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Increasing returns and the evolution of violent crime: the case of Colombia

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Abstract

This paper presents an explanation of the recent escalation of violent crime in Colombia. The paper considers three implicit models that isolate different types of externalities among criminals. In the first model, criminals make crime more appealing to nearby residents by congesting the law enforcement system and, hence, lowering the probability of punishment. In the second model, the interaction of career criminals and local crooks speeds up the diffusion of criminal know-how and criminal technology. In the third model, the daily contact of youth with criminal adults and criminal peers results in the erosion of morals and hence in a greater predisposition toward crime. The paper shows that a myriad empirical evidence — both statistical and anecdotal — lends support to the previous models in general and to the congestion-in-law-enforcement model in particular.

JEL classification: K40; K42
Keywords: Multiple equilibria; Dynamic externalities; Criminal dynamics

> What Moral flows from this? Probably none. Only the blood flows, drying quickly, and, as always, a few rivers, a few clouds.
>
> Wislawa Szymborska

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1. Introduction

Talking about ''crime epidemics'' has become fashionable among journalists, politicians and researchers alike. As trite as this expression might seem, it contains some truth: crime rates — as is certainly the case with epidemics — change dramatically and without apparent reason from one place to another and from 1 year to the next (Glaeser et al., 1996). Crime, to put it another way, seems to dance to its own music. Most economic explanations of this phenomenon rely on various types of positive externalities among criminals. Generally speaking, these externalities can be global or local, where the former refers to the effect of aggregate crime levels on individual behavior, and the latter to the effect of individual agents on each other's behavior. In this paper, I study both local and global externalities among criminals in an attempt to understand both the rise of violent crime and the emergence of dramatic regional differences of criminal prevalence that took place Colombia during the 1980s.

The Colombian experience over the past two decades constitutes a compelling case study in the evolution of violent crime. The magnitude of violent crime in Colombia is staggering. The homicide rate in the country is three times that of particularly violent countries as Brazil and Mexico, seven times that of the United States and 50 times that of a typical European country (see Appendix A). In some cities, the violent crime figures reached epidemic proportions. Medellin, Colombia's second largest city, experienced over 400 murders per 100,000 inhabitants in the early 1990s. These figures are even more striking when we recognize that Colombia has had a stable democratic government for over 40 years and the country is free of any form of racial and religious fragmentation.

The upward progression of the homicide rate in Colombia was severe. The violence started its ascending trend in the late 1970s and by the early 1990s had more than tripled. Yet, murder was not the only criminal activity that skyrocketed during the 1980s. Kidnappings, car thefts, bank robberies and even petty crimes also increased dramatically in the same period of time. Interestingly the acceleration of violent crime in Colombia was accompanied by a sharp spatial polarization — while crime increased by a factor of 10 in some regions, it barely changed in others.

Clearly, if we are to come to grips with what happened in Colombia, we must address both the rapid increase in violent crime and the emergence of huge regional disparities in crime prevalence. This poses a special challenge because it requires a model that includes both temporal and spatial dimensions. Most models in the literature focus only on one of these dimensions. Glaeser et al. (1996), for example, argue forcefully that we can make sense of the high variance of crime across cities in the United States with a simple model of local interactions that abstracts completely from the temporal dimension. These authors assume, in particular, that the degree of interactions among criminals do not differ across cities, and that all cities are close to steady state all the time. These assumptions,

however, are inappropriate for the case of Colombia because of the obvious regional differences in criminal interactions and the non-stationary nature of the data (see Fig. 1).

In this paper, I consider three implicit models that isolate different types of externalities among criminals. In the first model — based on a global externality — criminals make crime more appealing to nearby residents by congesting the law enforcement system and, hence, lowering the probability of punishment (Sah, 1991). In the second model — based on a local externality — the interaction of career criminals and local crooks speeds up the diffusion of criminal know-how and criminal technology. In the third model — based on a different local externality — the daily contact of youth with criminal adults and criminal peers results in the erosion of morals and, hence, in a greater predisposition toward crime.

Each of these models can account for the crime escalation that took place in Colombia. In the congestion-in-law-enforcement model, there are multiple equilib-

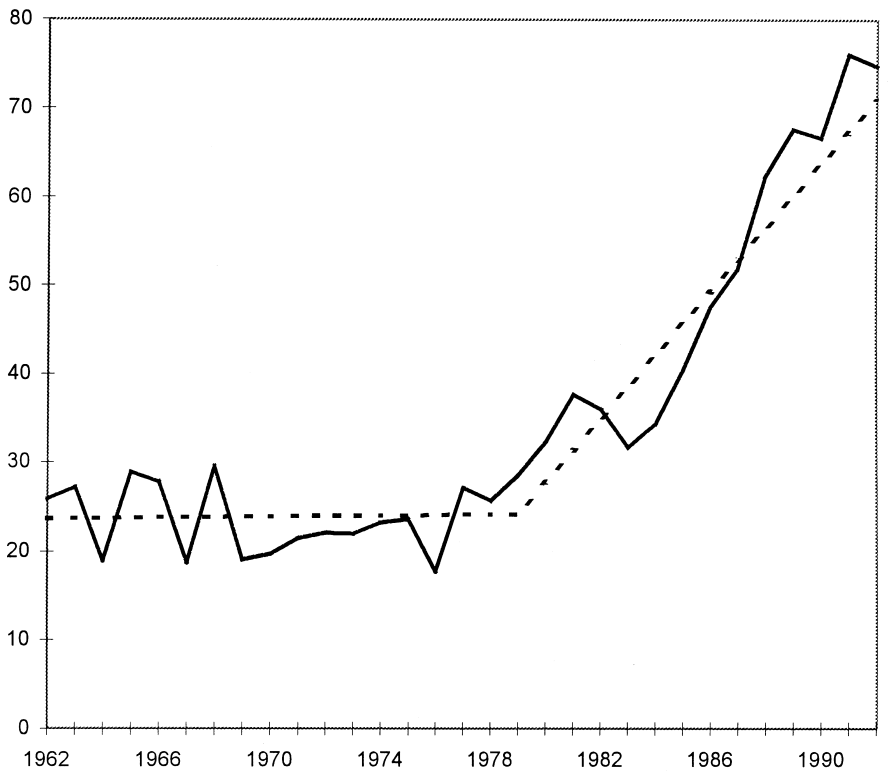

Fig. 1. Homicide rate in Colombia: 1962–1994 (Homicides per 100,000 residents).

ria and crime escalations can be rationalized as a movement from a low- to a high-crime equilibrium. The other two models postulate different types of dynamic externalities (knowledge spillovers and neighborhood effects), respectively that can also account for criminal escalations in a way analogous to the effects of human capital spillovers in ''new-growth'' theory models. Moreover, to the extent that the postulated externalities are geographically circumscribed, each of these models can also account for the regional differences in criminal rates that followed the wave of violent crime in Colombia.

The available empirical evidence lends support to the previous models in general and to the congestion-in-law-enforcement model in particular. For example, the rise of violent crime in Colombia was — as predicted by the latter model — accompanied by a dramatic decline in the probability of being punished. The proportion of homicides for which a main suspect was identified by Colombian authorities declined by more than half during the 1980s. On the other hand, a myriad of anecdotal and ethnographic evidence confirms both the importance of knowledge transfers from drug traffickers to local criminals and the presence of crime-related neighborhood effects in some Colombia urban areas.

To further evaluate the congestion-in-law enforcement model (and, in particular, its prediction of multiple equilibria), I conduct a simple test aimed at determining the extent to which the distribution of crime rates across Colombian states is consistent with the hypothesis of multiple equilibria. I show that the Colombian violent escalation was accompanied by the emergence of well-identified clusters in the distribution of homicide rates across states. Interestingly, all the extra variance in homicides rates brought about by the increasing violence can be explained by the formation of clusters. In sum, the multiple equilibria model can, at least partially, account for the evolution of both the country-wide homicide rates and the distribution of homicide rates across states.

The rest of this paper is organized as follows: Section 2 describes the magnitude of the crime problem in Colombia, Section 3 presents the theoretical background along with some general evidence, Section 4 presents an empirical test of the multiple equilibria model (the main hypothesis of the paper), and, finally, Section 5 draws some general conclusions.

2. The facts

2.1. International comparisons

International comparisons of crime rates are difficult. Not only do crime definitions vary greatly among countries, but also cross-country data is sparse. To make matters worse, the accuracy of the data varies substantially from country to country, which makes one wonder whether some of the data differences may be due to dissimilarities in the recording and reporting systems rather than to true

differences in criminal activity. International statistics, however, are readily available for murder. Murder is not only the most accurate of all crime statistics in all countries, but it is also part of the international health statistics published annually by the World Health Organization.

Appendix A shows — for a sample of 48 countries — the homicide rates for the male population along with some variables usually associated with the incidence of crime. These variables are GDP per capita, income inequality, human development index (a composite of income per capita, life expectancy and education), political stability and efficiency of the judiciary. All figures are from the late 1980s, and the data sources are listed in Appendix B. As shown in the last column of Appendix A, the homicide rate in Colombia is well-above any international standard even after controlling for the aforementioned variables. Not everyday does one come across such a huge outlier when comparing international indicators. Plainly, the level of violent crime in Colombia defies any attempt at an explanation based upon socioeconomic characteristics.

2.2. Time series evidence

The progression of the homicide rate in Colombia is shown in Fig. 1. [1] During the 1960s and 1970s, the homicide rate in Colombia seemed to be in line with the country's ''fundamentals''. The violence started its ascending trend in the late 1970s and by the early 1990s had reached the staggering levels mentioned above. Yet, murder was not the only criminal activity that skyrocketed during the 1980s; kidnappings, car thefts (including carjackings) and bank robberies also dramatically increased toward the end of the decade (Fig. 2).

Some ''contextualization'' of the previous evidence seems necessary at this point. Colombia is often considered the hub of international drug trafficking. In an often quoted figure, the Drug Enforcement Administration (DEA) claims that Colombian traffickers were responsible for 80% of the cocaine reaching the United States during the 1980s (the Economist, December 24, 1994). More importantly, some groups of drug traffickers engaged in a direct confrontation with Colombian authorities during much of same decade. The confrontation included a bloody campaign of bombings and the murder of some of Colombia's leading politicians, judges and journalists. In addition Colombia has been host of a thriving rebel activity for more than four decades. Current estimates set the number of active rebels well-above 10,000 people (Gaitan, 1995, p. 365).

[1] The dashed line in Fig. 1 corresponds to a linear trend with a break in 1979. A formal analysis using the methodology proposed by Perron (1989) indicates the presence of a structural break in the Colombian homicide rate in either 1978, or 1979, or 1980. This methodology fits a broken trend to the data and then examines if the de-trended series has a unit root. If not, the breaking points can be regarded as structural changes (see also Inwood and Stengos, 1991).

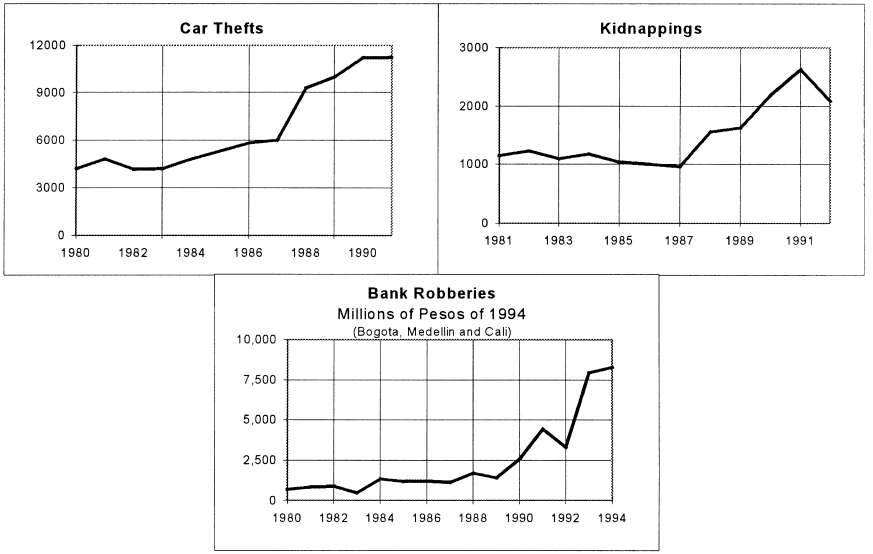

Fig. 2. Organized crime in Colombia: 1980s.

However, the escalation of violence in Colombia cannot be considered as a simple reflection of the criminal activities of drug smugglers and guerrillas. According to all available estimates, the proportion of homicides directly attributable to drug traffickers is less than 10% (Gaitan, 1995, p. 386). Likewise, it has been estimated that more than 95% of the all homicides are unrelated to the state-guerrilla confrontation (Vargas, 1993, p. 154; Gaitan, 1995, p. 361; Montenegro and Posada, 1995). In sum, over 80% of all homicides in Colombia are the manifestation of an amorphous violence not directly related to a few major criminal organizations.

3. A collage of possible explanations

The use of modern economic analysis to study criminal behavior has a long tradition. In a seminal paper published 30 years ago, Becker (1968) advanced the idea that criminals are rational, self-interested agents whose behavior can be best understood as an optimal response to incentives. This view, often referred to as the deterrence hypothesis, has become almost commonplace in the economics literature. Roughly speaking, Becker's model predicts that criminals will expand their activities if either the certainty or the size of punishment decreases.

The deterrence hypothesis has been extended to incorporate general equilibrium considerations in the so-called market-for-offenses model (Ehrlich, 1996). In this

model, the level of crime is jointly determined by the supply of offenses (which reflects people's decision to participate in illegal activities), and the demand for private and public protection from crime (which implicitly defines the demand for offenses).

Becker and Ehrlich's models are deeply rooted in the neoclassical tradition, and thereby they rely on the assumptions of optimizing behavior, rational expectations and stable preferences. Also, these models emphasize what we may call ''negative feedbacks''. That is, they emphasize mainly how private and public expenditures on crime control work to offset any change in criminal behavior. Thus, in these models, an exogenous crime shock will trigger a wave of anti-crime expenditures by both private and public agents, which in turn will lower the magnitude of the initial shock. High levels of crime are then short-lived in the Beckerian tradition.

Thus, the market-for-offenses model, at least in its standard form, does not appear to be the appropriate framework to study the causes of the Colombian criminal explosion. A more promising approach would be to focus on models stressing positive externalities among criminals and hence the possibilities of endogenous crime escalations. Below, I set forth three different implicit models that incorporate positive feedbacks stemming from interactions among criminals. Also, I present empirical evidence concerning the ability of these models to explain the dynamics of Colombian violence. The models are meant to be complements rather than substitutes, and together they provide a good understanding of the mechanisms underlying the emergence of Colombia as perhaps the most violent country of the world.

A clarification is in order at this point. The models presented below are models of crime and, hence, they do not deal explicitly with violence. More precisely, there is not a clear distinction between crime and violence throughout the paper. This is not as big a shortcoming as it might first seem, since most of the violence in Colombia can be understood as a by-product of criminal activities. In short, the puzzles of violence and crime are intertwined.

3.1. Crime and congestion in law enforcement

In this section, two additional assumptions are added to the static Becker's framework so as to make it more amenable to dynamic considerations. Here, I closely follow previous theoretical work that has examined the implications of adding dynamic assumptions to static incentive problems in general and criminal models in particular (see, e.g., Andvig and Moene, 1990; Sah, 1991; Schrag and Scotchmer, 1993; Freeman et al., 1996). In particular, I will expand Becker's model to include the following two assumptions.

First, the actual probability of punishing a criminal is negatively related to the current criminal rate. That is, the higher the incidence of crime, the more difficult it is to punish a criminal, holding police resources constant. Notice that this assumption suggests the presence of positive feedbacks in criminal activities. The

idea is simple: by reducing the amount of police resources spent per criminal, an exogenous increase in crime will lower the actual probability of punishment, and, hence, will tend to further increase crime. [2]

Second, criminal rates exhibit inertia in that they cannot deviate significantly from past values. Several sources of inertia have been emphasized in the literature. Sah (1991), for example, argues that people estimate the actual (and *unknown*) probability of being punished by ''sampling'' their neighbors — they incorporate both past and present information in their inferences. Obviously, insofar as people's inferences are rooted in the past, criminal rates will exhibit inertia. Accordingly, a drop in the *actual* probability of being punished — caused by, say, a cut in enforcement expenditures — will have only a limited effect on people's inferences, and hence will barely modify the current criminal rate in the short run. For their part Freeman et al. (1996) argue that high criminal rates today may cause some youths to defer human capital investments — they may drop out of high school lured by the prospects of high returns of criminal activities. This will in turn cause inertia since undereducated youth will have limited access to legal opportunities and, hence, will be more prone to commit crimes in the future.

It is worth noting that these two assumptions work in opposite directions: while the former implies that criminal shocks feed on themselves, the latter implies that criminal shocks wither as time goes by. This tension gives rise to rich dynamics. An apposite example based on Sah (1991) is depicted in Fig. 3. [3] As shown, both non-linearities and multiplicity of equilibria arise naturally in this model.

A qualitative characterization of the dynamics of the crime rate resulting from the previous assumptions can now be put forth. Criminal escalations are a distinct possibility in the model. The mechanics are simple: an exogenous criminal shock — if large enough — can set in motion a dynamic of mutual reinforcement between crime rates and lower probabilities of punishment. This is clearly indicated by Fig. 3. First, a criminal shock causes the system to jump from one basin of attraction to another, then the crime rate gradually increases until it reaches a new equilibrium. In other words, this model exhibits hysteresis in that *transitory* shocks may have *permanent* effects. Consequently, two identical economies (or regions) may end up having completely different crime rates as a result of different histories.

[2] This argument assumes that crime increases as more people become criminals with everybody committing the same number of crimes. If there is an ''incapacitation'' effect (a fixed number of criminals with each committing more crimes), the previous argument does not necessarily hold.

[3] The main assumptions behind the example are: (1) each person stays active for five periods, (2) each person observes five individuals (criminals and no criminals) every period, (3) the initial beliefs regarding the actual probability of punishment are distributed $\beta(1,3)$, (4) the updating of beliefs uses Bayes rule, and (5) the actual probability of punishment (r) is computed as $r = \max(1 - C^2, 0.1)$, where C is the economy wide crime participation rate.

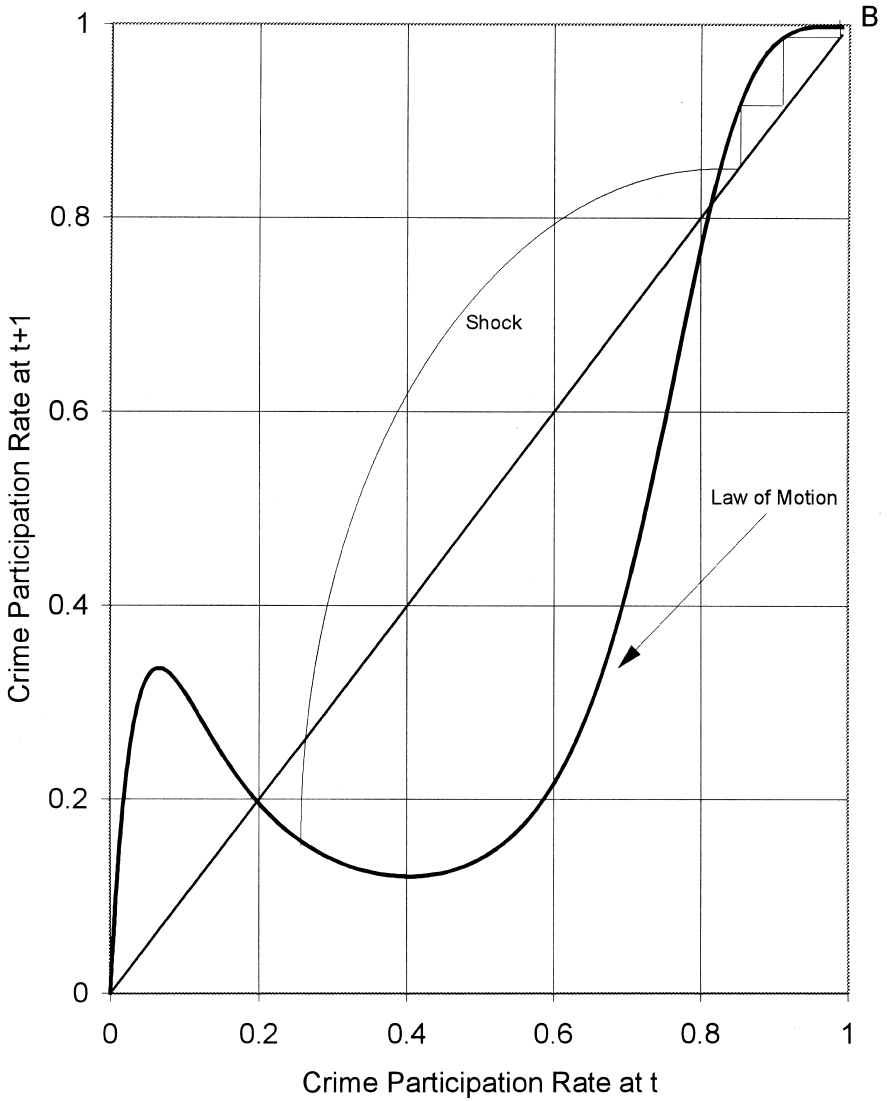

Fig. 3. Multiple equilibria in an artificial example.

What does this stylized story have to say concerning the escalation of violent crime in Colombia. I argue below that the available empirical evidence is compatible with the implicit model sketched above. But before reviewing the evidence, we must provide an important missing element in our story. Namely, we must identify the criminal shock that, supposedly, triggered the self-reinforcing

criminal escalation. From the theoretical discussion, we just know that the shock must have been large enough to drive the system from one basin of attraction to another, and long enough to offset the excess of inertia that presumably characterizes criminal rates.

I shall argue that an important coincidence provides the missing information: the acceleration of violent crime in Colombia coincided with the consolidation of the country as the main supplier of cocaine in international markets. I hypothesize then that the criminal activity brought about by the struggle for the control of the profitable cocaine exporting business was the initial thrust that set in motion the spiralling of crime in Colombia (more on this later on).

Once we have identified the detonator, the story is complete. During the late 1970s, some Colombian regions experienced an outburst of violent crime associated with the consolidation of the cocaine business. The cartels were establishing a reputation for violence while killing off their enemies outside and inside the government. This criminal wave overwhelmed a fragile justice system. Sooner than later local would-be criminals realized that both police and prosecutors were not keeping up with the increasing level of crime. This prompted many of them to enter a life in crime. As a result, kidnappings, carjackings and bank robberies skyrocketed (see Fig. 2). Eventually, the level of crime associated with drug trafficking subsided (the winners had been decided), but the crime level had already reached a critical mass — it was by then self-sustaining. Indeed, the probability of being punished (sent to prison) reached such low levels (3% for homicides and 1% for robberies, see Gaitan, 1995, p. 330) that would-be criminals were very certain that, literally, they could get away with murder.

As noted earlier, the available evidence lends considerable support to the previous story. First, kidnappings, carjackings and bank robberies lagged the rise in homicides, which makes perfect sense in the light of the hypothesized gradual congestion of the Colombian law enforcement system. Second, the sparse available information on arrests and indictments shows that the Colombian justice system became so overwhelmed by the rising levels of crime that unsolved cases began mounting at an exponential rate. Fig. 4 shows the striking decline of the probability of being charged with homicide (computed here as indictments over homicides) over the last decade (see Appendix B for the sources of information). The underlying data shows that while homicides almost tripled in this period, the number of indictments stayed almost constant at around 5000 per year. Moreover, Fig. 4 surely underestimates the breakdown of the Colombian law enforcement system for at least two reasons: first, many inductees are never brought to justice in Colombia, and, second, even when they are, they often bribe their way out of prison.

A qualification is in order. The previous story is meant to provide an explanation of the dynamics of violence in some regions rather than in the country as a whole. I do not want to argue that the entire country entered a vicious circle of violent crime as a result of the criminal activities of cocaine smugglers. Rather, I

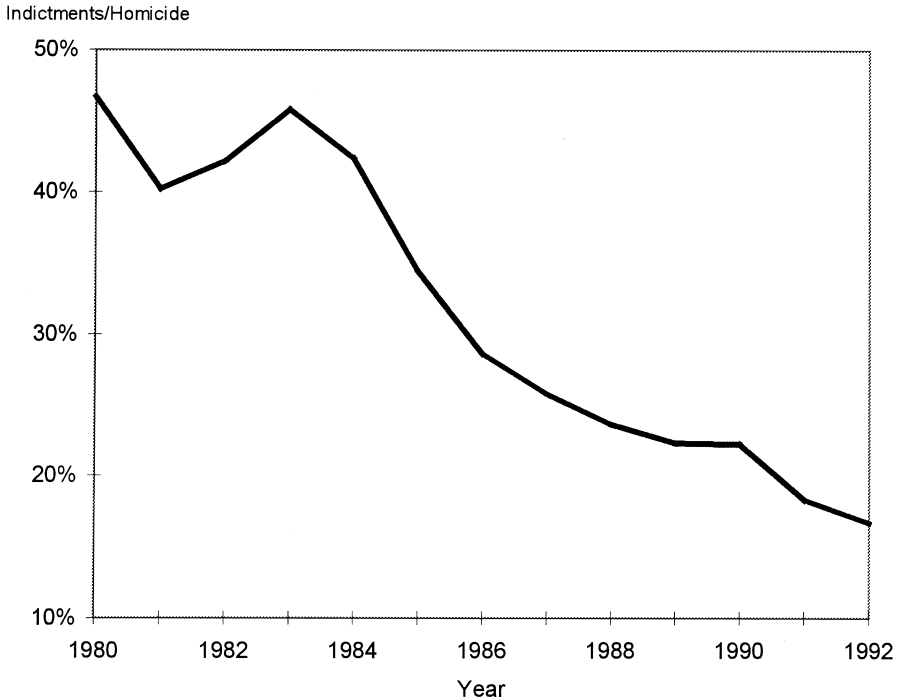

Fig. 4. Probability of being charged with homicide (1980s).

wish to argue that this is a plausible explanation for the rise in violent crime in some localities. This point is crucial because it provides a way to empirically test the model. The mechanics of the test are explained in Section 4.

Yet, another caveat might be necessary. There seems to be a discord between the theoretical discussion and the empirical evidence in that while the former predicts a change in criminal levels (a movement between steady states), the latter shows an increase in growth rates (see Fig. 1). How to reconcile these two views? Two arguments can be put forth. First, much of the observed data can be regarded as a transition from one steady state to another. If this is the case, increasing rates are no longer incompatible with the theoretical discussion. Second, learning spillovers and other dynamic externalities may explain the increasing growth rates. The latter point is developed in the following subsections, but first it is necessary to expand on the nature of the criminal shock that, supposedly, triggered the wave of violent crime in Colombia.

3.2. The nature of the shock

The rise of Colombians as the dominating ethnic group in the international cocaine market has been widely documented. In the early 1970s, the processing

and exporting of cocaine was controlled mainly by Chilean nationals. However, the Chilean preeminence in cocaine trafficking came to a sudden halt right after the military coup of 1973. In 1974, at least 19 Chilean traffickers were expelled to United States, and many others were forced to flee the country (Gage, 1975). As it turned out, this proved deadly to the Chilean cocaine businesses. Shipments of cocaine to the United States from Chile were reduced from more than 200 kilos a month in 1972 to less than 10 kilos in 1975 (Gage, 1975).

As early as 1975, the growing importance of Colombian nationals in the international cocaine market was apparent. On April, 2, 1975, the chief of the unified intelligence division of the DEA told the New York Times that ''a few years ago many Chileans were arrested in connection with the cocaine trade, but right now the Colombians seem to be the leaders of this traffic'' (New York Times, April 3, 1975). Another DEA officer told the New York Times in 1975 that ''Colombia sends more of the stuff to the United States than any other country'' (New York Times, April 21, 1975). DEA reports also show that ''of the 165 cocaine couriers arrested in the United States during the second half of 1974, 117 were Colombians'' (New York Times, April 22, 1975).

However, the dominance of Colombian nationals in the international cocaine market did not happen overnight. Cubans, for example, had an important stake in the business as late as 1978. According to Stares (1996) (p. 30), ''[b]eginning in 1978, the Colombians set about wresting control of cocaine distribution from the Cubans in South Florida. At the same time, the Colombians started developing their own cocaine distribution network in many of the major metropolitan centers of America. By 1982, their domination of the cocaine market was complete.''

3.3. Learning and technological spillovers in the criminal industry

As evident from the increase of kidnappings, bank robberies and car thefts, local criminal organizations are a crucial element in the equation of Colombian violence. Drug cartels and guerrillas are just part of a thriving industry with earnings in the billions of dollars. [4] The question in order is: why did organized crime in Colombia reach such proportions? Section 3.2 provided a partial answer to this question. I argue below that learning and technological spillovers may also have played a role in the rise of the Colombian criminal industry.

Learning spillovers among criminals and criminal organizations are not difficult to imagine. In prisons, criminals interact and learn from each other. Children of

[4] Different estimates of net proceeds from drug trafficking range from US$1 to US$3 billion annually (Gomez, 1988; Kalmanovitz, 1990). Net proceeds from kidnappings are close to US$30 million (Gaitan, 1995, p. 379).

criminals are exposed to the criminal experience of their parents and associates. Criminal organizations make frequent alliances that may result in exchanges of knowledge and technological innovations. [5] In short, knowledge and technological spillovers among nearby ''firms'' may be an important source of positive feedbacks in the criminal industry.

Drug traffickers (and to a lesser extent guerrilla groups) were an additional source of learning and technological spillovers in the case of Colombia. As far as knowledge transfer goes, drug business played a similar role to the one often associated with multinationals in less-developed countries. Romer (1993), for example, has argued that local firms in poor countries benefit a great deal from multinationals' transfers of production, marketing and management techniques. In the same view, we can hypothesize that local criminals in Colombia benefited from the cocaine cartels expertise in international crime operations. For instance, they may have learned from the cartels' how to buy arms in international black markets, how to launder illegal money and how to identify ''connections'' inside the law enforcement agencies.

Also, drug business played a prominent role in the diffusion of criminal technology and, particularly, of weapons. Imports of arms were widely used by drug traffickers as a way to launder money (Salazar and Jaramillo, 1992, p. 82). As a result, arms ranging from grenades to R-15 rifles were routinely rented and sold in Medellin. The consequences were deadly: murders using firearms in Medellin grew by 1211% during the 1980s whereas murders using other means grew ''just'' by 100% in the same period (Salazar and Jaramillo, 1992, p. 82).

The type of dynamic externalities described above are appealing because they not only can explain the acceleration in crime rates in the country as a whole, but also can make sense of the differential growth rates of crime in different regions (Glaeser et al., 1992). The empirical side of this story remains complicated, however, remains problematic. As Krugman (1991) (p. 53) puts it, ''knowledge flows are invisible; they leave no paper trail by which they may be measured and tracked.'' This is even more so in this case given the obvious informational limitations.

Press reports and testimonies showing the prominent role of narco-traffickers and guerrilla groups in the diffusion of criminal knowledge and the transfer of criminal techniques abound. Hit-squad training schools funded by cocaine traffickers and led by Israeli and British mercenaries were a crucial factor in the diffusion of explosive and other criminal techniques among local criminals (see ''Bogota Security Alleges Mercenary Aid to Cartels'', Washington Post, August 29, 1989). Not surprisingly, car bombings, once only used by drug traffickers, started being

[5] The partnership between guerrillas and drug traffickers is well-known in Colombia. In its most common form, rebels provide protection for cocaine labs while charging a ''sale tax'' in exchange (Gaitan, 1995).

routinely used by local (and even petty) criminals. [6] Likewise, extensive military training by guerrilla groups to Medellin youngsters contributed to the emergence of criminal gangs in that city (Salazar, 1990, pp. 77–81). Lastly, the recent breaking up of the drug cartels in a wealth of small organizations led by former cartel's employees is indicative of the presence of significant learning spillovers within the drug industry (see ''Young Gangs Decentralize Drug Trade'', Washington Post, June 11, 1994 and ''Birth of the Baby Cartels'', Newsweek, August 21, 1995).

3.4. Change of values

The neoclassical models of crime portray individuals as rational beings willing to break the rules whenever a favorable opportunity arises. This simplification, although convenient in certain settings, cannot be taken too far. As has been pointed out many times, no society would survive if its citizens violated its rules whenever the risk of punishment is small enough to make violation the optimal decision (North, 1983; Margolis, 1991). In short, values, moral convictions and codes of conduct do matter and cannot, in general, be assumed away. More important yet, values change over time. The stability of preferences, a cornerstone of neoclassical theory, is a problematic assumption from a historical standpoint as that of this paper (North, 1990).

North (1990) (p. 24) has argued convincingly that there is ''no way to explain the demise of slavery in the 19th century that does not take into account the changing perception of the legitimacy of one person owing another.'' In a parallel argument, I think that there is no way to explain the shocking increase of violent crime in Colombia over the last decade that does not take into account the changing perception of the legitimacy of violence as the proper way to resolve conflicts and to achieve economic prosperity. This aspect of Colombian violence has received a great deal of attention from Colombian scholars. Many books have been written on the topic and together they provide a wealth of casual evidence showing the devaluation of human life and the corruption of morals that took place in the country (see, e.g., Camacho and Guzman, 1990; Salazar, 1992; Salazar and Jaramillo, 1992).

The question in order at this point is a difficult one: how did the new values come about? A satisfactory answer would require a theory of cultural change that, to my knowledge, does not exist (see North, 1990, Chap. 5 for a discussion). However, a partial answer, based mainly on anecdotal evidence gathered by Colombian sociologists, can be advanced. One thing is evident: as drug traffickers

[6] The worst non-drug related bombings occurred on February 17, 1991 (22 dead, 176 injured) and on June 11, 1995 (29 dead, 205 injured). See, for example, San Diego Union Tribune, Feb. 18, 1991, p. A20 and June 11, 1995, p. A.10.

became role models for a broad sector of the population, their actions and attitudes started being widely emulated and imitated (Salazar and Jaramillo 1993, Chaps. 2 and 3). So, by instilling their values in a large sector of the population, drug traffickers may have played a crucial role in the erosion of morals mentioned above.

The key argument here is that as crime became the way of life, many youngsters reduced the value they place on legitimacy, and hence became more predisposed toward crime. Wilson (1987; 1996) has repeatedly made the some argument in his studies of inner-city youth in the United States. In Wilson's words, ''the more often certain behavior such as the pursuit of illegal income is manifested in a community, the greater will be the willingness on the part of some residents of the community to find that behavior not only convenient *but also morally appropriate*.'' Similarly we can argue that criminal behavior reproduced itself in Colombia by fostering the emergence of a social environment in which crime became not only a source of income, but also a source of pride and status (Case and Katz, 1991 offer empirical evidence of this phenomenon for the United States).

Thus, the interplay between crime and values should not be seen as a simple unidirectional relation in which moral degradation gives rise to criminal escalation. Rather, it should be viewed as a bi-directional process in which, on the one hand, increasing crime prompts a change in values by repeatedly exposing people to illicit behavior and, on the other, the erosion of values fosters crime by making people more predisposed toward crime.

4. Testing the multiple equilibria model

What are the empirical predictions of the multiple equilibria model concerning the distribution of crime rates across localities? Generally speaking, this model does not provide clear-cut predictions in this respect. However, a stark prediction can be derived if we impose a few reasonable assumptions. If we assume first that ''fundamentals'' [7] do not differ significantly across localities and then that all localities are in steady state, the multiple equilibria model predicts a tight clustering of the data in that the *between-cluster* variance (as opposed to the *within-cluster* variance) should account for the bulk of the variation of crime rates across localities. Fig. 5 summarizes the argument in a schematic way.

Fig. 5 does not imply that there will always be some regions clustered around both the low- and the high-crime equilibrium. Formally, the equilibrium points refer to latent states that need not be ''active''. Nothing in the model precludes that a certain point in time *all* regions within a country could be clustered around,

[7] Fundamentals include the availability of lawful opportunities, the profitability of crime, and social capital in a broad sense.

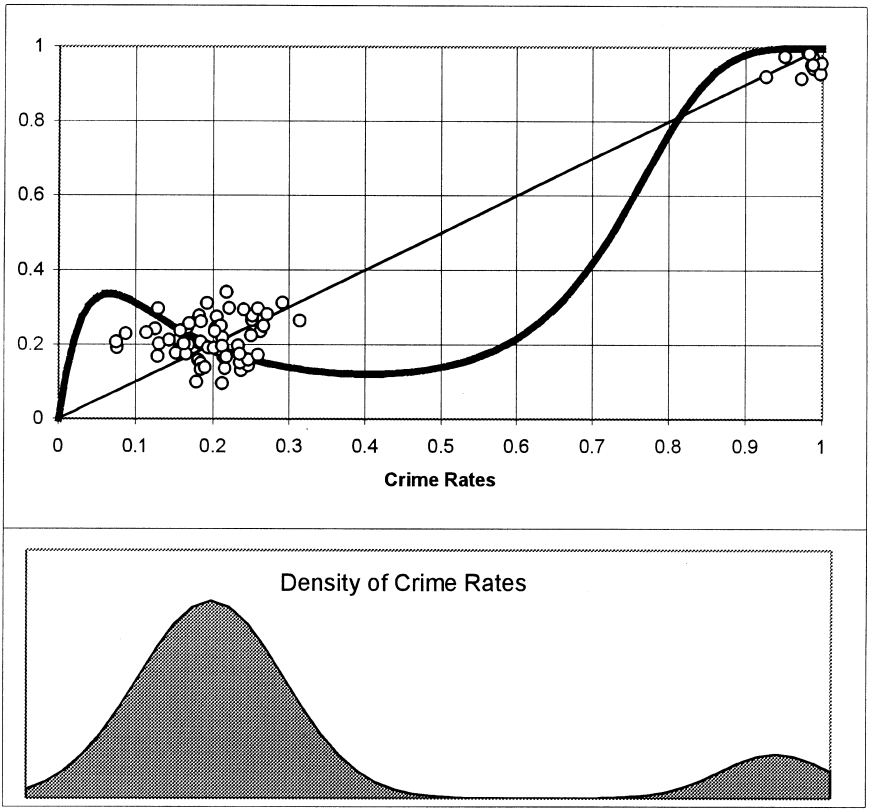

Fig. 5. Cross-section distribution as predicted by the model.

say, the low-crime equilibrium. Now, if an exogenous shock — large enough to rattle the system — hits some regions, we should expect to see the gradual emergence of a multimodal distribution as the regions hit by the shock flip from the low-crime to the high-crime equilibrium. As shown below, the Colombian experience seems to be consistent with this pattern. More precisely, we observe that those Colombian regions widely regarded as the centers of cocaine trafficking gradually moved toward a high-crime equilibrium during the 1980s.

A sequence of estimated densities of the homicide rate across 25 Colombian states is shown in Fig. 6 (see Appendix B for a description of the data). The homicide rate is defined here as homicides per 10,000 residents. I chose the homicide rate over alternative indices of violent crime because it is by far the most reliable uniform definition of violent crime. The choice of states over cities as the appropriate geographic unit to test the cross-sectional predictions of the multiple equilibria model is more controversial. Ideally, we should use the largest geo-

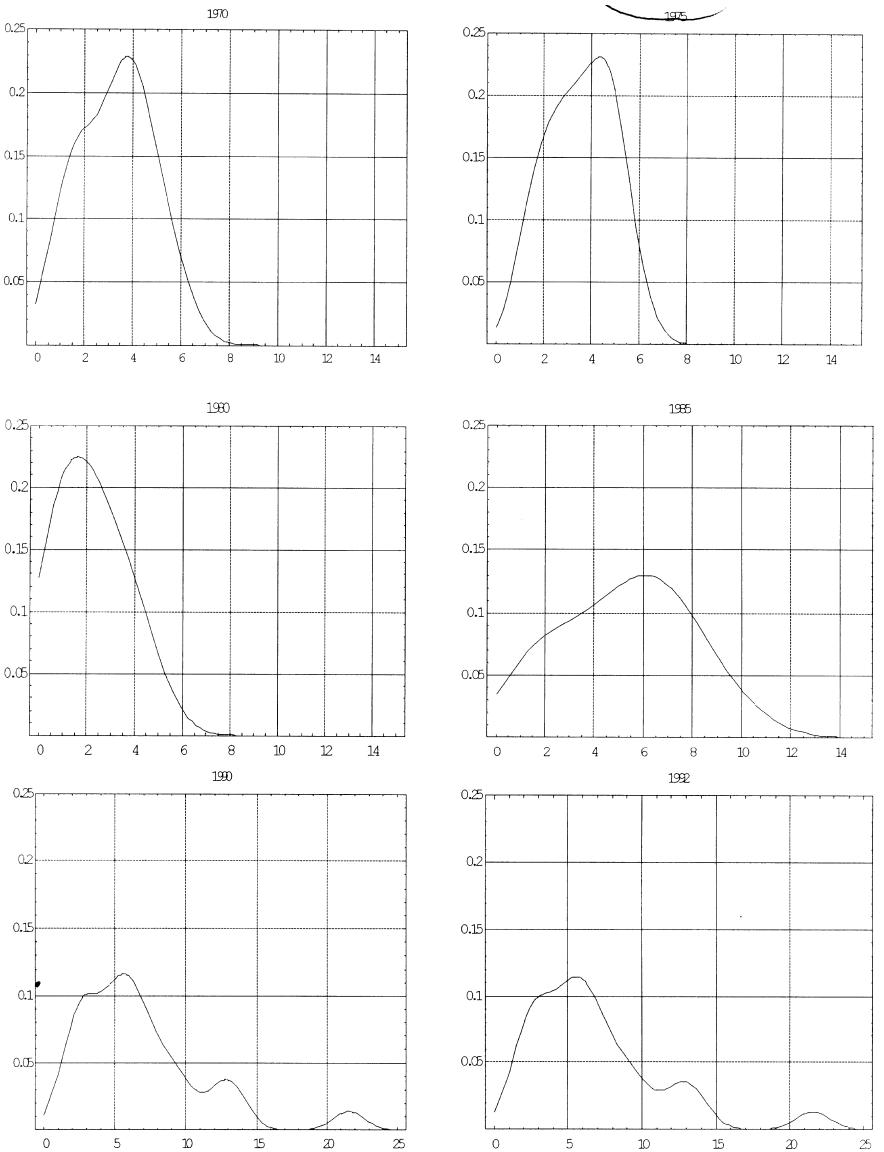

Fig. 6. Densities of homicides rates across Colombian states.

graphical unit for which the average crime participation rate in an ‘‘average’’ unit exerts a significant influence on the probability of arrest everywhere within the unit. There are at least two reasons to think that states are the right choice in this case. First, in Colombia, many important budgetary decisions concerning law

enforcement are made at the state level, so presumably a failure of state authorities to react to rising crime levels will lower the probability of arrest everywhere in the state. Second, the presence of substantial spatial autocorrelation of crime rates at the city level suggests that crime in adjacent cities may be driven by similar forces. If so, we should not treat cities as separate entities when testing the multiple equilibria model. Spatial autocorrelation, on the other hand, is completely absent at the state level data. [8]

The densities shown in Fig. 6 were computed using a Gaussian Kernel. The crucial step in non-parametric density estimation is the choice of the bandwidth (Simonoff, 1996). I used two different methods in this paper. The first method assumes that the underlying data comes from a Gaussian distribution whereas the second is completely non-parametric and only presupposes the existence of a smooth enough density (Sheater and Jones, 1991). Both methods involve some sort of minimization of the mean square error. The latter methodology yielded what appears to be a great deal of spurious bumpiness, so I opted for the former. Neither the choice of the kernel nor the bandwidth estimation method affect the results in a qualitatively important way.

The emergence of a multimodal distribution is evident from Fig. 6. The increase of homicides is clearly apparent as early as 1985, and the formation of clusters was completed by 1990. As noted above, this pattern is consistent with the hypothesis of a gradual movement of some Colombian states from a low- to a high-crime equilibrium. Three modes are noticeable in the last two densities: the peak at six homicides per 10,000 residents (nearly identical to the historical value), a bulge at 12, and a bump at the staggering value of more than 20 homicides per 10,000 residents.

Alternatively, we can test the predictions of the multiple equilibria model by computing the extent to which allowing the data to come from a mixture of distributions reduces the variance (Glaeser et al., 1995). If allowing for multiple equilibria results in a substantial reduction of the variance, this will provide additional evidence in favor of the model. Table 1 depicts the results of a test along these lines for the cross-state homicide rates in 1992. Mixtures involving two and three normal distributions were estimated using the EM principle developed by Dempster et al. (1977). All distributions were assumed to have the same variance but different means.

The results of Table 1 confirm the findings of the non-parametric density estimation. When a mixture of two normal distributions (two equilibria) was fitted to the data, the variance drops by 68% from 20.6 to 6.7. The data can then be split in two clusters: a low-crime one comprising 96% of the sample, and a high-crime comprising the remaining 4% (the latter ‘‘cluster’’ includes only one state,

[8] Using the Moran I statistic, I fail to reject the null hypothesis of the absence of spatial autocorrelation of crime rates across states for all periods analyzed.

Table 1
Mixtures of normals distributions multiple equilibria test
Data: Homicides per 10,000 residents.
Method: EM algorithm. Same variance in all distributions was assumed in the computations.
Benchmark computed using a log-normal distribution with identical first two moments to the actual data.

Number of distributions	Variance	Reduction in variance	Benchmark	Mean 1	Mean 2	Mean 3
1	20.60			6.85		
				100.0%		
2	6.66	67.7%	59.1%	6.23	21.29	
				95.9%	4.1%	
3	2.46	88.0%	72.9%	4.67	11.07	21.56
				72.5%	23.5%	4.0%

Antioquia, with roughly 13% of the country population). Allowing for three equilibria reduces the variance by 88% and yields almost the same clustering revealed by the non-parametric density estimation: a big cluster around five homicides per 10,000 residents, a medium-size cluster around 11, and a single point at 22. Interestingly, the within-cluster variance is almost identical to the variance of homicide rates in the years previous to the shock (the two values are 2.46 and 2.45, respectively). In other words, the extra variance brought about by the crime escalation is — as predicted by the model — explained in its entirety by the formation of clusters.

We should bear in mind, however, that even if the data does not exhibit any clustering, allowing for multiple equilibria will always reduce the variance, meaning that the previous exercise is somewhat uninformative in the absence of a benchmark. Thus, it will be useful to know, for example, the extent to which allowing for multiple equilibria reduces the variance in a case when we are certain that the data come from a unimodal distribution. In order to provide a benchmark, I implemented the following Montecarlo exercise. To start, I drew 500 samples of 25 observations from a log-normal distribution whose first two moments are identical to the mean and variance of the 1992 distribution of homicide rates. Then, I computed, for each sample, the reduction of the variance resulting from fitting the data to mixtures of two and three normal distributions. The average values over the 500 samples are reported in column 4 of Table 1. As shown, allowing for multiple equilibria does reduce the variance for the artificial data although not nearly as much as it does it for the actual data, which provides some additional evidence in favor of the multiple equilibria model.

A caveat is necessary at this point. The previous analysis hinges heavily on the assumption of similar fundamentals across Colombian states. Few would argue, however, that this assumption is even slightly realistic. To address this problem, I repeat the previous analysis after orthogonalizing the homicide rates with respect

to the following state characteristics: percentage of the population with primary and secondary education, GDP per capita, percentage of the population without basic public services, number of police officers per 100,000 residents, and number of governors in the previous 5 years. [9] While these variables explain 32% of the variance of homicide rates across Colombian states, the results are the same as before with a small difference; allowing for three equilibria reduces the variance by 92% this time around (as opposed to 88% in the previous case).

There is an important difference across Colombian states that was not addressed above. We have not controlled here for the fact that the bulk of drug smuggling activities was concentrated in a few states. So, we might as well argue that the clustering in homicide rates uncovered above is just a reflection of the fact that drug smugglers murdered more people on those states where they routinely operated. Bluntly, we can argue that we need not appeal to a multiple equilibria story to explain the evidence. This alternative explanation, however, is not borne out by the available evidence. As noted in Section 2, more than 80% of all homicides in Colombia are unrelated to either drug trafficking or rebel activity. The same view has been repeatedly advanced in numerous studies and press reports dealing with the origins of violence in Colombia. In sum, fundamentals alone (including the relative prevalence of drug-smuggling and rebel activities) cannot explain the regional disparities of violent criminal studied above.

There is an important subtlety in the previous discussion that is worth spelling out. I have repeatedly argued that drug-related crime, despite being a small fraction of the bulk of Colombian violence, was instrumental in catapulting crime rates to the staggering levels described in Section 2. This argument draws a key distinction. In my opinion, drug traffickers played two distinct roles in the emergence of Colombian violent escalation. On the one hand, they *directly* generated violence through their activities, and, on the other, they *indirectly* generated violence through various criminal externalities: congestion in law enforcement, spillovers of knowledge, supply of weapons, and the creation of a ''culture'' that favors easy-money and violent resolution of conflicts over more traditional values. The point of this paper is that the indirect role may have been much more important than the direct role. As subtle as it might seem, this point is, in my opinion, paramount to understanding what has happened in Colombia.

To complete the analysis, there is a final question that needs to be settled. Why does the multiple equilibria model fail to organize the aggregate crime data in the United States (Glaeser et al., 1995) but not in Colombia? I think the answer to this question is simple: while in the United States externalities among criminals operating through congestion in law enforcement are quickly offset by the reaction

[9] In the period under analysis, governors in Colombia were appointed rather than elected. Arguably, the number of appointments within a period of time provides a good proxy of political instability in the state.

of local authorities, the same is not true in Colombia. This is obvious by comparing the correlations across regions between crime and the number of police officers for the two countries: whereas in Colombia the number of police officers per capita is not correlated with the homicide rates (the coefficient is 0.15 and not significantly different from zero), in the United Sates there is a strong correlation across cities between crime prevalence and the number of sworn officers per capita (Levitt, 1997).

Needless to say, corruption goes a long way toward explaining these differences, as does the absence in Colombia of an institutional framework that provides local officials with the right incentives to quickly react to the public demands to curb crime. A formal analysis of these issues is, of course, beyond the scope of this paper.

5. Concluding remarks

This paper has offered an explanation to the dynamics of violent crime in Colombia that relies mainly on the presence of spillovers among criminals. The models and ideas developed here can be regarded as elaborations on the common view according to which crime begets crime and violence begets violence. Likewise, this paper can be viewed as an attempt to show that criminal shocks can have far-reaching consequences and that ''crime multipliers'' can be both common and large.

I want to stress here that we should not approach the study of Colombian violence as a quest for the idiosyncratic conditions (social, economic, genetic, institutional, geographical, etc.) that, supposedly, made this country an exceptional breeding ground for the flourishing of violent crime of all types. Rather, we should hope for a model that spells out how criminals themselves created such conditions. A biological metaphor may help get this point across. Modern evolutionary biologists recognize that, against more traditional views, individuals do not adapt to environments, but construct them (Lewontin, 1982, p. 159). In the same view, I have argued all along that the Colombian ''crime-friendly'' environment was not so much a pre-existent niche as a construct of criminals themselves. In particular, I have attempted to show in this paper that some criminal groups, with drug traffickers prominent among them, transformed Colombia into a more-than-suitable place for the flowering of criminal activities of all sorts.

Finally, the Colombian experience may offer important lessons for some countries where both crime and drug trafficking are gaining prominence (Mexico and some ex-Soviet republics are cases in point). As recognized by Stares (1996), ''if extensive drug cultivation gathers momentum in some former communist states, most notably within the Central Asian republics of the former Soviet Union, a Colombian-style process could unfold.'' Policy making may prove especially difficult in this case given the inertia of criminal dynamics. Timing is paramount

here. In the words of economic historian Paul David, there are only ''narrow'' windows in which policy can be effective.

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Appendix A

Country	HOM	GDPP	HDI	IC	EJS	PS	RESID
Argentina	8.9	3.4860	0.91	35.2	6	7.72	−6.49
Australia	2.7	8.8500	0.978	28.1	10	8.5	−5.31
Austria	1.9	8.9290	0.961	28.7	9.5	9.04	−3.71
Bahamas	15.3		0.88	32.1			
Barbados	7.1	5.2120	0.925				
Belgium	1.5	9.7170	0.966	21.57			
Brazil	29.4	3.1640	0.784	46.2	5.75	7.54	−0.83
Bulgaria	3.7		0.918	22.5			
Canada	2.5	12.196	0.983	24.1	9.25	9	1.64
Chile	5	3.4860	0.931	34.8	7.25	6.46	−17.37
China	1		0.716				
Colombia	**91**	**2.5990**	**0.801**	**43.5**	**7.25**	**6**	**55.88**
Costa Rica	7.6	2.6500	0.916	39.8			
Czechoslovakia	1.3		0.931	21.8			
Denmark	1.1	10.884	0.971	25.6	10	8.5	−4.21
Ecuador	21.8	2.3870	0.758	51.5	6.25	6.63	−20.34
Finland	4	9.2320	0.967	26.9	10	8.79	−0.86
France	1.3	9.9180	0.974	25.5	8	8.92	0.28
Germany	1	10.708	0.967	23.4	9	8.21	−1.60
Greece	1	4.4640	0.949		7	8.63	
Hong Kong	1.7	9.0930	0.936	37.3	10		
Hungary	3.7		0.915	20.9			
India	5	0.75000	0.439	34.9	8	7	−7.31
Israel	3.3	6.2700	0.957	23.2	10	6.25	−7.18
Italy	3.6	7.4250	0.966	25.3	6.75	7.92	0.27
Japan	0.7	9.4470	0.996	22.7	10		
Luxembourg	3.3	10.540	0.934				
Malta	1.7		0.898				
Mexico	30.7	3.9850	0.876	40.6	6	6.88	3.47

Netherlands	1.4	9.0920	0.984	23	10	8.83	2.26
New Zeland	3.4	8.0000	0.966	28.7	10	8.5	−4.89
Norway	1.9	12.623	0.983	26.6	10	9.5	−0.93
Panama	12.1	2.9120	0.883	44.2	6.75		
Poland	3.8		0.91	20.6			
Portugal	2.3	3.7290	0.899	33.4	5.5	7.54	−10.94
Puerto Rico	21.8			34.7			
Romania	7.4						
Russia	16.3						
South Korea	1.3	3.0560	0.903	24.5	6	9.42	10.29
Spain	1.2	6.4370	0.965		6.25	6.67	
Sri Lanka	12		0.789	35.2	7	7.22	
Sweden	1.7	9.9040	0.987	18.6	10	9	9.36
Switzerland	1.4	10.640	0.986	27	10	9.25	−2.29
Trinidad and Tobago	12.6	6.8840	0.885	33.6	8	7.79	−3.10
United Kingdom	1	8.6650	0.97	24.8	10	8.33	−2.85
Uruguay	6.9	3.4620	0.916	29.3	6.5	9	6.02
USA	13.3	12.532	0.961	25	10	9.33	12.30
Venezuela	14.4	3.5480	0.861	35.7	6.5	7.71	−1.53

HOM: Homicide rate for the male population in 1988. World Health Organization (1988–1991) annual reports, several issues. GDPP: GDP per capita in 1985 (Barro, 1991). HDI: Human Development Index in 1988. Human Development Report, 1990. IC: Percentage of total income received by the highest 10% of households. Brittanica World Data, Comparative National Statistics, 1990, pp. 848–852. EJS: Efficiency of the judiciary system as computed by Mauro (1995). PS: Political stability as computed by Mauro (1995). Resid: Residual after regressing HOM on all the other variables.

Appendix B. Data sources

Aggregate homicide rates (Fig. 1): The source for yearly homicides is Colombian National Police. The source for population data is Colombian National Department of Statistics (1990) (DANE). Both series can be downloaded from: http//cedebase.uniandes.edu.co/.

Homicide rates at state level (Fig. 6): The primary sources are Colombian National Police and DANE. I took this data from Gaitan (1995), p. 310 and Montenegro and Posada (1995).

Car thefts (Fig. 2a): The source is Colombian National Police. I took this information from Gaitan (1996, p. 324).

Kidnappings (Fig. 2b): The source is Colombian National Police. I took the information from the Monthly Bulletin of the Colombian National Department of Statistics (1995), p. 186.

Bank robberies (Fig. 2c): The source is Colombian National Police. This Series can also be downloaded at http://cedebase.uniandes.edu.co/. I use Colombian CPI to deflate money values. The standard source for CPI is DANE.

Indictments (Fig. 4): The source is Colombian National Police. This information was previously published in Gaitan (1995), p. 329.

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