CHAPTER 6

Crime and Punishment in Central America

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INTRODUCTION

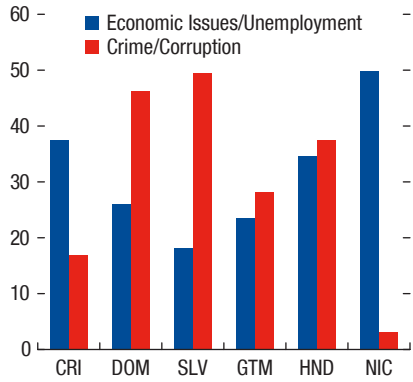
Persistent crime in Central America, including the Dominican Republic (CAPDR), presents one of the biggest challenges to economic development and surpasses unemployment as the most important issue in most countries in the region (Figure 6.1). The Northern Triangle countries—Honduras, El Salvador, and Guatemala—account for 4½ percent of world homicides outside of war, but only ½ percent of the world's population. Aside from human and social costs, crime also distorts economic incentives. Northern Triangle and Dominican firms consistently cite crime and theft as among the five biggest problems for doing business (World Economic Forum 2017). The World Bank (2011) puts losses associated with crime in the Northern Triangle at about 10 percent of annual GDP. Crime tends to disproportionately impact poorer individuals who are unable to protect themselves, and so exacerbates inequality (Davoodi and others 2002).

Crime and economics are intrinsically linked. Theoretically, crime has direct and indirect costs. Direct costs include the share of output (goods and services) and resources (labor productivity of both victims and criminals) lost due to theft, robbery, murder, and other crimes, and the resources spent on security costs—public and private—that otherwise could have been used on productive activity. Indirect costs are potentially much larger. They include lower economic activity as individuals internalize the direct costs of crime. Examples include fewer employment opportunities, higher outward migration, the erosion of institutions, and corruption. All these outcomes, in turn, exacerbate crime and generate a vicious cycle.

While many studies have examined the negative relationship between crime and growth, starting with a seminal paper by Becker in 1968, much of this work remains hindered by both measurement and analytical issues, including:

- Crime is inherently hard to measure. First, definitions of crime differ across countries and time, complicating cross-country comparisons. A criminal action in one country is not necessarily illegal in another. Second, data on crime is often inaccurate and underreported, especially in emerging economies. For example, victimization surveys often indicate higher crime rates than official statistics (IMF 2017). To cut measurement error to a minimum, this chapter focuses primarily on homicide rates as the most consistent and

Figure 6.1. Crime as the Priority Problem for Central America
(Percent of respondents indicating the corresponding issue is important)



Source: Latinobarometro, 2016.
Note: CRI = Costa Rica; DOM = Dominican Republic; SLV = El Salvador; GTM = Guatemala; HND = Honduras; NIC = Nicaragua.

accurate measure of crime across countries. For comparison, robbery rates are also considered.

- Crime's effect on economic growth is difficult to isolate. The vicious cycle between growth and crime muddles causality. To identify its effect on growth, first, we instrument crime using criminal deportations from the United States (for homicides) and gun ownership (for robberies). These variables affect crime but have no direct impact on growth. Second, the effect of crime and labor market policies on economic and criminal activity is analyzed within a structural general equilibrium framework.

With this in mind, and with a focus on better understanding the economic drivers of crime in CAPDR, this chapter brings together an overview and examination of the facts about crime in CAPDR, an estimate of crime's causal impact on the region's economic growth, and case studies for Honduras and El Salvador that illustrate different approaches to fighting crime.

Criminal choices and policy options are featured within a structural general equilibrium framework that represents the first attempt to address the relationship of crime and output in Central America, and is one of the few attempts to incorporate crime into a macroeconomic model.[1] The model supports estimates

[1]Engelhardt, Rocheteau, and Rupert (2008) and Huang, Laing, and Wang (2004) present search frameworks calibrated to data from the United States that are the closest to the model described in this chapter. Both papers focus on how employment, not output or growth, interacts with crime in the United States.

that the direct and indirect effects of crime in Central America suppress economic activity by as much as 16 percent of GDP. If CAPDR countries were able to bring crime rates down to the world average, economic growth would improve by about half a percentage point a year for the Northern Triangle countries and marginally for other Central American countries, according to other analysis in this chapter (Box 6.1).

Policy implications to improve countries' policies toward crime include deterrence, enforcement, and community engagement that supports economic development and more broadly tackles the root causes of crime.

SOME FACTS ON CRIME IN CAPDR

Rates of violent crime in Central America are among the highest in the world, driven by the Northern Triangle. El Salvador and Honduras have the two highest homicide rates in the world—109 and 64 for every 100,000 people in 2015.[2] These rates (Figure 6.2) are also significantly above the Latin America and Caribbean (LAC) average of 23 and the world average of 8 per 100,000 people recorded in the same year. At the same time, only 5 percent of homicides in CAPDR result in a conviction in comparison with 24 percent in Latin America and 43 percent globally (UNODC 2013). These patterns have contributed to significant emigration, predominantly to the United States. In 2014, nearly 2.8 million people from the Northern Triangle lived in the United States.[3] Between October 2009 and September 2016, nearly 140,000 unaccompanied minors from the region crossed into the United States.[4]

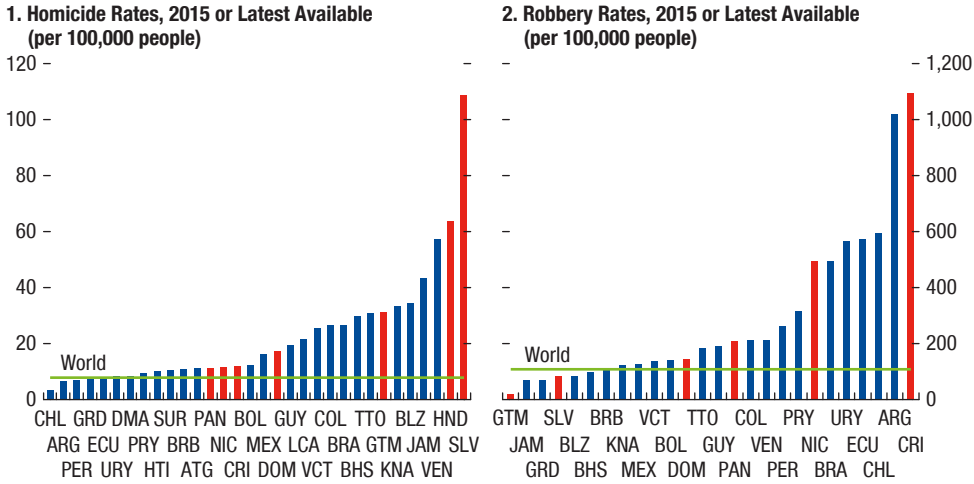
By contrast, robbery rates in the Northern Triangle countries are relatively low, likely reflecting significant underreporting in some countries. Guatemala and El Salvador report robbery rates of 19 and 84 per 100,000 people, below the world average of 106. On the other hand, the highest reported robbery rate in LAC is in Costa Rica which, at 1,096 per 100,000 people, is one of the highest in the world, even as it has a homicide rate of 11 per 100,000 people. While these numbers could have some comparison value, they are likely driven by different reporting behaviors, reflecting factors such as a country's development level, institutional strength, and confidence in government, which in turn affect the crime rate.

[2]Honduras is missing data on robberies for 2015 and, therefore, is not included in the small graphic.

[3]While crime is a significant driver of recent migration patterns from the Northern Triangle, other factors have historically also been important (for example, conflict in home country). See IMF Working Paper 17/144 for discussions of different drivers.

[4]US Customs and Border Protection, *Southwest Border Unaccompanied Alien Children Statistics FY 2016* (https://www.cbp.gov/site-page/southwest-border-unaccompanied-alien-children-statistics-fy-2016). According to the reports by the United Nations and the American Immigration Council, most unaccompanied children are fleeing "join or die" gang threats.

Figure 6.2. Crime in Latin America and the Caribbean



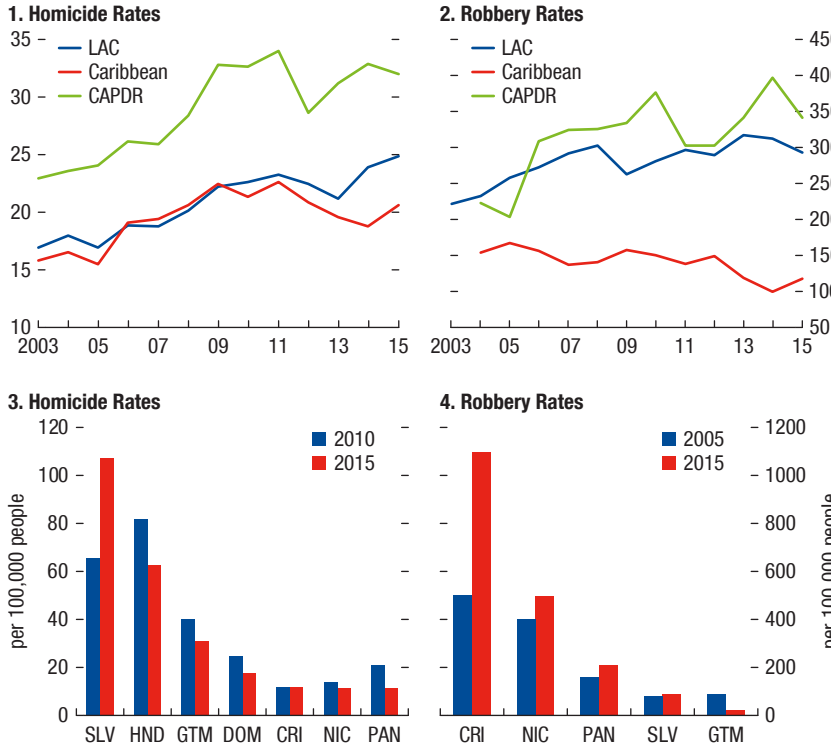
Sources: World Development Indicators; United Nations Office on Drugs and Crime; and IMF calculations.
Note: ARG = Argentina; ATG = Antigua and Barbuda; BHS = The Bahamas; BLZ = Belize; BOL = Bolivia; BRA = Brazil; BRB = Barbados; CHL = Chile; COL = Colombia; CRI = Costa Rica; DMA = Dominica; DOM = Dominican Republic; ECU = Ecuador; GRD = Grenada; GTM = Guatemala; GUY = Guyana; HND = Honduras; HTI = Haiti; JAM = Jamaica; KNA = Saint Kitts and Nevis; LCA = Saint Lucia; MEX = Mexico; NIC = Nicaragua; PAN = Panama; PER = Peru; PRY = Paraguay; SLV = El Salvador; SUR = Suriname; TTO = Trinidad and Tobago; URY = Uruguay; VEN = Venezuela; VCT = Saint Vincent and the Grenadines.

Homicide rates in CAPDR have remained relatively constant since peaking in 2011. In 2010, Honduras was the most violent country in the world, but the homicide rate dropped by about 30 percent to 64 homicides per 100,000 inhabitants in 2015 (Figure 6.2). By contrast, El Salvador started from a similar level, but homicides have increased substantially. Factors behind these developments are examined in the case studies. Other countries have generally improved their security, although robbery rates for all CAPDR countries have increased since 2005, potentially driven by improved reporting (Figure 6.3).

A significant factor behind these high crime levels is drug trafficking. The 2017 US State Department International Narcotics Control Strategy Report estimates that 90 percent of cocaine trafficked to the United States in the first half of 2015 passed through Central America. UNODC (2012) estimates the value of cocaine that passed through Honduras in 2010 was equivalent to 13 percent of the country's GDP, or nearly two-thirds of spending on crime prevention in the entire region that year.

Victimization surveys are an important complement to official crime data (Figure 6.4). Robbery rates reported in these surveys for Guatemala and El Salvador are some of the highest in the region, in contrast to the official statistics. Nearly 800,000 Salvadoran residents, or 14 percent of Salvadoran residents,

Figure 6.3. Crime Trends in Central America

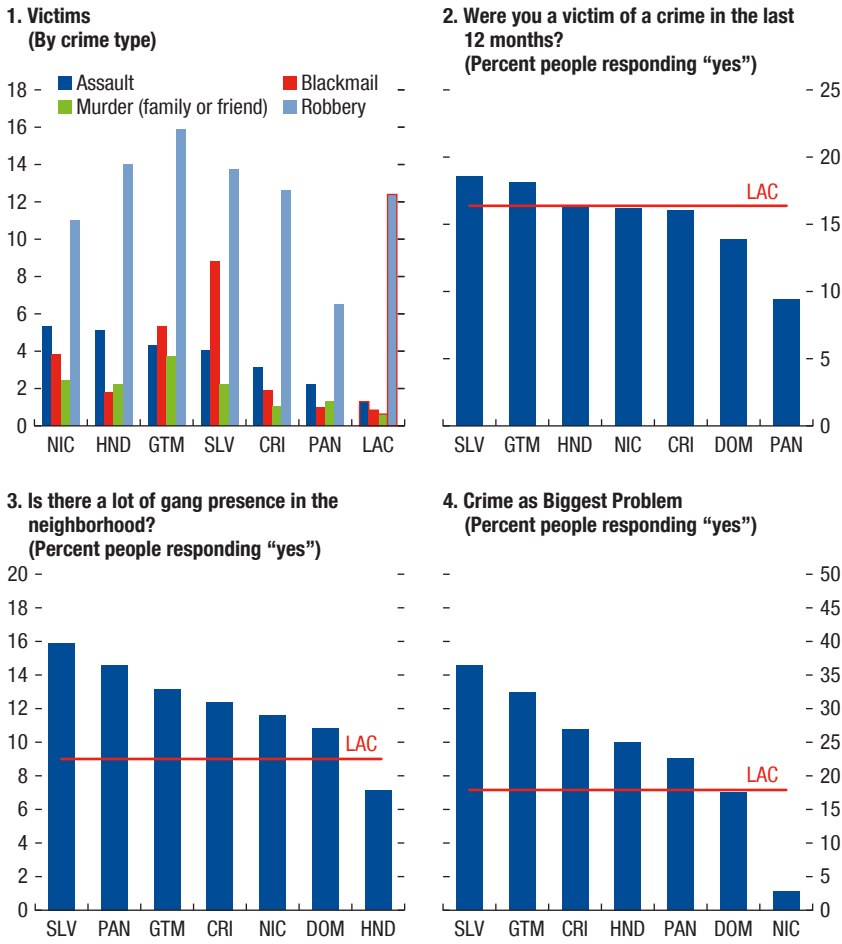


Sources: United Nations Office on Drugs and Crime; and IMF staff calculations.
Note: For convenience, references to Central America refer to the IMF subregion Central America, Panama, and the Dominican Republic (CAPDR). The Central American countries in this group are: Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua.

reported having been victims of robbery in 2012. That is 130 times higher than the 5,521 registered reports of robbery. Furthermore, the incidence of assault, blackmail, and murders in all CAPDR countries is higher than the LAC average, according to victimization surveys.

Victimization surveys also paint a picture of a region plagued by gangs and where tackling crime is a priority. Over 14 percent of people in Guatemala, Panama, and El Salvador say there is "a lot of" gang presence in their neighborhoods. Interestingly, Panama enjoys relatively low homicide rates, yet residents report a significant gang presence. Only 7 percent of Hondurans report significant gang presence, reflecting still low average gang membership compared to Guatemala and El Salvador (see, for instance, Seelke 2016). Over one-fifth of people surveyed in CAPDR countries except Nicaragua identify crime as their country's biggest problem.

Figure 6.4. Evidence from Victimization Surveys



Sources: Latin America Public Opinion Project and IMF staff calculations.
Note: CRI = Costa Rica; DOM = Dominican Republic; GTM = Guatemala; HND = Honduras; LAC= Latin America and the Caribbean; NIC = Nicaragua; PAN = Panama; SLV = El Salvador.

CAUSAL LINK BETWEEN CRIME AND GROWTH

What is the effect on growth of such elevated crime levels? Reverse causation complicates the estimation of the causal link between crime and growth. While crime poses costs and hindrances to economic growth, growth also lowers the relative payoff of criminal activity—by generating more economic opportunities.

To establish the causal effect of homicide on growth, this chapter follows Blake (2017), using deportations from the United States as an instrument for crime.

Changes in the number of criminal deportees from the United States provide an exogenous source of variation to crime rates because such changes do not directly impact growth other than through their effect on crime. A potential criticism of this approach is that deportees may enter the labor force back in their home country and impact growth through that channel.

While robbery rates suffer from mismeasurement issues discussed in the previous section, they are also included in the analysis for comparison. Gun ownership rates are an instrument for robbery rates, as ownership has been found to affect burglaries and robberies (Cook and Ludwig 2002), but are unlikely to directly impact growth.

Deportations from the United States

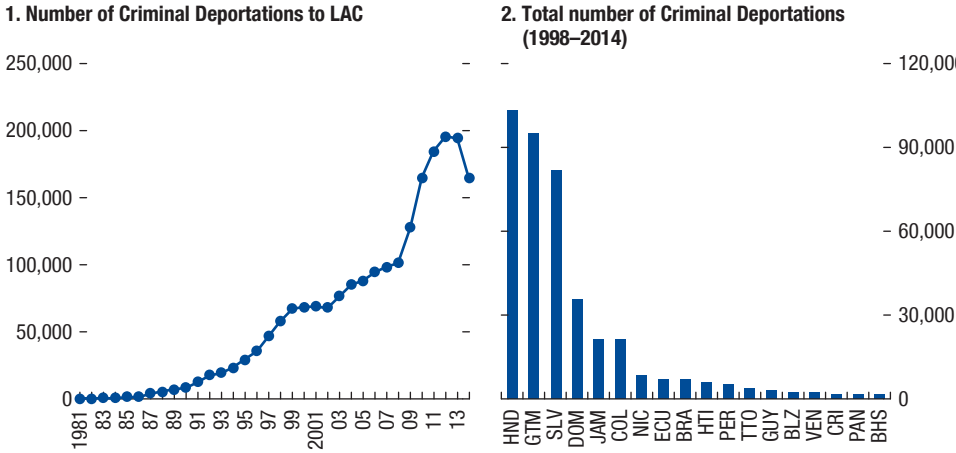
US immigration laws significantly changed throughout the 1980s and 1990s. The Immigration Reform and Control Act of 1986 removed discretion from deportations and made them mandatory for people convicted of a set of "deportable" crimes. Together with the Anti-Drug Abuse Act of 1988, this law resulted in the immediate deportation of any non-citizen convicted of an aggravated felony crime (including offenses such as murder, dealing drugs, and firearm trafficking). The list of deportable crimes was expanded in the 1990s to include money laundering, theft and burglary, prostitution, tax evasion, armed assaults, some types of fraud, drug possession, and shoplifting, with deportation applicable retroactively for the expanded list of crimes. Immigrants previously convicted of any deportable offense became subject to criminal deportation, including naturalized US citizens who committed offenses before obtaining citizenship. Effectively, any non-citizens sentenced to one year or more in prison were deported, even if the sentence was suspended. Total deportations from the United States between 1998 and 2014 almost tripled, with several CAPDR countries leading the count (Figure 6.5).

The results of the estimation (Box 6.1) indicate that if CAPDR countries were to bring their crime rates down to the world average, GDP growth could be around 0.6 percentage point higher a year for El Salvador, 0.5 percentage point higher for Honduras, 0.3 percentage point higher for Guatemala, and 0.1 percentage point higher for the other CAPDR countries. On a cumulative basis, El Salvador and Honduras lost over 9 and 8 percentage points of GDP, respectively, due to their higher-than-world-average crime rates during the analysis period.

The estimated effect for robberies is only significant at the 10 percent level, and lower for most countries. The effect ranges from 0 (Guatemala) to 0.5 percentage point a year for Costa Rica.

The estimation results described in Box 6.1 should be interpreted carefully because they are skewed by underreporting; the estimated effect of robberies on growth in Costa Rica (where underreporting of robberies is supposedly less serious) is quite large, and comparable to the effect of homicides for CAPDR countries' growth (Figure 6.6). This hints at a potentially significant (and yet underestimated) effect of robberies (and crimes other than homicides) on growth.

Figure 6.5. Deportations from the United States



Sources: Sourcebook of Criminal Justice Statistics; US Department of Homeland Security; and IMF staff calculations.
Note: BHS = The Bahamas; BLZ = Belize; BRA = Brazil; COL = Colombia; CRI = Costa Rica; DOM = Dominican Republic; ECU = Ecuador; GTM = Guatemala; GUY = Guyana; HND = Honduras; HTI = Haiti; JAM = Jamaica; NIC = Nicaragua; PAN = Panama; PER = Peru; SLV = El Salvador; TTO = Trinidad and Tobago; VEN = Venezuela. LAC = Latin America and the Caribbean.

Box 6.1. Instrumental Variables for Judging the Effect of Crime

The effect of crime on growth is estimated using a two-stage least squares method with a large panel data set for Latin America and the Caribbean.[5] At the first stage, a connection is established between homicides and robberies (as the dependent variables) and deportation rates and gun ownership rates (the explanatory variables). At the second stage, GDP growth is regressed on the instrumented homicide and robbery rates while controlling for other economic or social determinants of economic growth (X_{it}), including the level of PPP-GDP, government consumption, inflation, trade, foreign direct investment, the poverty rate (all lagged), years of schooling, population growth, capital account openness, changes in terms of trade, and dummy variables for legal origin, disaster, and war.[6]

[5] The data set includes 34 Latin American and Caribbean countries over the period from 1995 to 2014. Deportation and homicide rates are included on a per capita basis (per 100,000 persons). The immigration data including number of criminal deportations are published annually on a country level basis in the *Yearbook of Immigration Statistics* by the US Department of Homeland Security. Criminal deportation refers to persons removed who have a prior criminal conviction, and it may include immigration- and smuggling-related crimes but excludes deportations based on immigration rules violations.

[6] These are standard control variables in the growth literature (see for example Ghosh and Phillips 1998, or Ostry, Berg, and Tsangarides 2014).

Box 6.1. Instrumental Variables for Judging the Effect of Crime *(continued)*

First stage:

$$\ln homicides_{it} = \lambda_1 \ln deportations_{it} + \eta_1 \ln gunowned_{it} + \gamma_1 X_{it} + \epsilon_{1_{it}}$$

$$\ln robberies_{it} = \lambda_2 \ln deportations_{it} + \eta_2 \ln gunowned_{it} + \gamma_2 X_{it} + \epsilon_{2_{it}}$$

Second stage:

$$\Delta GDP_{it} = \alpha \ln \widehat{homicide}_{it} + \beta \ln \widehat{robberies}_{it} + \mu X_{it} + \delta_{it}$$

Results are reported in Box Table 6.1.1 below

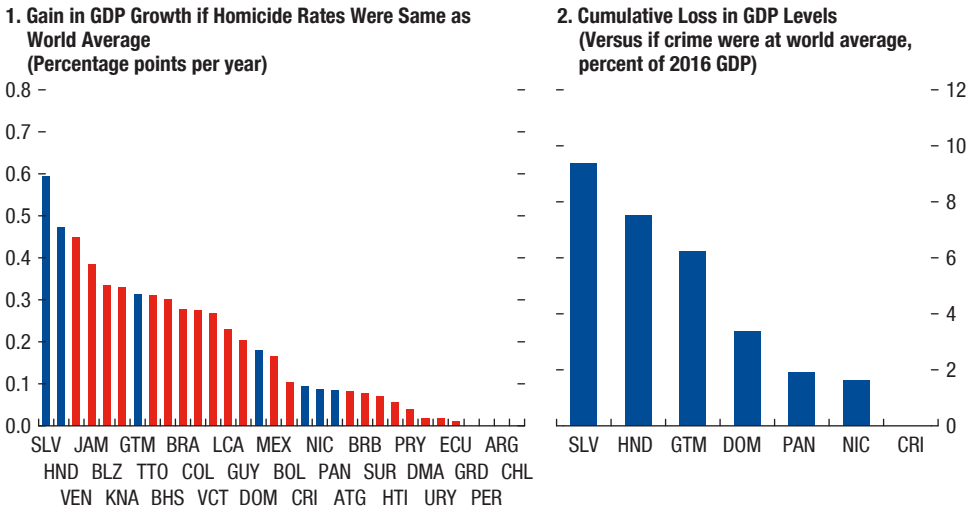
BOX TABLE 6.1.1

Dependent Variable: GDP Growth

VARIABLES	(1) Naïve version	(2) 2SLS	(3) GMM
ln Homicide rates	−0.0419	**−0.210***	**−0.225***
	(0.0861)	(0.127)	(0.119)
ln Robberies	0.204***	**−0.147**	**−0.119**
	(0.0783)	(0.341)	(0.302)
GDP-PPP per capita (lagged)	1.72e-05	4.21e-05	4.97e-05**
	(1.38e-05)	(2.75e-05)	(2.16e-05)
Government Consumption (lagged)	0.00970	−0.00436	−0.0190
	(0.0199)	(0.0264)	(0.0205)
Inflation (lagged)	−0.0115	−0.00634	−0.00941
	(0.00784)	(0.00939)	(0.0127)
Trade Openness (lagged)	0.00741***	0.00791***	0.00670***
	(0.00231)	(0.00254)	(0.00213)
FDI (lagged)	0.00752	0.0104	0.0102
	(0.0177)	(0.0184)	(0.0205)
Ave. Years of Schooling	0.00560	0.0182	0.0134
	(0.0497)	(0.0717)	(0.0756)
Change in Population	0.0177	0.0425	0.0742
	(0.103)	(0.121)	(0.119)
Capital Account Openness	0.320	0.0174	−0.170
	(0.228)	(0.321)	(0.279)
Change in Terms of Trade	1.691**	1.400*	1.148
	(0.811)	(0.844)	(0.883)
English legal origin?	−0.620***	−0.898**	−0.914**
	(0.230)	(0.454)	(0.415)
Disaster	−0.356**	−0.408**	−0.340**
	(0.157)	(0.164)	(0.152)
War	−0.228	−0.107	−0.156
	(0.177)	(0.210)	(0.170)
Poverty rate (lagged)	−0.0127***	−0.0124**	−0.0116**
	(0.00388)	(0.00549)	(0.00497)
Constant	0.102	2.441	2.630*
	(0.819)	(1.761)	(1.547)
Observations	191	191	191
R-squared	0.289	0.202	0.202

Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Figure 6.6. Effect of Homicides on GDP Growth



Source: IMF staff calculations.
Note: ARG = Argentina; ATG = Antigua and Barbuda; BHS = The Bahamas; BLZ = Belize; BOL = Bolivia; BRA = Brazil; BRB = Barbados; CHL = Chile; COL = Colombia; CRI = Costa Rica; DMA = Dominica; DOM = Dominican Republic; ECU = Ecuador; GRD = Grenada; GTM = Guatemala; GUY = Guyana; HND = Honduras; HTI = Haiti; JAM = Jamaica; KNA = Saint Kitts and Nevis; LCA = Saint Lucia; MEX = Mexico; NIC = Nicaragua; PAN = Panama; PER = Peru; PRY = Paraguay; SLV = El Salvador; SUR = Suriname; TTO = Trinidad and Tobago; URY = Uruguay; VCT = Saint Vincent and the Grenadines; VEN = Venezuela.

STRUCTURAL FRAMEWORK

A structural approach confirms the important influence of crime on growth and facilitates evaluation of the impact of labor policies and output growth on crime, and the effect on economic activity of policies aimed at mitigating crime. The structural model presented in this section is based on Plotnikov (2019).

The general equilibrium framework in this section puts together key transitions for firms (job creation and production) and for workers: (1) employment and unemployment, (2) the choice between criminal and productive activities and (3) prison spells and the return to the labor market. The determinants of flows between these states are examined as part of the attempt to assess the relationship between economic output and crime.

Crime's Effect on Firms and Workers

The model builds on the standard Diamond-Mortensen-Pissarides (DMP) search framework. There are two types of agents: workers and firms. The main features of the model, including its interaction with crime, are presented here with additional details in Appendix 6.1 and in Plotnikov (2019). A search and matching

framework is a natural environment to study flows between employment, unemployment, criminal activity, and prison (Figure 6.7). The framework incorporates the frictions that exist in real world labor markets (such as costs of posting vacancies and searching) and generate unemployment in equilibrium.

The general idea behind the model is that individuals and firms can calculate a value of being in each possible state (vacancy and production for firms; employment, unemployment, criminal activity for individuals) given the underlying parameters. A higher value of employment relative to crime increases transition flows toward employment. Search frictions ensure that the flows are not instantaneous. A policy action changes the value of potentially every state, altering the transition flows among states and the number of economic agents in every state.

Representative firms post vacancies at a cost c per period. Similarly, individuals who are unemployed search for a job. Unemployed individuals and firms with vacancies meet randomly. The number of matches per time period is determined by a matching function $m = m(u, v)$, where u is the number of unemployed individuals and v is the number of firms with vacancies. Therefore, the probability per period of a firm filling an existing vacancy is $q = \frac{m}{v} = q(\theta)$, where $\theta = \frac{v}{u}$ is the labor market tightness. Similarly, the probability of a worker finding a job is equal to $\frac{m}{u} = \theta q(\theta)$[7].[8]

The present-discounted value of expected profit from an occupied job, V_J, can be written as

$$V_J = \frac{c}{q(\theta)} = \frac{\alpha(p - w)}{r + \lambda} \quad (1)$$

where c is the cost of posting a vacancy per period, p is labor productivity, w is the wage of a worker, r is the discount rate, λ is the exogenous job destruction rate, and $0 < 1 - \alpha < 1$ is the crime rate.

Equation (1) states that the present value of an open vacancy (left side) must equal the present value of the filled job (right side). This equation is standard in the search literature (for example, Pissarides 2000) except for the crime rate. The crime rate enters the equation under the assumption that after the firm produces output, a criminal steals it with probability $1 - \alpha$ and the affected firm and worker receive zero income in the same period. With probability α, a firm's output p is produced with no disruptions and is split between wage w and firm's profit $p - w$. Thus, criminal activity in the model can be interpreted as any economic disruption of production, including extortion by gangs through a "war tax," fraud, corruption, and theft of assets. An indirect effect of crime on job creation is clearly illustrated here: crime reduces expected profits and therefore leads to less vacancy posting, all else equal.

An unemployed worker receives z per period, representing gains from leisure or unemployment benefits. With probability $\theta q(\theta)$ an unemployed person finds a job, and with probability $1 - \theta q(\theta)$ the person continues to be unemployed in the next period. Employed individuals receive wage w per period with probability

[8]Assuming homogeneity of degree of one of the matching function m.

α, if the contracting firm is not affected by crime, and zero with probability 1 – α if the firm is victimized. After the crime uncertainty is realized, the match is destroyed with exogeneous probability λ. If the match is destroyed the worker becomes unemployed and the firm opens a vacancy. Under these assumptions, the values of being employed, V_w, and unemployed, V_u, are:

$$r V_w = (1 + r) \frac{\lambda z + \alpha w(r + \theta q(\theta))}{\lambda + r + \theta q(\theta)} \tag{2}$$

$$r V_u = (1 + r) \frac{z(\lambda + r) + \alpha w \theta q(\theta)}{\lambda + r + \theta q(\theta)} \tag{3}$$

Clearly, crime influences the present values of being employed, V_w, and unemployed, V_u (see annex for derivation of equations (2) and (3)). The value of being employed in the presence of crime ($\alpha < 1$) is lower than in a world without crime ($\alpha = 1$).

Accounting for Organized Crime

The model includes full-time rather than petty criminals, consistent with the prevalence of gangs in CAPDR. The transition rate into crime, b, is endogenous in the model and is such that individuals experience indifference between searching for a job and becoming a criminal.[9] In equilibrium, every period a share b of unemployed individuals receives the opportunity to become criminals.

In the model, criminals earn per period income w_B (see equation (5)) and go to jail with exogenous probability η. The parameter $0 < \eta < 1$ measures overall effectiveness of the police and the judicial system in catching and prosecuting criminals, with higher values representing a more effective system. Criminals that have not been arrested continue to be criminals in the next period.

Prosecuted criminals are sent to jail where they earn zero income and transition into the unemployment pool with probability ξ, which represents the average sentence duration once a criminal is convicted.[10] The value of criminal activity V_B can be expressed as

$$V_B = \frac{\left(1 + r\right) w_B + \eta\left(\frac{\xi}{r + \xi}\right) V_U}{\eta + r} \tag{4}$$

which, given assumptions, means that $V_B > V_U$ (that is, it is better to be a criminal than unemployed). Thus, criminal activity becomes less attractive if (1) the prosecution rate η increases, (2) the average sentence length increases (lower ξ) or (3) if the per-period income of criminal activities decreases.

How is the criminals' income, w_B, determined? For simplicity, the entire stolen income, which includes both wages and firms' profits, is assumed to be uniformly distributed across active criminals:

[9]This condition is required for coexistence of productive and criminal activities in the long term.

[10]Note that lower values of ξ correspond to longer sentences.

$$w_B = \frac{p(1-\alpha)N_L}{N_B} \tag{5}$$

where N_L is the number of producing firms—which equals the number of employed individuals—and N_B is the number of active criminals. The aggregate crime rate $1-\alpha$ is an increasing function of the number of active criminals. Under certain regularity conditions, $\alpha(N_B)$ has the following two properties: (1) if there are no criminals, the first criminal will make an infinite profit; (2) two criminals together "steal" more output than one, but receive less income per person. This ensures the existence of an equilibrium with positive crime (see Plotnikov 2019).

Occupational Choices and Transitions

For productive and criminal activities to coexist in the steady state individuals must be indifferent between searching for a job or becoming a criminal. Therefore:

$$b\,V_B + (1-b)\,V_U = \theta q(\theta)\,V_w + \left[1-\theta q(\theta)\right] V_u \tag{6}$$

Equation (6) determines the transition rate to criminal activity, b and implies that the expected present value of becoming a criminal (left side) is equal to the expected present value of legal activities (right side).

In the steady state of the model, every period the unemployed pool grows with workers whose match was destroyed and ex-convicts released from jail and it decreases as workers find jobs or become criminals. The number of criminals grows as the unemployed transition in and shrinks as criminals are captured/convicted. The number of individuals in jail increases due to inflow of convicted criminals and decreases as convicts are released. Figure 6.7 summarizes flows within the model with corresponding per period rates.

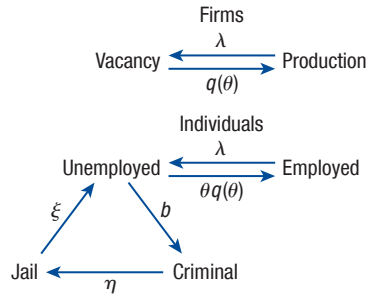
Results and Policy Experiments

The calibrated model implies a GDP loss of about 16 percent, through direct and indirect effects. About 13 percent is lost directly due to crime (that is if all crime were eliminated), while 3 percent is lost to its indirect effects.[11] Direct losses are in line with existing estimates in the literature (Jaitman 2017), although closer to the upper bound of the range. The main reason is that this measure of the cost of crime includes not only forgone labor income (the largest cost of crime mentioned in Jaitman 2017) but also firms' lost profits. The estimated direct cost is below the cost of 16 percent of GDP for El Salvador and a slightly higher number for Honduras, both calculated by the UN Development program and quoted by the *Economist* in 2016.

One of the advantages of using the model is the possibility of estimating the indirect effect of crime. It is impossible to calculate it directly from the data

[11]For simplicity, the model is calibrated for Honduras but qualitative results hold for other Northern Triangle countries. Details are in the Annex 6.1.

Figure 6.7. Flow Chart of State Transitions in the Model



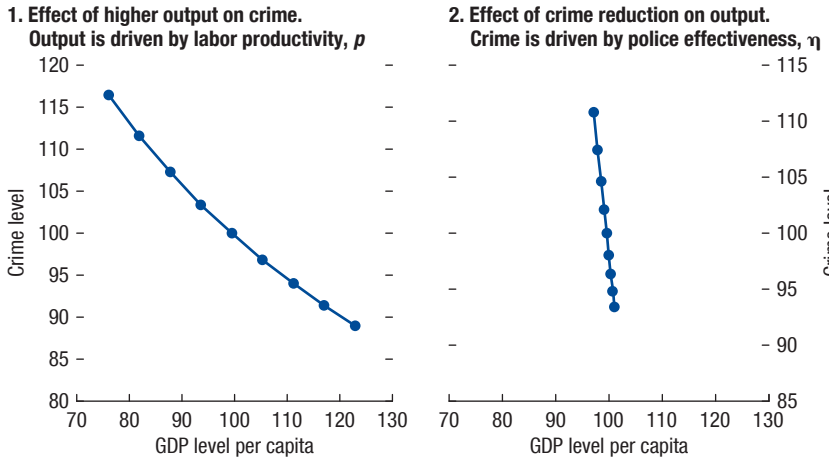
Source: Plotnikov (2019).

because doing this requires an estimate of the counterfactual level of employment in the absence of crime. However, it can be calculated in the model by setting $\alpha = 1$. The implied indirect cost of crime is an additional 25 percent of direct cost of crime (3 percent of GDP under the parameters used), measured by lower equilibrium output and employment due to crime. Labor demand is reduced because firms post fewer vacancies in expectation of lower returns from production (equation (1)). Labor supply is reduced because workers foresee lower returns from working (equation (2)).

The discussion now turns to the question that motivated the use of the model: the relationship between crime and output. Many underlying factors lead to the inverse relationship between crime and output observed in the data. The model quantifies the effects of two factors: one directly associated with output and only indirectly with crime, and other directly associated with crime and only indirectly with output.

The model implies that on average a 1 percent increase in output per capita, driven by an increase in labor productivity p, implies about ½ percent decline in crime. To see this, Figure 6.8, panel 1, shows how crime rate and GDP per capita change when labor productivity varies from 80 percent of its steady state value to 120 percent of its steady state value (in 5 percent increments, see markers). The initial level of output and crime is normalized to 100. As productivity improves, legal activity becomes more attractive than criminal activity. Although existing criminals also receive higher income from higher growth, the higher profitability of the legal employment outweighs these gains. Higher firm profits in turn encourage more firms to enter the market, thereby expanding employment. The effect is nonlinear: the positive incremental effect on crime shrinks as productivity reaches higher levels. Crime is a multiplier between productivity and observed output: if productivity increases (decreases) by 10 percent, output per capita increases (decreases) by about 11 percent, while if the increase (decrease) is twice as big, output increases (decreases) by 23 percent.

Figure 6.8. Relationship between Crime and Output



Source: Model simulations or author calculations.

The model suggests that on average a decrease of about 5¼ percent in crime, driven by an increase in police effectiveness η, leads to about a 1 percent increase in output per capita. Figure 6.8, panel 2, presents the impact of changes in police effectiveness (again, in 5 percent increments of η) on output and crime. A 20 percent increase in police effectiveness, where by way of example the prosecution rate increases from 4 percent to 4.8 percent, decreases crime significantly—by about 7 percent. Again, effects are nonlinear and the positive effect from increased policing on output and crime shrinks at higher levels.

Next comes examination of the effects of three policy variables on crime and growth: (1) the leisure value of unemployment/recreational activities, (2) reducing barriers to entry for firms, and (3) higher unionization. The results of these experiments are summarized in Table 6.1.

Table 6.1 shows that increasing unemployment benefits or providing recreational activities for the unemployed reduces crime and improves output. Intuitively, increasing z makes crime less attractive by reducing the gap between the payoff of being a criminal and continuing to look for a job. Thus, the criminal population declines, which in turn improves the attractiveness of legal activities and increases output as less is lost to crime. However, the effect is small and is not welfare-improving. Why? Increasing the value of unemployment is costly (especially if one interprets z as unemployment benefits) and discourages job seeking. Therefore, providing higher unemployment benefits or recreational activities for high-risk youth can help reduce crime in the short term and increase trust in policing authorities, but in the medium term these policies should be complemented with job training and education to encourage reentry into the employed labor force.

TABLE 6.1.

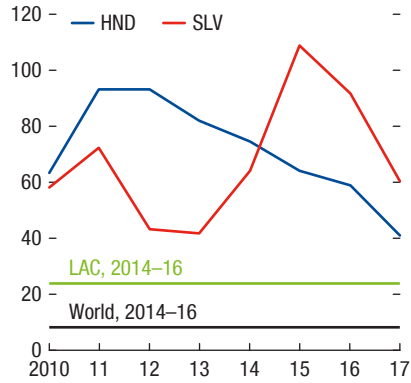
Effects of Policy Experiments on Crime and Growth								
Change in the policy variable, percent of sum of squares value	**−20**	**−15**	**−10**	**−5**	**+5**	**+10**	**+15**	**+20**
	Leisure value/Outside activities, *z*							
Crime, percent	0.4	0.3	0.2	0.1	−0.1	−0.2	−0.3	−0.4
Output per capita, percent	−0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
	Vacancy cost/Barriers to entry, *c*							
Crime, percent	−13.2	−9.9	−6.6	−3.3	3.3	6.5	9.8	13.1
Output per capita, percent	3.8	2.8	1.9	0.9	−0.9	−1.8	−2.8	−3.7
	Worker's bargaining weight/Unionization, β							
Crime, percent	−24.4	−19.1	−13.3	−7.0	7.9	16.9	27.6	41.1
Output per capita, percent	6.7	5.2	3.6	1.9	−2.1	−4.5	−7.4	−10.9

What constitutes z matters. For example, providing recreational activities to at-risk youth or organizing police fairs—as is currently done in Honduras—can increase trust in policing and, as a result, indirectly boost police effectiveness, η.

Reducing vacancy-posting costs is beneficial for both output and security (see Table 6.1). Vacancy-posting costs can be interpreted as hiring expenses, on-the-job training, or a flow-equivalent entry cost for firms. A decrease in these costs would imply that more firms will find it profitable to enter the market and start production once vacancy is filled. Vacancies posted by these additional firms will boost the job finding rate, employment, and therefore the value of legal activities. As relative attractiveness of criminal activities falls, the numbers of criminals decreases, reducing the crime rate. The model implies that 10 percent reduction in the vacancy cost per period reduces crime by 6.6 percent and improves output by almost 2 percent. In addition, since a fixed entry cost is most binding for firms with lower productivity, reducing it will lower inequality.

Table 6.1 also shows that, in the presence of crime, boosting attractiveness of legal employment by increasing wages through higher unionization or higher minimum wages might backfire. In the presence of crime, one may also wonder if higher bargaining power for workers (which can also be interpreted as higher minimum wage) will encourage the switch from crime into employment. Interestingly, the model shows that such policy would be detrimental to both growth and security. The reason for this is that, in the presence of crime, incentives for firms to enter the labor market are already weak. Increasing the bargaining power of workers reduces it further, resulting in lower vacancies. This in turn leads to a lower job finding rate and employment, encouraging criminal activity as an alternative. Fundamentally, increasing the bargaining power of workers has a purely redistributional effect, it generates no surplus and reduces firms' payoff for job-creation. That said, the negative effect on the economy is likely to be significantly lessened, as higher unionization is likely to push the economy toward informality rather than criminal activity, which is the only alternative to legal activity available in the model.

Figure 6.9. Homicide Rates in Honduras and El Salvador
(Per 100,000 inhabitants)



Source: United Nations Office of Drugs and Crime, Insight Crime.
Note: HND = Honduras; SLV = El Salvador.

CASE STUDIES

This section presents case studies of two countries in the region that have had very different approaches to crime. Honduras had higher crime than El Salvador in the beginning of the 2010s but that situation has since reversed (Figure 6.9). The case studies analyze the policies that contributed to this dynamic.

Honduras

Despite the decline in both the amount of drug trafficking and the homicide rate since the beginning of the 2010s, Honduras remains a major stop in the cocaine route to the United States. As in other Northern Triangle countries, the value of drug trafficking, a major factor behind crime and violence, declined from about 13 percent of national GDP in 2010 to about 5½–7½ percent in 2015.[12] This decline contributed to the drop in homicides—by more than 30 percent—over the same period. However, the still enormous drug trade value, together with persistently high poverty (about ⅔ of population live in poverty according to the national definition), weak institutions, low education levels, and wide availability of firearms, continue to fuel still-high violence.

To reduce homicides and drug trafficking, Honduras targeted police operations and crime prevention programs in the highest crime areas, and improved its

[12]This is calculated combining the amount of cocaine reported in the 2017 International Narcotics Control Strategy Report of the US State Department and wholesale prices of cocaine reported in World Bank (2011).

police force. Security resources were increased substantially to support these operations. As a percentage of GDP, the budget of Ministry of Security rose by 20 percent from about 1 percent of GDP in 2012 to 1.2 percent in 2017. The defense budget was increased even more—from 0.8 percent of GDP in 2012 to 1.3 percent in 2017.

To reduce homicides, the police concentrated efforts on the most violent areas over the previous five years. Many of the crime bosses who controlled these areas were captured and extradited to the United States. Crime prevention programs also focused on high-crime areas. To prevent homicides, the authorities focused on crimes that often lead to murders, such as extortion (InSight Crime 2017). The government implemented several real-time monitoring initiatives. These included two new 911 centers in the two largest Honduran cities, security cameras, street lights, and panic buttons in public buses. The government also improved the poor public opinion of the police force, which more than half of people said they distrusted at the beginning of 2016,[13] by organizing fairs for citizens to meet police and receive free medical services. Since then, the authorities reported an increase in emergency calls to police and anonymous "tip" calls, which along with higher attendance to police fairs signal that the public image of the police is improving.

Both the quality and quantity of the police force have improved over the past three years. In 2013, Honduras simultaneously had the highest homicide rate in the world and one of the lowest police coverage rates—147 officers per 100,000.[14] To correct for this, the authorities decided to train about 2,000 officers a year for five years, with the objective of doubling the number of police officers by 2022. Police training and equipment have also improved. First, a high school diploma is now mandatory to enter the police force. Second, mandatory police academy training has increased from three to eleven years, though it remains below the average of selected European countries in the 1990s (Pagon and others 1996). The average monthly salary of a police officer increased from $300 in 2013 (170 percent of GDP per capita) to $500 in 2016 (254 percent of GDP per capita). The authorities also invested in uniforms and vehicles, which many precincts were lacking. Third, to break ties between police and organized crime, a government-established civilian committee in charge of investigating and dismissing corrupt officers started operations in April 2016. As of October 2017, the committee had reviewed about 14,000 police employees of which 4,500, including several high-ranking officers, have been suspended.

To stop the homicide rate from rising, the authorities need to continue reforming the prison system. Honduran prisons are understaffed and overcrowded. According to the World Prison Brief, as of mid-2016, the prison population was at 163 percent capacity, with more than half of prisoners behind bars without

[13]According to a survey administered by the National University.

[14]According to the United Nations Office of Drugs and Crime (UNODC), the region had double the number of police officers on average—about 300 police officers per 100,000.

a conviction. Moreover, prisons had a staggering ratio of 9½ prisoners to every staff member in 2015, while Costa Rica had about 3¼.[15] The high ratio inhibits monitoring and control of prison population, which can lead to the formation of gangs within prisons. In the past two years, Honduras has made several advances in prison reform. The most notorious and chaotic prison in San Pedro Sula was closed and two high-security prisons were built. This contributed to dismantling criminal organizations and a reduction in homicides.

While some progress has been made with the arrival of an Organization of American States anti-corruption mission, the judicial system remains one of the weakest links in the fight against corruption and crime. ASJ (2016) documents that, over 2008–15, only 8 percent of corruption complaints ended up in court, and only 17 percent of these resulted in a guilty verdict. In most guilty verdicts, no sentencing or jail time was handed out. Amid the embezzlement episode at the Honduran Social Security Institute (IHSS) that led to public outcry, the authorities obtained the help of the Organization of American States support mission against corruption and impunity (MACCIH).[16] It received a four-year mandate, formally starting operations in April 2016. However, MACCIH's inability to open a criminal investigation without approval from the Honduran public prosecutor has inhibited progress.

The government needs to engage MACCIH on the justice reform, and to increase both the independence of the judicial system and its funding (it has been stagnant as a share of GDP since 2012). The authorities should also investigate and dismiss corrupt judicial system officials. Police reforms can serve as an example.

El Salvador

Despite street gangs not being the only criminal actors in El Salvador, the government and public opinion attribute the increase in violent crime to them. About 30 percent of homicides occur in San Salvador, the capital, and the victims are mostly young men aged between 15 and 35.[17] Many of these deaths are a consequence of gang fights for territorial control, but gangs have also targeted public security officers. Armed robberies and extortions are common and constitute the gangs' main source of income (Cruz 2010). Almost 70 percent of the businesses in the country are forced to pay as a result of extortion, which amounts to 3 percent of GDP.[18]

The fight against gangs up to 2011 had a repressive nature, mostly focused on law enforcement efforts, and did not reduce the violence. The *Mano Dura* and

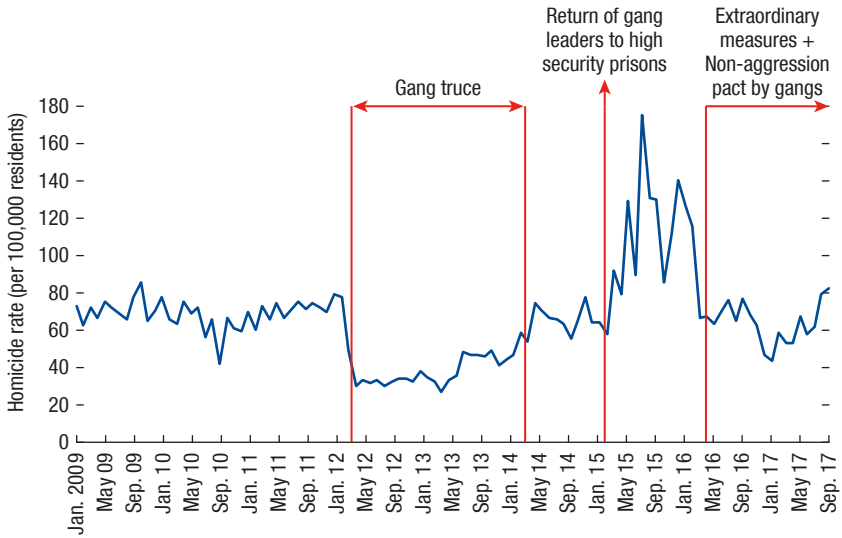
[15]UNODC data.

[16]During 2010–14, the director of the IHSS appointed by the administration of then-president Lobo allegedly misspent at least $120 million. At least part of this sum ended up in the National Party, to which the incumbent President Hernandez also belongs.

[17]El Salvador National Civil Police data.

[18]"The gangs that cost 16% of GDP." *The Economist*. May 21, 2016. Web access, January 24, 2018.

Figure 6.10. Homicides in El Salvador, 2009–17



Source: Author calculations based on data from El Salvador National Civil Police. Annualized monthly rates.

Super Mano Dura security plans of 2003 and 2004 introduced discretionary crimes that increased incarceration of gang members and prison sentences and involved military personnel in policing and prison control. Contrary to the authorities' objective, homicides rose during the *Mano Dura* era from 32 per 100,000 inhabitants in 2002 to 63 in 2006–11 (Figure 6.10).[19] The mass incarceration of gang members led to overcrowding. Prisoners were separated according to gang affiliation, which strengthened group cohesion and helped gang leaders organize. To support their imprisoned peers, street-based gang members redoubled their illicit income-generating activities, leading to the increase of other crimes such as extortion (Wolf 2012; Cruz and Durán Martínez 2016).

In 2012, the government secretly negotiated the reduction of homicides with gang leaders. The two largest gangs, *MS-13* and *Barrio 18*, agreed to stop killing each other and to end attacks on public security officers. In exchange the government moved gang leaders to low-security prisons, provided them with visitation privileges, and reduced military control in prisons. The gang truce was effective at drastically reducing homicides from 14 to 6 a day (Figure 6.10). Several factors explained this. First, gangs were responsible for most homicides in El Salvador at the time. Second, gangs had a hierarchical structure with little or no fragmentation, which guaranteed that gang members in the streets would abide by the

[19]El Salvador National Civil Police data.

decisions of their imprisoned leaders. Third, the government provided gangs with incentives to reduce violence.

While it reported short-term benefits, the truce was fragile and did not prove to be a long-term solution to the violence. Criminals had incentives to conceal instead of abandon violence (Cruz and Durán-Martínez 2016). The truce also increased the power of gangs by legitimizing them as social entities and transforming them into political actors. A decline in public support for the truce, the new government's dismissal of key mediators, and limited programs to help gang members integrate back into society led to the truce's collapse. As shown in Figure 6.10, the homicide rate increased slowly about a year after the truce was agreed, and within two years it had reached past levels. Throughout 2014 a new government started reducing the benefits of the truce from imprisoned gang members and in February 2015 imprisoned gang leaders were sent back to high-security prisons. As a response, homicide rates increased to record highs. Violence continued through 2015, making El Salvador the most dangerous country in the world outside of war zones. In early 2016, the authorities resorted to repressive measures aimed at reducing communication of imprisoned gang leaders with members on the streets. At the same time the major gangs established a non-aggression pact. While it is hard to assess their relative effect, both measures reduced the number of homicides.

In the aftermath of the truce, the country has transitioned to a hybrid model that combines *Mano Dura* elements with *El Salvador Seguro*, a plan that incorporates stronger prevention and rehabilitation efforts to address the root causes of violence. The plan, established in September 2014, envisages using about $1.5 billion in external funds for rehabilitation and prevention,[20] particularly to strengthen and expand *Yo Cambio*. This program helps inmates to develop workforce skills that can help them enter into productive life and earn legitimate income. While promising, *Yo Cambio* lacks methods and tools to monitor and evaluate its effectiveness, and its current size is insufficient to accommodate all youths in the prison population, the group most prone to recidivism.[21] To tackle these challenges, El Salvador has received external financial support. However, there is still no evidence of impact because political polarization hinders the allocation of funds to security programs and slows down disbursements. Also, its effects may take longer to materialize due to the structural nature of the violence problem.

The recent hybrid approach contributed to reducing homicides. Rehabilitation and prevention components of *El Salvador Seguro* should help to sustain the result. However, this will also require stronger monitoring efforts through the development of unified and consistent crime statistics, which will help allocate

[20]"El Salvador Government Releases Plan to Reduce Violence." *Insight Crime*. January 16, 2015. Web access, January 24, 2018.

[21]"Violence Prevention Strategy Comprehensive Support Program (ES-L1025) Loan Proposal." *Inter-American Development Bank*. 2012. Web access, January 24, 2018.

adequate resources to crime-prevention activities with potential to permanently reduce the violence.

CONCLUSIONS AND POLICY RECOMMENDATIONS

While crime remains a headline issue for CAPDR, not enough work has been directed toward quantifying the effects of crime in the region, examining its drivers, and formulating solutions. The reasons are many, including data limitations, capacity and resource constraints, a bias toward punitive rather than analytical or preventive measures in public policy, and sensitivities around the topic. In addition, despite substantial economics research into crime, not enough attention has been paid to the effects of economic policies on crime and vice versa.

From an economic perspective, as articulated by Becker half a century ago, criminals are rational individuals who compare the expected cost and benefit of committing crimes with those of legal activities. Taking the profit out of crime should be a key policy goal. As demonstrated in the general equilibrium setup in this chapter, a combination of higher returns to legal activities (productivity) and increased police effectiveness will reduce crime rates.

Given the deep poverty in CAPDR (especially the Northern Triangle), tackling crime will require a combination of:

- Policies to spur growth, promote labor market opportunities, and therefore increase expected benefits from legal and non-violent activities.
- Improvements to policing and other deterrence activities to curb gang activity.
- Strengthening the criminal justice system (impunity rates can currently be as high as 95 percent, according to the Wilson Center) while promoting the reintegration of ex-convicts (including lower-status gang members) in the productive economy.

From a fiscal point of view, higher resourcing (for example, tax revenues) could help public service provision. Given gangs' recruitment techniques among the youth, it is essential to reduce costs for skills development and support vocational programs and social programs that target at-risk youth. While providing recreational activities can reduce crime in the short term and obtain trust, in the medium term these programs should invest in job training and education. To succeed, there is a need to channel (scarce) resources to prevention programs, which are often understaffed and neglected, as are most budgets for a security focus on deterrence. Avoiding making public security a political issue would also help.

On the pillar of smart policing and deterrence, it is critical to invest in data collection and monitoring, and to adjust strategies in real time. Given the region's constrained fiscal resources, interventions should be targeted to the most-needed areas and adjusted based on evidence.

Strengthening the credibility and efficiency of the criminal justice system would allow for swift conviction and punishment of offenders. At the level of secondary prevention (working with the criminally active), governments should also provide basic skills training to convicts to bolster reintegration in the

productive sector. Lowering overcrowding and improving the quality of prison facilities and personnel to prevent crime and gang formation within prisons is vital.

Crime and low growth are closely intertwined. As demonstrated in the model, higher productivity is one of the most consistent drivers of crime reduction as it tilts incentives of unemployed individuals toward productive activity. Thus, complementing the crime-fighting recommendations in this chapter with policies that reduce barriers to entry for new firms and improve the business climate would be key to promote employment and increase profit of legal activities, therefore fostering job creation and a reduction in crime.

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ANNEX 6.1: DERIVATION OF EQUATIONS (2) AND (3) IN THE MODEL

The assumptions about income per period and transition probabilities from unemployment to employment and vice versa imply

$$V_u = z + \frac{1}{1+r}\left(\theta q(\theta) V_w + \left(1 - \theta q(\theta)\right) V_u \right) \quad (1)$$

$$V_w = \alpha w + \frac{1}{1+r}\left(\left(1-\lambda\right) V_w + \lambda V_u\right) \quad (2)$$

Solving for the present values of being employed V_w and unemployed V_u leads to equations (2) and (3).

Wage is determined using Nash bargaining. Denote $0 < \beta < 1$ the bargaining weight of individuals. Then the wage is determined through

$$V_w - V_u = \beta\left(V_f + V_w - V_u\right) \quad (3)$$

The expression in parentheses is the total created from the match between the worker and the frim. Solving this yields the aggregate equilibrium wage equation

$$\alpha w = (1-\beta)z + \beta(\alpha p + c\theta) \quad (4)$$

Intuitively, Equation (4) is an equivalent of the labor supply equation in the model. It says that the expected wage is a weighted average of a worker's income if unemployed, z, and the sum of the expected match surplus αp and the average hiring cost $c\theta$ per unemployed worker. Clearly, if the worker's bargaining weight decreases (and, therefore, the firm's bargaining weight increases) the wage decreases. In the extreme case when $\beta = 0$, individuals are indifferent between working and staying unemployed as both activities result in the same income. As in the standard model, a worker is rewarded for the saving of hiring cost that the firm receives when the match is formed, $c\theta$. See Plotnikov (2018) for more details and intuition.

ANNEX TABLE 6.1.1.

Calibration Summary

Parameter name	Symbol	Source/Target
Discount factor	r	2.2 percent annual real interest rate
Job destruction rate	λ	Job average duration of 2 years as in the United States (Shimer 2005)
Outside option, leisure	z	Social spending—3.2 percent of GDP
Worker bargaining power	β	Surplus is split equally between worker and firm
Vacancy cost per period	c	Implied by other parameters and the target unemployment rate of 7.3 percent
Effectiveness of the judicial system	η	Four percent of murders are prosecuted per year
Release rate from jail	ζ	Average imprisonment duration is 15 years. Lower bound for murder in the Honduras penal code.
Matching function	$q(\theta) = A\theta^{-s}$	The scaling factor A is implied by λ and the target unemployment rate (7.3 percent). The matching function is assumed to be equally elastic to the number of vacancies and unemployed ($s = ½$)
Effectiveness of criminals	$\alpha(N_B) = N_B^{\mu}$	Parameter μ is assumed to be ½.

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