

# The Impact of Gang Violence on Educational Choices in El Salvador

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## Abstract

This paper explores the impact of violent crimes on educative choices of households in El Salvador. It evaluates the relevance of murder rates as explanatory factors of the recent decrease of enrollment rates. It employs panel data for the 262 municipalities in El Salvador, including information regarding educative outcomes and murder rates for the period 2005-2013. Additionally, it employs cross-sectional household survey data in order to account for household level variables, and employs the drop in murder rates due to a truce between gangs in 2012 as a source of exogenous variation for identification. Panel data reveals that the recent country-wide downward trend in enrollment rates is mostly not associated to the variation of murder rates. Micro-data analysis does not find evidence of any significant association between murders and enrollment to the extensive level, although a significant impact is found at the intensive level. The average reduction in murder rates during 2012 is found to have had the equivalent impact of between 1 and 2 additional parental years of schooling on educational expenditures.

JEL Codes: I25, J18, C23

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## 1. INTRODUCTION

El Salvador has been named one of the most violent countries in the world. With murder rates that rise to over 61 per 100,000 inhabitants in 2014, the capital city of San Salvador was the 13<sup>th</sup> most violent city. The heavy presence of gangs and the violent conflict between them is believed the cause of a large share of the murder rates. After a one-year drop from March 2012 due to an unexpected truce between gangs, murder rates have increased considerably, especially during 2015, reaching levels never seen since the end of the civil war in 1992. This recent trend has raised concerns that high murder rates might have a negative impact on enrollment rates, which have already began to decline during the last decade (by as much as 11.3% for compulsory education levels, and 46.3% for high school levels<sup>2</sup>).

Attempting to clarify the relationship between murder rates, and enrollment among primary

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and secondary school students in El Salvador, this research employs city-level panel data for the period 2005-2013 and household-level cross-sectional data from several sources to verify the existence and nature of a significant relationship between violent crime and several educative outcomes such as enrollment and household expenditure in education. A secretly coordinated truce between gangs achieved in March 2012 is used as an exogenous source of variation for identification. The content of this paper is organized as follows: Section 2 briefly introduces the historical background of gangs in El Salvador, and describes the characteristics of the 2012 truce. Section 3 presents the data, introduces the methodology and the identification strategy. Section 4 presents the estimation results, and finally Section 5 concludes.

## **2. VIOLENT CRIME IN EL SALVADOR**

Gang violence in El Salvador is attributable to the war between of two major gangs: the 18<sup>th</sup> Street gang<sup>3</sup> and the MS-13 gang, both of them born in the United States, among the Latin American young immigrants, and brought to Central America by massive deportations, accelerated by the Illegal Immigrant Reform and Immigrant Responsibility Act (IIRIRA) of 1996. The average number of murders per month during the period Jan-2004 to Feb-2012 is roughly 315, with a slight increasing trend, reaching 404 murders in the last month. On March 20<sup>th</sup> of 2012, a truce between the major gangs coordinated by the Minister of Security was announced by the Catholic Church, bringing murder rates to under 260 until March 2014, when declarations by the left party candidate for the presidential elections reduced hopes on the continuation of the truce.

Due to the demographic composition of gang members (mostly males in the 12-24 years range), school-aged children are believed to be an important group at risk. Crime can have an impact on children's educational attainment by several channels. Rud et. al. (2014) finds a robust and significant negative impact of the criminal involvement of parents on their children's educational attainment. Kristoffersen et. al. (2015) show that peer-effects are another way that crime involvement can have an impact on educative attainment. Disruptive children were found to reduce academic achievement as much as a 2% of a standard deviation. At the same time, some authors have shown that educative achievement (Bjerk, 2012) and economic development (Gaviria and Pagés, 2002) can have an impact on crime rates, indicating that reverse causality is an issue of concern, especially in cross-sectional analysis.

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<sup>3</sup> Recently divided into two factions by internal fights, effectively becoming two different gangs.

### 3. DATA AND METHODOLOGY

This research employs data from diverse sources. Panel data analysis employs initial enrollment data for all the 262 municipalities of El Salvador from the Educative Census for the years 2005-2013 by MINED, as well as yearly number of murders registered by the Institute of Legal Medicine of El Salvador (IML). The econometric model is as follows:

$$E_{g,t,i} = \beta_0 + \beta_1 m_{t-1,i} + \beta_2 E_{g-1,t-1,i} + \varepsilon_{g,t} + u_{g,i} + \mu_{t,i,g} \quad (1)$$

Where  $g$  represents the grade,  $t$  is the year, and  $i$  is the municipality index.

$E$  is the initial enrollment rate. Explanatory variables include the murder rate  $m$  of the previous year and the enrollment rate of the previous grade during the previous year in order to account for cohort size. The error is assumed to be composed by time and municipality fixed terms, and a random iid component.  $E$  and  $m$  are rates per 100,000 persons.

Cross-sectional analysis employs data from the Salvadoran Multi-purpose Household Survey (EHPM) 2013 collected by the National Statistics Bureau (DIGESTYC), which has a total sample size of over 85 thousand individuals. The sample is further limited to individuals between 5 to 22 years old who reported being the sons or daughters of the head of household. Population data comes from the estimations by DIGESTYC. The probability of enrollment is expressed as the following Probit model for the  $i$ -th individual living in the  $j$ -th municipal region taken from the sample year  $t \in (2012, 2013)$ :

$$\Phi^{-1}(\Pr(E = 1|X)) = \beta_0 + \beta_{1,t} \text{truce drop}_{j,t} + \beta_{2,t} M2011_{j,t} + \beta_{3,t} M2010_{j,t} + \gamma_t X_{i,j,t} + u_{i,j,t} \quad (2)$$

Truce drop is a variable that represents the reduction in the number of murders per 100,000 individuals in the  $j$ -th municipality between 2011 and 2012. In other words, it is positive for municipalities that experienced a reduction in the number of murders by the end of 2012. This is believed to be an exogenous source of variation due to the unexpected nature of the 2012 truce.  $M2011$  and  $M2010$  represents the murder rate of the corresponding municipality during the years 2011 and 2010 respectively.  $X$  represents a set of individual and family level variables including: age, a dummy variable for female, for married and for urban residence, and continuous variables for the maximum years of education of the parents. It also includes dummy variables for families classified as relatively poor or extremely poor. The model is estimated for two age groups: children from 5 to 14 years old, and children from 15 to 22 years old.

In the case of expenditure in education, it is of interest to understand whether crime rates have a differential impact on the extensive and intensive margins. In order to allow for this kind of flexibility, the analysis is based on a Two-Part Model, which simultaneously estimates the extensive margin by employing a Probit model, and the intensive margin by OLS. Expenditure in education is given in USD per month for each child in the sample. Explanatory variables are the same as in the case of enrollment.

#### **4. RESULTS**

Regression estimates of the linear coefficient, as well as the elasticity between murder rates and enrollment rates for the panel data analysis are presented in Table 1 for each grade in primary and secondary education. Coefficients for the lagged murder rate are negative for all levels, except for 11th Grade, and a significant coefficient can only be found in the case of 8<sup>th</sup> grade to the significance level of 10%. Elasticity estimates are also mostly negative and insignificant at almost all levels, except for grade 12. In both cases, the magnitude of the coefficients is also small, indicating that enrollment rates are inelastic to violence levels and that recent declines in enrollment rates are more likely to be associated to the country's poor macroeconomic performance during the last decade. The Table 2 presents results for the Probit model for enrollment, and the Two-Part Model of expenditure in education. finds no significant impact of the truce in any of the age groups. However, the Two-Part Model estimates indicate that the drop in murders due to the truce period had a significantly positive impact on the three educational expenditures categories equivalent to adding between one and two years of education to the head of household on the 5-14 years old group, and close to two years for the case of enrollment on the 15-22 years old group in the case of enrollment expenditures.

#### **5. CONCLUSIONS**

While panel data estimations show an insignificant association between murder rates and enrollment rates, cross-sectional data analysis seems to indicate that enrollment expenditures were affected by the drop in murders during 2012. One possible explanation for this is that this effect happens mostly on the intensive margin, meaning that some parents react to fluctuations in murder rates by having their children attend cheaper (and possibly, lower quality) schools.

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**Table 1: Panel Data Model Estimation Results**

<b>Panel A: Impact of murder rates on enrollment rates (in levels)</b>												
	<b>Grade 1</b>	<b>Grade 2</b>	<b>Grade 3</b>	<b>Grade 4</b>	<b>Grade 5</b>	<b>Grade 6</b>	<b>Grade 7</b>	<b>Grade 8</b>	<b>Grade 9</b>	<b>Grade 10</b>	<b>Grade 11</b>	<b>Grade 12</b>
Murder Rate (t-1)	-0.298 (0.318)	-0.303 (0.314)	-0.595 (0.398)	-0.229 (0.305)	-0.426 (0.276)	-0.446 (0.417)	-0.202 (0.385)	-0.608* (0.253)	-0.358 (0.272)	-0.061 (0.359)	0.312 (0.196)	-0.279 (0.194)
Enrollment Rate (g-1)(t-1)	0.459*** (0.054)	0.642*** (0.027)	0.720*** (0.047)	0.705*** (0.030)	0.724*** (0.031)	0.718*** (0.028)	0.631*** (0.029)	0.634*** (0.039)	0.679*** (0.026)	0.442*** (0.107)	0.489*** (0.054)	0.267*** (0.032)
R-sq	0.707	0.807	0.799	0.719	0.639	0.559	0.476	0.614	0.698	0.231	0.502	0.556
<b>Panel B: Elasticity of enrollment rates and murder rates</b>												
	<b>Grade 1</b>	<b>Grade 2</b>	<b>Grade 3</b>	<b>Grade 4</b>	<b>Grade 5</b>	<b>Grade 6</b>	<b>Grade 7</b>	<b>Grade 8</b>	<b>Grade 9</b>	<b>Grade 10</b>	<b>Grade 11</b>	<b>Grade 12</b>
Log-Murder Rate (t-1)	-0.009 (0.005)	-0.007 (0.004)	-0.007 (0.005)	-0.002 (0.004)	-0.008 (0.005)	-0.006 (0.005)	-0.010 (0.007)	-0.010 (0.006)	-0.006 (0.005)	-0.022 (0.024)	0.033 (0.025)	0.360*** (0.104)
Enrollment Rate (g-1)(t-1)	0.271*** (0.034)	0.503*** (0.123)	0.644*** (0.113)	0.514** (0.161)	0.467** (0.142)	0.554*** (0.163)	0.542*** (0.109)	0.642*** (0.070)	0.605*** (0.071)	0.590*** (0.156)	0.504*** (0.057)	0.391 (0.279)
R-sq	0.725	0.772	0.725	0.575	0.397	0.375	0.394	0.525	0.610	0.367	0.471	0.702

All regressions include year and municipality Fixed Effects. Robust Standard Errors in Parenthesis. \* p<0.05 \*\* p<0.01 \*\*\* p<0.001.  
 Dependent variable is the enrollment rate (per 100,000 persons) in Panel A and the natural logarithm of the enrollment rate in Panel B.  
 The sample size in all regressions is 1,834 observations.

**Table 2: Cross-sectional Data Analysis Estimation Results: Enrollment and Expenditures**

	<b>Panel A: 5-14 Years Old</b>				<b>Panel B: 15-22 Years Old</b>			
	<b>Enrollment</b>	<b>Total Expenditure</b>	<b>Enrollment Expenditure</b>	<b>Books Expenditure</b>	<b>Enrollment</b>	<b>Total Expenditure</b>	<b>Enrollment Expenditure</b>	<b>Books Expenditure</b>
Truce	-0.0002 (0.0002)	0.0579*** (0.0138)	0.0080*** (0.0018)	0.0045*** (0.0008)	0.0002 (0.0003)	0.0205 (0.0303)	0.0146*** (0.0044)	0.002 (0.0018)
Murder rate 2011	0.0000 (0.0001)	-0.0252** (0.0115)	-0.0052*** (0.0015)	-0.0025*** (0.0006)	-0.0002 (0.0003)	-0.0311 (0.0258)	-0.0094*** (0.0033)	-0.002 (0.0014)
Murder rate 2010	0.0000 (0.0001)	-0.0243*** (0.0082)	-0.0005 (0.0009)	-0.0007 (0.0005)	0.0000 (0.0002)	-0.0459** (0.0184)	-0.0023 (0.0021)	-0.0012 (0.0011)

Values represent marginal effects. Robust Standard Errors in Parenthesis. \* p<0.05 \*\* p<0.01 \*\*\* p<0.001. The sample size is 12,633 observations for the 5-14 years old group and 10,126 observations for the 15-22 years old group. Other controls include age, maximum education of parents and dummy variables for woman, urban, married, extremely poor and relatively poor.