.10802
	(0.04845)		(0.07875)
Homicide rate (*t*–4)	0.24883***	Extortion rate (*t*–4)	0.35267***
	(0.04554)		(0.08377)
Robbery rate (*t*–1)	0.01518	Robbery rate (*t*–1)	0.07544*
	(0.02048)		(0.04025)
Theft rate (*t*–1)	0.00373	Theft rate (*t*–1)	0.02816
	(0.01333)		(0.02290)
Extortion rate (*t*–1)	0.02377	Homicide rate (*t*–1)	–0.03139
	(0.02594)		(0.04771)
Gang homicide people (*t*–1)	0.07711	Gang homicide rate (*t*–1)	–0.18686
	(0.16590)		(0.25917)
Recession dummy	9.42697***	Recession dummy	
	(2.55180)		
Population (*t*)	–0.00002	Population (*t*)	0.00002
	(0.00003)		(0.00005)
Constant	4.56288*	Constant	2.07458
	(2.59922)		(3.81655)
No. observations	786	No. observations	262
R^2	0.493	R^2	0.494

*Statistically significant at the 10 percent level.
**Statistically significant at the 5 percent level.
***Statistically significant at the 1 percent level.
a. Rates are per 100,000 inhabitants. Each observation corresponds to one of the 262 municipalities for each year in the period of analysis. Standard errors in parentheses.

TABLE 3. Differences in Truce Effects by Sanctuary City Status

	City status			
Effect	*Nonsanctuary*	*Sanctuary*	*Difference*	*T value of difference*
Truce effect on homicides	0.404	1.214	–0.810	–2.598
Truce effect on extortions	0.007	–0.289	0.296	0.748

level. The mean truce effect on extortions is not significantly different from zero at conventional levels in either type of municipality. This is consistent with the perception that the truce did not have an effect on crimes other than homicide.[28] The distributions of both truce effects on the EHPM sample are shown in figure 5.

With these measures of crime obtained, the next step is to evaluate their impact on education choices. Assume that in a given school year, individuals are presented with three alternatives: enrolling in a public school, enrolling in a private school, or not enrolling in school at all. The utility of choosing a given option is determined by $y^*_{i,j} = U_{i,j} + \omega_{i,j}$, where $U_{i,j}$ represents the utility for individual i of choosing alternative j, which can be represented by the linear combination

$$C_i'\alpha_j^C + \mathbf{X}_i'\beta_j.$$

Here, C_i represents a measure of the crime level experienced by individual i, and $\mathbf{X}_i$ represents a set of characteristics of the individual, her household, and her environment. One can only observe the discrete variable y_i, representing the discrete choice of the individual, where

$$p\left(y_i = k|\mathbf{X}_i\right) = p\left[y^+_{i,k} = \max\left(y^+_{i,1}, y^+_{i,2}, y^+_{i,3}\right)\right].$$

Assuming that $\omega_{i,j}$ follows a multivariate normal distribution, the set of coefficients β_j can be estimated employing a multinomial probit model. This model does not rely on the assumption of independence from irrelevant alternatives and therefore is robust to the correlation of errors across choices. The estimation is performed separately using different measures of crime: the truce effect on homicides, the truce effect on extortions, the homicide rate in the municipality of residence in 2012, and the extortion rate in the municipality of residence in 2012. The vector $\mathbf{X}_i$ includes a set of individual and family level controls including age; dummy variables for female, married, and urban residence; and a continuous variable for the maximum years of schooling of the head of household and the spouse. It also includes dummy variables indicating whether the household is classified as relatively poor

28. Steven Dudley, "El Salvador's Gang Truce: Positives and Negatives." *InSight Crime*, 10 June 2013. Available online at www.insightcrime.org/investigations/el-salvadors-gang-truce-positives-and-negatives.

FIGURE 5. Distribution of the Effects of the Truce on Homicides and Extortions in the EHPM Sample

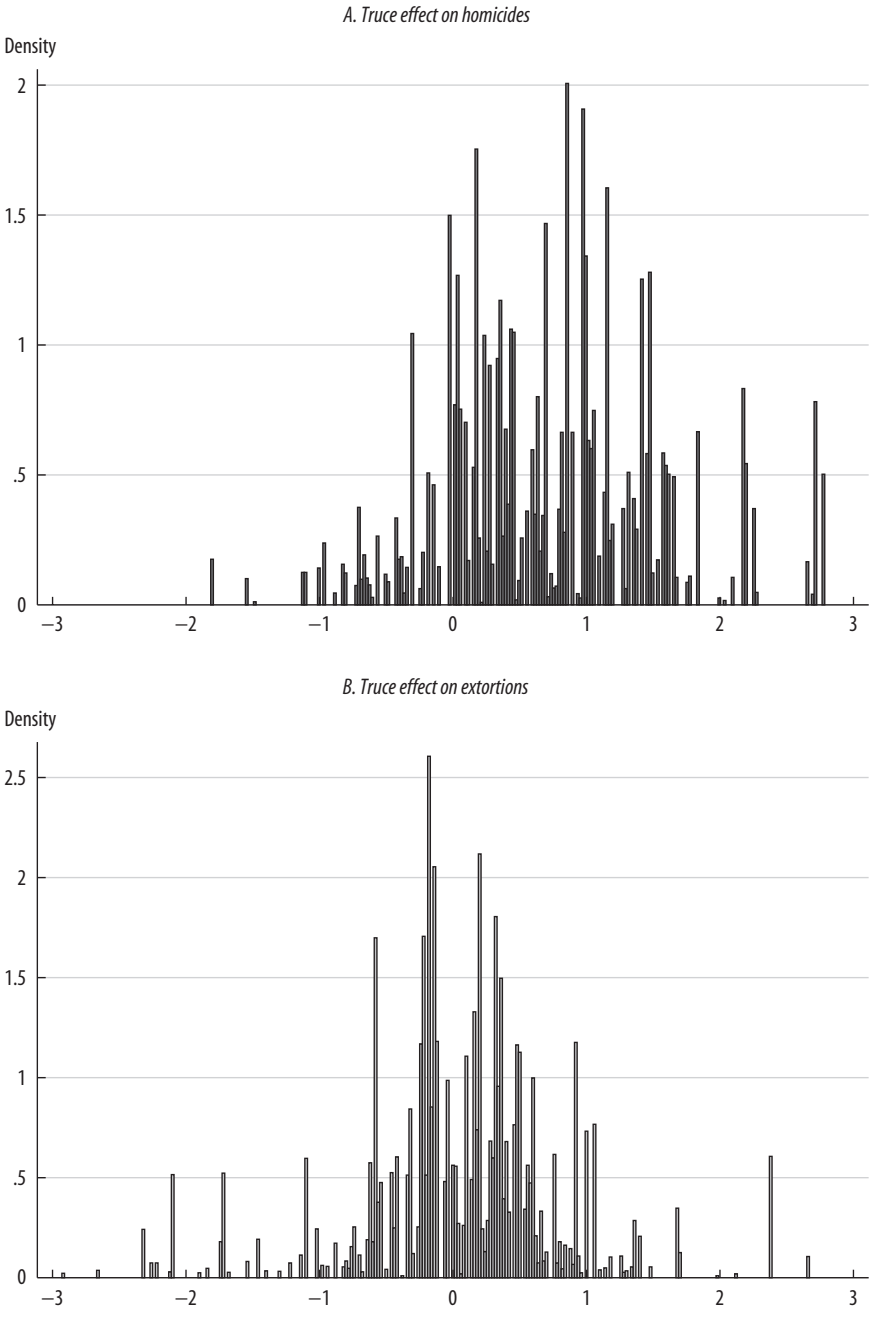


TABLE 4. Sample Means of Variables Used in the Multinomial Probit Regression Analysis
Percent

Variable	Age group	
	5–14 years	*15–22 years*
Enrollment rate (males)	94.7	50.4
Enrollment rate (females)	94.6	55.1
Attendance given enrollment (males)	99.2	99.0
Attendance given enrollment (females)	99.6	98.9
Enrolled in a public educational institution (males)	91.1	80.3
Enrolled in a public educational institution (females)	91.3	75.9
Total expenditure in education (USD per month)[a]	$18.61	$55.66
Truce effect on homicides (standard deviations from the trend)	0.7	0.7
Homicide rate 2012 in the city of residence (per 100,000 inhabitants)	42.5	41.6
Extortion rate 2012 in the city of residence (per 100,000 inhabitants)	40.3	40.8
Age	10.8	18.1
Female	49.4	45.7
Urban	46.8	50.0
Married	0.0	3.3
Extremely poor	15.2	11.3
Relatively poor	34.5	28.6
Maximum education of head of household and spouse (years)	6.8	6.0

a. Among those who spend a positive amount.

or extremely poor.[29] Additionally, $\mathbf{X}_i$ contains a dummy variable for sanctuary city status, controls for the homicide rates in 2009, 2010, and 2011, and the population of the city of residence in 2012. Table 4 presents summary statistics of the main covariates for two age groups. The enrollment rate is over 90 percent for both genders up to age fourteen and it then drops to roughly 50 percent for the older group. In both age groups, 99 percent of the children who enrolled in school reported attending school during the time of the survey. Among those enrolled in school, 91 percent of the younger group is in the public education sector, with no difference between genders. For the older group, the share of students who attend a public institution declines to 80 percent for male students and 76 percent for female students. Monthly expenditure on education per child among those spending a positive

29. Under the DIGESTYC definition, households in extreme poverty are those where the income per capita does not cover the basic food basket. Households in relative poverty have a per capita income equivalent to more than the basic food basket, but less than twice its value. This ranking is expected to be less prone to underreporting bias than the monetary amount of income.

amount averages US$18.61 for the younger group and over US$56.00 for the older group. Individuals in the sample were exposed, on average, to a drop in the homicide rate due to the 2012 truce of roughly 0.73 standard deviations relative to the previous trend. The mean homicide rate and extortion rate are both roughly forty cases per 100,000 persons, while the mean property crime rate (thefts and robberies) is slightly over 220 cases. The 2013 EHPM is obtained from a stratified sample, where the strata are defined based on the socioeconomic and industrial conditions of the sampling units. The survey was designed to be representative at the country level, while representativeness at the municipality level is not guaranteed. This design is likely to bias the estimates if the household response to crime levels is heterogeneous across cities.[30] To account for sample design, the estimations are performed using sampling weights provided by DYGESTYC.

Finally, the standard errors used for inference must account for two characteristics of the data. First, residuals are likely to be correlated across individuals living in the same municipality, which reflects the security and educational policies of the local government and the territorial nature of gangs. Second, the complex sample design makes the assumption of fixed covariates unlikely to hold, so a conditional estimate of the standard errors is not appropriate. This paper employs unconditional standard errors clustered at the municipal level, calculated through linearization with a method based on Graubard and Korn and employing sample weights.[31]

Results

Table 5 shows the average marginal effects for the main controls in the model and for each of the three choices, estimated using the full sample of individuals between seven and twenty-two years old who are the children of the head of household. For the sake of brevity, only results obtained using the truce effect on homicides as a measure of crime are shown. Living in an urban area and having highly educated parents is associated with a higher probability of enrollment in a private school, while being poor is associated with higher probabilities of public school attendance or not enrolling at all. The signs

30. Solon, Haider, and Wooldridge (2015).

31. Graubard and Korn (1999). Standard errors were obtained using the *vce(unconditional)* option of Stata's margins command. The conclusions drawn from the results in this paper are robust to whether the delta method or the linearization method is used.

TABLE 5. Average Marginal Effects on Education Status: Full Sample[a]

Explanatory variable	*Not enrolled*	*Public school*	*Private school*
Truce	0.00280	–0.01905*	0.01624
	(0.00812)	(0.01025)	(0.01003)
Age	0.04585***	–0.04948***	0.00362***
	(0.00139)	(0.00168)	(0.00086)
Urban	–0.06687***	–0.03194**	0.09881***
	(0.00909)	(0.01420)	(0.01396)
Married	0.25603***	–0.18085**	–0.07518
	(0.03653)	(0.07560)	(0.08162)
Extremely poor	0.06215***	0.04642**	–0.10857***
	(0.01293)	(0.02188)	(0.02513)
Relatively poor	0.01326	0.06742***	–0.08068***
	(0.00979)	(0.01483)	(0.01149)
Maximum education of parents	–0.01540***	–0.00223	0.01763***
	(0.00098)	(0.00296)	(0.00241)
Sanctuary city dummy variable	–0.00564	–0.00852	0.01416
	(0.01211)	(0.02723)	(0.02040)
No. observations	20,733	20,733	20,733

*Statistically significant at the 10 percent level.
**Statistically significant at the 5 percent level.
***Statistically significant at the 1 percent level.

a. Average marginal effects from multinomial probit regressions. The sample is restricted to children of both genders aged seven to twenty-two years who reported being children of the head of household. Other controls include the homicide rate in 2009, 2010, and 2011, and the city's population in 2012. All models include a constant term. Coefficients and standard errors are obtained by applying sampling weights. Unconditional standard errors (clustered at the municipal level) are in parentheses.

of these marginal effects are consistent with the normality of education as a consumption good.

Results also show that older students are more likely to be in private institutions or outside the education system than in public institutions. This pattern clearly responds to two facts: first, older students face a higher opportunity cost (that is, the value of their marginal productivity in the labor market). Second, the provision of public education at higher levels in El Salvador tends to shrink considerably, especially in the third cycle of primary education and secondary education. It is therefore reasonable to expect that some older students who would have attended a public school might be left outside the education system for lack of supply at an affordable cost.

Being married increases the probability of not being enrolled at all. Sanctuary city status is not significantly associated with differences in education status.

The truce effect on homicides is associated with a lower probability of public school attendance. However, the estimate is only significant at the

10 percent level, and it is not possible to tell whether it goes in favor of higher private school participation. Such a weak association is likely to be observed if heterogeneity of the relationship between crime and education choices exists across demographic groups. To verify this assumption, table 6 shows the average marginal effects of several measures of crime for different sample segments according to gender and age. All regressions include the same set of controls employed for the estimates in table 5. Results using the truce effect on homicides as the measure of crime (part A) suggest heterogeneity in the way different demographic groups respond to drops in homicide rates. For older males, marginal effects suggest migration within the education system, with lower homicide levels associated with higher private school attendance. In contrast, for young girls, lower homicide levels are associated with lower public school attendance and a higher probability of being out of the education system, while there was no significant evidence of higher private school attendance.

A plausible interpretation of these differences involves the way households respond differently to perceived risk for boys and girls. When risk is high, households may decide to spend more on reducing the risk of the child's commute (such as paying for private transportation services or buying a car), which means that less income is available for school fees. Lower perceived risk would therefore allow parents to enroll their children in better, more expensive schools. In the case of older students, if parents are more protective of girls than boys, their decision to disinvest in protective measures for girls will be more inelastic to drops in risk levels, while a higher elasticity would be expected in the case of boys. A lower victimization risk is also likely to increase the expected relative return to the education of older boys, leading parents to invest in higher quality education for them.[32]

In the case of younger girls, drops in homicide rates can lead to a lower value of schools as safe havens, allowing some girls to stay at home helping their parents with the family business. However, further study is needed on whether the 2012 truce was really perceived by households as a long-term drop in victimization risk and whether this perception led to changes in household consumption patterns. Finally, although the regressions include income controls, controlling for the impact of the truce on income levels (a measure of the magnitude of crime-induced income shocks) would require panel data. For this reason, the effect of income shocks on intrahousehold educational

32. Becker and Tomes (1976).

TABLE 6. Average Marginal Effects of Crime Measures on Education Status, by Gender and Age Group[a]

Crime measure and education status	*Age cohort and gender*			
	7–14 years old		*15–22 years old*	
	Male	*Female*	*Male*	*Female*
A. Truce effect on homicides				
Not enrolled	–0.00730	0.01600**	0.00079	–0.00188
	(0.00738)	(0.00729)	(0.01423)	(0.01553)
Public school	–0.00470	–0.03390*	–0.02757*	–0.00879
	(0.01461)	(0.01790)	(0.01622)	(0.01676)
Private school	0.01200	0.01790	0.02678**	0.01067
	(0.01535)	(0.01748)	(0.01330)	(0.01580)
B. Homicides				
Not enrolled	0.00025	–0.00051**	0.00031	0.00034
	(0.00025)	(0.00024)	(0.00050)	(0.00052)
Public school	0.00023	0.00130**	0.00086	–0.00034
	(0.00046)	(0.00058)	(0.00053)	(0.00058)
Private school	–0.00048	–0.00079	–0.00118**	–0.00000
	(0.00046)	(0.00056)	(0.00051)	(0.00052)
C. Truce effect on extortions				
Not enrolled	–0.00427	0.00625	0.00427	–0.00389
	(0.00410)	(0.00389)	(0.00945)	(0.00868)
Public school	–0.00363	–0.01223	–0.00943	–0.00643
	(0.00683)	(0.00895)	(0.00832)	(0.01247)
Private school	0.00790	0.00598	0.00517	0.01031
	(0.00694)	(0.00775)	(0.00768)	(0.00996)
D. Extortions				
Not enrolled	0.00020**	–0.00008	0.00035	0.00016
	(0.00010)	(0.00009)	(0.00027)	(0.00023)
Public school	0.00021	0.00051***	0.00021	–0.00040
	(0.00018)	(0.00014)	(0.00023)	(0.00028)
Private school	–0.00041**	–0.00043***	–0.00056***	0.00025
	(0.00017)	(0.00013)	(0.00021)	(0.00017)
No. observations	5,366	5,241	5,500	4,626.0

*Statistically significant at the 10 percent level.
**Statistically significant at the 5 percent level.
***Statistically significant at the 1 percent level.

a. Average marginal effects from multinomial probit regressions, including the full set of controls in the base model. Coefficients and standard errors are obtained by applying sampling weights. Unconditional standard errors (clustered at the municipal level) are in parentheses.

gender inequality through a mechanism like the one presented by Dahan and Gaviria cannot be discarded.[33]

Marginal effects when homicide rates are used as the measure of crime are presented for reference in part B. Homicides are associated with higher public school attendance among young girls and lower private school attendance for older boys, which is consistent with the results shown in part A and with findings by Gerardino.[34]

Average marginal effects for the truce effect on extortions are shown in part C. Although the pattern in the signs of average marginal effects is the same as for the truce effect on homicides, they are not accurately estimated, mainly because no significant deviation in extortions was observed during the period of the truce. Finally, average marginal effects for the extortion rate are also presented for reference in part D. Higher extortion rates in 2012 are associated with a lower probability of attending a private school (with a 5 percent significance level) in almost all segments of the sample. The fact that the pattern of coefficients is so different from part C could indicate that measurement error is larger for extortions than for homicides. The following section addresses the robustness of these results to changes in the specification of the model and their causal interpretation.

Robustness Tests and Conclusions

Table 7 shows the average marginal effects of the truce effect on homicides under several changes in the specification of the model in order to evaluate the variability of the results. Part A shows estimation results when the sample is segmented into age groups based on the risk of gang recruitment, rather than labor market incentives. Children older than eleven are considered at high risk of recruitment, while younger children have a lower risk.[35] Significant effects are no longer found for older males. The loss of significance suggests that children between eleven and fourteen were not as affected by the truce as working-age people. This suggests that the effect of crime on education choices is more strongly associated with the labor market value of children than with the possibility of recruitment. In the case of females, marginal effects are less consistent. The negative impact on the probability of attending a public

33. Dahan and Gaviria (2003).
34. Gerardino (2014).
35. Seelke (2014).

TABLE 7. Robustness Test Results for the Average Marginal Effect of the Truce Effect on Homicides on Education Status, by Age Group and Gender[a]

Robustness test and education status	*Age cohort and gender*[b]			
	Younger cohort		*Older cohort*	
	Male	*Female*	*Male*	*Female*
A. Age groups defined by risk of gang recruitment				
Not enrolled	–0.00724	0.00871	–0.00156	0.01095
	(0.00871)	(0.00586)	(0.01211)	(0.01258)
Public school	–0.01803	–0.04042**	–0.01673	–0.01953
	(0.01683)	(0.01739)	(0.01375)	(0.01471)
Private school	0.02527	0.03171*	0.01829	0.00858
	(0.01679)	(0.01656)	(0.01215)	(0.01306)
B. Placebo truce effect on homicides				
Not enrolled	–0.01534	0.00781	0.04230	0.02649
	(0.01706)	(0.01764)	(0.03150)	(0.03801)
Public school	0.00749	–0.00487	–0.03874	–0.05329
	(0.04172)	(0.03711)	(0.03370)	(0.04558)
Private school	0.00785	–0.00294	–0.00356	0.02680
	(0.04024)	(0.03166)	(0.02789)	(0.03405)
C. Truce effect on homicides without sample weights				
Not enrolled	–0.00574	0.01295*	–0.00126	–0.00296
	(0.00667)	(0.00748)	(0.01490)	(0.01383)
Public school	–0.00347	–0.02638**	–0.01826	–0.01825
	(0.01105)	(0.01183)	(0.01536)	(0.01377)
Private school	0.00922	0.01344	0.01953**	0.02122**
	(0.01144)	(0.01032)	(0.00890)	(0.01031)

*Statistically significant at the 10 percent level.
**Statistically significant at the 5 percent level.
***Statistically significant at the 1 percent level.

a. Average marginal effects from multinomial probit regressions, including the full set of controls in the base model. Part A shows estimation results when the sample is segmented into age groups according to their risk of gang recruitment. Part B shows the average marginal effect of a placebo truce effect on homicides in 2011. Part C estimates the base model with the original definition of the truce effect on homicides without employing sample weights. All models include the full set of controls in the base model. Except for part C, coefficients and standard errors are obtained by applying sampling weights. Unconditional standard errors (clustered at the municipal level) are in parentheses.

b. The standard age cohorts are 7–14 years old and 15–22 years old (parts B and C). The age cohorts defined by risk of gang recruitment (panel A) are 7–11 years old and 12–22 years old

school remains strong and significant, although there is now a positive impact on private school attendance (significant at the 10 percent level). This seems to indicate that homicide rates produce shifts in the public-private choice for the youngest girls. Dropout due to violence, probably among public school students, would be a characteristic of girls approaching puberty.

Another robustness test evaluates the performance of the truce effect on homicides as a measure of crime. This variable is defined as a deviation with respect to the trend in homicides before 2012. If this variable truly reflects

variations in homicides attributed to the truce, one would expect to fail to observe a significant truce effect in a year when a structural change in homicides did not happen. Furthermore, such a placebo control should not have a significant impact on education choices. Part B of table 7 shows estimation results for a placebo truce effect on homicides. This effect is estimated by equation 1 using data for 2005–10 and obtaining fitted values for the homicide rate in 2011. In other words, it represents deviations in 2011 with respect to the previous trend. The mean value for this effect in the panel of municipalities is of 0.005 standard deviations, and it is not statistically significant from zero at the 10 percent level. This is consistent with the assumption that 2011 did not present significant deviations from the preexisting trend, and it supports the idea that the truce effect on homicides in 2012 effectively captures a structural break, likely attributed to the truce. As expected, the average marginal effects are not significant for any of the sample segments. The pattern of signs in the marginal effects is also different from the pattern in panel A of table 6, suggesting that the lack of significance in the marginal effects of the placebo control is not attributed solely to the lack of statistical power due to the use of a noisier control.

Finally, part C of table 7 evaluates the variability of results when sample weights are not used. Although the conclusions remain the same for seven- to fourteen-year-olds, there is a positive impact on the probability of private school attendance for older girls, in a pattern that resembles that for males in the same age group.

Results so far suggest that the reduction in homicide rates due to the truce had a significant impact on education choices, especially for girls under fifteen and boys between fifteen and twenty-two years old. Furthermore, it is shown that homicide rates induce migration within and outside of the education system for young girls and working-age boys. One note of caution is necessary. These effects were obtained using variations attributed to the 2012 truce between gangs, for which a causal interpretation is not strictly guaranteed. The truce was not randomly distributed across municipalities, so there is no control group for comparison. Controlling for the cooperation capabilities of gangs through the sanctuary city status is not a perfect substitute for a propensity score. Furthermore, endogenous measurement error cannot be discarded for either extortions or homicides. Data on extortions are self-reported, so they could reflect underreporting bias.[36] Furthermore, the measurement

36. Svensson (2003).

error on self-reported extortions could also have been affected by the truce. Homicides tend to be less prone to measurement bias because they can be verified with death certificates from the Salvadoran Institute of Legal Medicine. However, gangs can still influence the accounting of homicides by hiding the evidence.

The relationship between crime and education choices has not been studied in detail in El Salvador. Did the 2012 truce affect households' long-term expectations of risk? Is this perception of risk the main driver of the effect of crime on educational inequality? Did households adjust their expenditures as a response to a lower perceived risk? These are important questions that remain unanswered. Finally, open access to data sets with richer characteristics of municipalities would greatly improve the quality of research on crime and education in El Salvador. The Salvadoran Institute of Access to Public Information (IAIP) represents an important first step in that direction.

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