HOMICIDE CYCLES IN COLOMBIA, 1950-1999

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Abstract

We estimate a model to account for homicide cycles in Colombia, 1950-1999. The variables that together account for about eighty percent of the variation in murder cycles are the years of Colombia's *La Violencia* period, the years of collusion between the two establishment parties (the National Front years), the inflation-adjusted trade balance and real social expenditure, both in per capita terms, and the size of Colombia=s military forces as a proxy for all armed forces (military, para-military, guerrilla, and drug-related) in the country.

JEL codes: C22, D63, D74, H56, K42, N46, O54
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1. Introduction

Latin American countries record, by far, the highest homicide rates in the world, averaging 20 to 30 murders per 100,000 people. This is

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two to three times as many as the next most violent regions of the world (Guerrero, 1998; Londoño, 1998, p. 72). Within Latin America, Colombia is known for its extremely high levels of homicidal violence, resulting in one of the highest murder rates in the world. According to Colombian National Police statistics, homicides increased from around 5,000 per year in the 1950s and 1960s to about 10,000 per year by 1980 and to about 25,000 per year by 1990. A further surge to nearly 30,000 murders per year was seen in the early 1990s. This has moderated somewhat but, in absolute numbers, still hovers between 20,000 to 25,000 per year or around 50 murders per 100,000 people (figure 1).

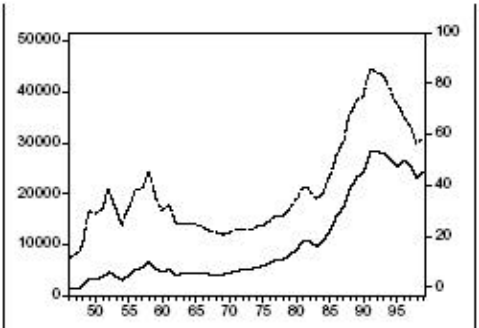

Figure 1: Homicides in Colombia, 1946-1999
Source: see appendix on data sources

The country´s murder rate varies substantially not only over time, but also from region to region (Dinar and Keck, 1997, pp. 9-10; Guerrero, 1998, pp. 96-97; Londoño, 1998, p. 76), with rates as low as 16/100,000 that would be regarded as near Anormal@ elsewhere to rates as high as 900/100,000 (Guerrero, 1998, p. 97).

These numbers underestimate the truth. Following a survey, Rubio (1998a, p. 606) writes that even for murder, “more than half of the households victimized stated that they had ‘not done anything’, and only 38 percent reported that they had made a formal complaint” to the authorities. Comparing separate statistical reporting by the police and the justice agencies Rubio finds wide disparities for more than a quarter of Colombia’s municipalities. The disparities are largest in

municipalities characterized by the presence of an armed force (military, para-military, drug-gangs, or guerrillas; Rubio, 1998a, p. 607). Apparently, victims fear reprisals.

Without doubt, Colombia´s murderous violence is related to two of its most salient features, the drug trade and the political violence, both of which have marred the country for decades. Less well-known and appreciated is that these two factors account only for a portion of all murders in the country (Guerrero, 1998, p. 98). For murder, the primary risk factors are alcohol consumption and possession of firearms. A quarter of all murders take place on Sundays, more than half on Friday, Saturday, and Sunday, with disproportionate increases on holidays. Most murders are non-political, take place at night, in urban areas, are committed by poor people on poor people, and alcohol is frequently found in the victims (Londoño, 1998, p. 75), although Guerrero observes that while alcohol consumption might explain the high levels it cannot explain the drastic *changes* in violence in Colombia in the 1980s and 1990s (1998, p. 98).

Studies have failed to establish links between murderous violence and poverty rates, unemployment rates, urbanization rates, or rates of economic growth (Londoño, 1998, p. 74; Guerrero, 1998, p. 97).[i, ii] One compelling reason why these failures might have occurred is that the time series of homicide data is an amalgam of differently motivated murder. (In particular it would seem that the high prevalence and incidence of politically motivated murder, well-known from the narrative literature and the news media, needs to be subtracted out of the overall homicide data series.) This suggests that homicide data series should be decomposed into trend and cyclical information. Once the cyclical component is subtracted out, lack of economic opportunity, unemployment, poverty, urbanization, breakdowns in the justice system, and so forth might then well explain trend levels of murder.

By the same token, one might build a model that explains not trend homicide data but the cyclical data. To do so is the purpose of this paper. Inasmuch as generalized violence is a widely acknowledged

impediment to economic and social development, our work should be of considerable interest to a wide range of scholars and practitioners.

Data and methods

Cyclical murder data are taken from Brauer, *et al*. (2004). Other data were collected in Colombia from various Colombian sources and adjusted for inflation and population growth (see data source appendix for a detailed description). The estimation method used is multiple regression analysis. Special attention was paid to functional form and regression diagnostics. Because of the sharp downturn in cyclical murder after 1991, we run our models separately for 1950-1991 as well as for the full 1950-1999 time period.

Initial model

Political variables

In Colombia, the time-period from 1946 to 1957 (or, in Bushnell's, 1993, discussion from 1947 to 1960) is generally referred to as *La Violencia*, a period of intense power clashes between the "liberal" and "conservative" parties, mingled with a brief, overt military intervention (1954-1958) and incipient guerrilla activity. From 1958 to 1978, the two main establishment parties came to a peace of sorts and, under the name of National Front, arrived at a power-sharing agreement according to which the presidency would be swapped between the parties every four years, and cabinet and other high-ranking political posts would be divided up as well. During those years, cyclical murder fell, even as guerrilla activity continued and intensified. After 1978, the power sharing arrangement broke down and intense struggles over political dominance reemerged, now intensified by cocaine riches. The latter brought drug-cartels into the political struggle as well as drug-lords sought control over land to grow coca leaves. This, in turn, appears to have drawn owners of large-scale land-holdings, generally used for cattle-ranching, into the conflict and various para-military groups emerged to participate in the struggle.[iii]

A structural model explaining cyclical murder then should contain

variables for the *La Violencia* and the National Front years. As a first approximation this is done in the simplest and most effective way with the use of dummy variables. Following Bushnell (1993), we code *La Violencia* equal to 1 for 1947 to 1960, and we call the variable "B" (for *Bogotazo*, which refers to the violent, murderous rioting in Botogá on 9 April 1948). The National Front years ("CL" -conservative/liberal) are coded equal to 1 for 1958 to 1978.

It is not so clear how to best represent the post-1978 years. Whereas we do have numbers on the strength of the police and armed (i.e., military) forces, we are not in possession of such numbers for para-military, guerrillas, and drug-gangs.[iv] It might be argued, however, that the police and military personnel numbers reflect information about the strength and intensity of the various opposing forces so that, from a modeling perspective, the police and military forces can stand as a proxy for *all* armed groups in the country.

The data show a remarkably constant level of total police (PFp100) and military (AFp100) forces – from 400 to 450 per 100,000 people – during the National Front years, 1958 to 1978 (the top line in figure 2).

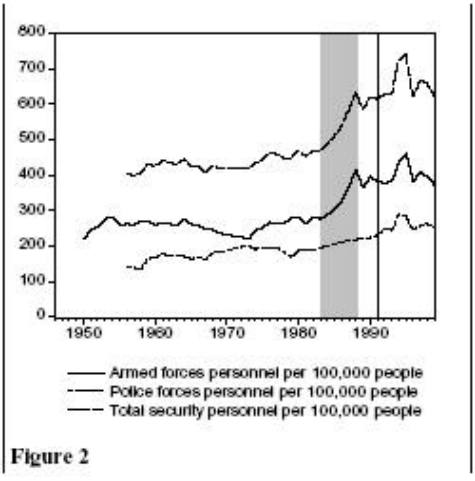

Figure 2

Thereafter, we note a drastic force increase, especially for the period from 1983 to 1988 (the shaded area; we refer to the line drawn at 1991 later on). The 1983-1988 time-period saw heightened, often spectacular, guerrilla activity. This is also the time when cocaine become so

profitable as to spur competition for control over land and corresponding political influence. This mingling of old and new economic interests and political control, in which established political parties, the police and military, the drug cartels, landowners, and para-military participated, lasted, roughly, from 1978 to 1991 at which time Colombia adopted a new constitution. Also, in June 1991, infamous drug-lord Pablo Escobar turned himself in for a jail term to be served in Colombia. With the exception of a total security force spike in 1994 and 1995, the post-1991 period shows a stable level of total security forces and reflects relative *political* quietude, even as violent conflict carried on among the drug cartels. Bushnell (1993) explicitly refers to the post-1991 era as the "end of war" period (and we will return to this point).

It is not clear that both police and military force data should be included in the modeling. Examining figure 2 more closely, it does appear as if police and armed force strength respond to different underlying motivations. In particular, note that during the National Front years, the armed force variable declines, picking up in the mid-1970s as the National Front consensus begins to break apart, and increases drastically during the 1980s. In contrast, the police force variable moves quite differently. That is, the armed forces variable shows more cyclicality than the police force variable (which seems more closely associated with trend homicide), and we therefore use the armed force in our model. This also has the advantage of reaching back to 1950, giving us additional degrees of freedom. In fact, the sharp rise in this variable in the early fifties is entirely consistent with the initial *La Violencia* years; it then declines slightly as the military under General Rojas Pinilla (1954-1958) assumed direct governmental power.

A different way to characterize the post-1978 period might be with the further use of dummy variables such as "all-out-war" (1979-1991) and "end-of-war" (post-1991) but the use of a continuous, relevant variable such as AFp100 that stretches across the entire time-period (1950-1999) is statistically preferred. One might also try multiplicative effects, such a *La Violencia* with armed forces (BxAFp100) or the National Front years with armed forces (CLxAFp100), but it is not clear

on theoretical grounds why that would be an improved functional form and why one should test for such variables. (One exception is discussed later on in this paper.)

Economic variables

Repeatedly, the Colombian narrative literature has noted a seemingly curious link between commodity-export booms and political violence, i.e., between a measure of income flows and cyclical murder. One hypothesis is that commodity booms increase the pot-of-gold over which it is "worth" fighting.[v] One might therefore test the hypothesis that, for Colombia, the inflation-adjusted trade balance per capita (rTBpcap) is an explanatory variable for murder cycles. An inspection of the descriptive graph (in figure 3) is suggestive.

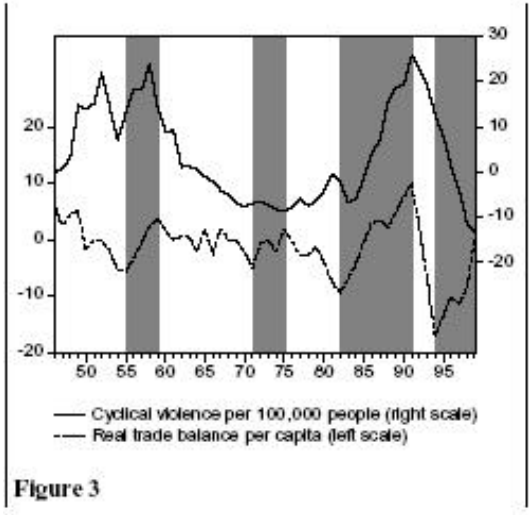

Figure 3

There are four time-periods of pronounced improvements in the balance of trade (1955-1959; 1971-1975; 1982-1991; and 1994-1999; the shaded areas in figure 3). Levels of murderous violence in the first and third period are strongly associated with trade balance improvements; the second period shows no relation to the trade balance, and the fourth

shows an opposite movement. Thus, there might well be something to the argument, at least as from the mid-1950s onward, and we include this variable in our model. At a minimum, we can test statistically whether the suggestion in the narrative literature B that commodity booms are associated with upswings in cyclical homicide B has merit.

Other relevant economic variables are levels of inflation-adjusted private consumption per capita (rCpcap) and, perhaps, social consumption as reflected in government real social expenditure per capita (rSpcap) or real government total consumption expenditure per capita (rGOCpcap). Unlike the trade balance variable, private and social consumption are not so directly linked to export success and pot-of-gold attractions. The hypothesis is that improvements in private and social consumption are associated with reduced levels of political unrest, general violence, and murder. Since social consumption (health and education expenditure) in Colombia is small, we at first thought that the more encompassing government consumption variable should be used in our model. However, rGOCpcap is highly correlated with the police and armed forces variables (on the order of r=0.8), and the expenditure on these forces is part of rGOCpcap. It turns out that rSpcap also is highly correlated with the force numbers, but at least the variables are conceptually different. We therefore decided to use rSpcap, instead of rGOCpcap, as our measure of social consumption.[vi]

Results and interpretation

Our initial model to be tested thus is (with expected signs preceding the variables):

(1) cvp100 = f (+B, -CL, +rTBpcap, -rCpcap, -rSpcap, +AFp100)

where;

cvp100	cyclical murder per 100,000 people
B	years of *La Violencia* (1947-1960, following Bushnell=s dating)
CL	years of the National Front (1958-1978)
rTBpcap	real trade balance level per capita

rCpcap	real private consumption level per capita
rSpcap	real social (health and education) consumption level per capita
AFp100	number of armed (i.e., military) forces per 100,000 people

The monetary variables are measured in millions of pesos, adjusted for inflation. To gauge the pronounced "kink" in the cyclical murder data in 1991 (figure 3), the model is also run for 1950-1991. The initial results are displayed in table 1.

Table 1: Initial estimation results

Dependent variable: cvp100; all numbers are rounded
The first reported numbers are for 1950-1991; **bold numbers are for 1950-1999**
Estimates for 1950-1999 are Newey-West HAC (see text)

Variable	coefficient	std.error	t-stat	p-value
constant	-13.77	12.70	-1.08	0.2858
	-25.71	**5.95**	**-4.32**	**0.0001**
B	10.62	3.23	3.29	0.0023
	7.45	**3.75**	**1.99**	**0.0533**
CL	-4.76	2.38	-2.00	0.0538
	-5.32	**2.02**	**-2.64**	**0.0116**
rTBpcap	0.74	0.26	2.84	0.0074
	0.52	**0.24**	**2.22**	**0.0319**
rCpcap	-0.23	0.28	-0.82	0.4187
	-0.03	**0.21**	**-0.12**	**0.9059**
rSpcap	-20.45	270.78	-0.08	0.9402
	-354.34	**179.83**	**-1.97**	**0.0552**
Afp100	0.13	0.03	3.84	0.0005
	0.15	**0.04**	**3.91**	**0.0003**

adj. R^2 = 0.84 (**0.74**); DW = 1.63 (**0.98**); F-stat = 36.77 (**24.38**); p-value

(F) = 0.0000 (**0.0000**)

We first discuss the estimates for the shorter time-period, 1950-1991 (displayed in regular type font, i.e., not bolded). All coefficient estimates conform to our prior expectations. The *La Violencia* dummy ("B") is positive and statistically significant; the National Front dummy ("CL") is negative and statistically significant.[vii] Of the monetary variables, the trade balance effect is positive, confirming the narrative literature, and is also statistically significant. Even though they do show the expected negative sign, neither the private nor social consumption variables are statistically significant.

Finally, the armed force variable is statistically significant and carries, as expected, a positive sign. The adjusted R^2 is large at 0.84. The Durbin-Watson statistic (DW=1.63) appears low but residual tests do not show evidence of serial correlation. Not shown here, for 24 lags, all autocorrelations and partial correlations show low Q-statistics and high p-values. Also, the Breusch-Godfrey Serial Correlation LM Test (with two lags) shows no evidence of serial correlation. It appears that our model characterizes the data well, but that neither social nor private consumption should affect cyclical homicide puzzled us. Upon further investigation, we found a theoretically (and statistically) more satisfying model which we discuss in another section (see Amended model).

When considering the time-period beyond 1991 (in **bold typeface** in table 1), the conclusion of having found a satisfactory model does not hold so easily. Even though the signs of all coefficients were as expected and only the coefficient for private consumption was statistically insignificant, the Durbin-Watson statistic suggested, and the Q-statistics and the Breusch-Godfrey Serial Correlation LM Test confirmed, severe positive serial correlation. With two possible exceptions to be discussed shortly there seemed no obvious misspecification problem. If there is no misspecification, we would be dealing with pure serial correlation, and the coefficient estimates are then unbiased. In this case only the standard errors, and thus the t-stats and p-values would be affected. Thus, we employed the Newey-West

method to produce heteroskedasticity and autocorrelation consistent (HAC) estimates (see, e.g., Studenmund, 2001, pp. 334-335). The standard errors, t-stats, and p-values reported in table 1 are the HAC values.

Model misspecification

We can think of two reasons for potential model misspecification. One is the possibility of *violence inertia* (e.g., revenge motives) so that the model might need to include a lagged term, say $cvp100_{-1}$ (a one-period lag of the dependent variable). A second possibility is that we encounter in 1991 a *systemic change*, requiring an altogether different model for the post-1991 period. *A priori* we like the notion of systemic change better. Whereas for weekly or monthly data, we would more readily accept the concept of violence inertia, it is not clear why inertia should last for the duration of one or more years. For annual data it seems more likely that other factors are at work.[viii] In contrast, the notion of a systemic change is more appealing on the grounds of what actually happened in the country. President Gaviria (1990-1994) became, at age 43, the youngest Colombian president in the 20th century, and the first president of the post-*Violencia* generation (the "Kennedy" of Colombia). This was an important break in Colombian political culture. Gaviria pushed through a new constitution, adopted in 1991, that was greeted with enthusiasm across the country. And he appointed a former M-19 guerrilla leader, Antonio Navarro Wolf, to the post of minister of health. Colombian social consumption (health and education expenditure) rose drastically, as did other government and private consumption. The spending differences to the pre-1991 period are striking (see figure 4).

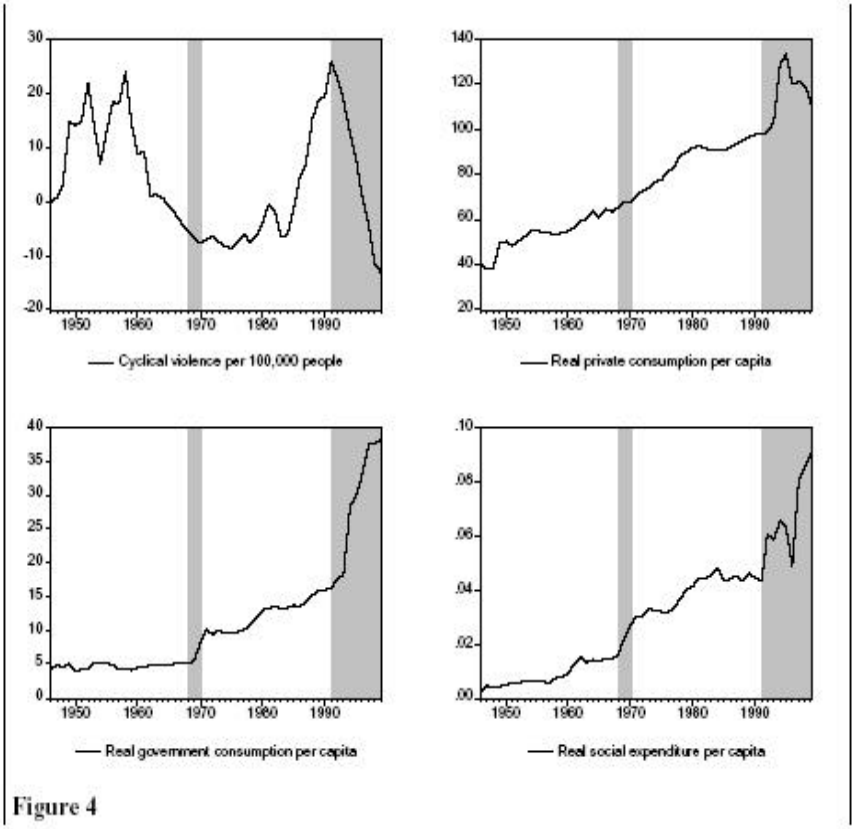

Figure 4

We therefore decided to test for a structural break between 1991 and 1992. This, in turn, not only required a correct model for 1950-1991 to carry forward to 1992-1999 but allowed us to revisit the question of why, in our initial model, social and private consumption did not result in statistically significant coefficients.

Amended model

Starting, then, with the initial 1950-1991 model results as reported in table 1, we applied Ramsey's Regression Specification Error Test (RESET) which indeed suggested misspecification. We also ran another

stability test, Recursive Coefficient Estimation (RCE), which permits us to gauge coefficient instabilities as data points are added to the model. A particularly obvious coefficient jump occurred from 1968 to 1970 for the social consumption variable (confirmed by figure 4; the thin shaded vertical bar). This, combined with the fact that, in table 1, the rCpcap and rSpcap coefficients were statistically insignificant prompted us to test whether either or both were redundant. Both variables turned up redundant, but rCpcap (private consumption) much more clearly so.[ix] We thus dropped rCpcap from the model. Next, we added a shift dummy (DS) to account for the social consumption-slope shift that occurred in 1969 (and another slope-shift in 1996, see figure 4, so that DS is coded as 1950-1968=1; 1969-1995=2; 1996-1999=3). The results are reported in table 2.[x]

Table 2: Amended model

Dependent variable: cvp100; all numbers are rounded
The first reported numbers are for 1950-1991; **bold numbers are for 1950-1999**
Estimates for 1950-1999 are Newey-West HAC (see text)

Variable	coefficient	std.error	t-stat	p-value
constant	-22.09 **-30.51**	8.73 **4.82**	-2.53 **-6.32**	0.0159 **0.0000**
B	12.16 **10.74**	2.85 **2.32**	4.27 **4.64**	0.0001 **0.0000**
CL	-4.64 **-4.38**	2.36 **1.72**	-1.96 **-2.55**	0.0574 **0.0145**
rTBpcap	0.79 **0.51**	0.26 **0.15**	3.06 **3.33**	0.0041 **0.0018**
DS*rSpcap	-87.79 **-119.27**	35.89 **17.98**	-2.45 **-6.63**	0.0195 **0.0000**
Afp100	0.11 **0.14**	0.03 **0.02**	3.94 **7.89**	0.0004 **0.0000**

adj. R^2 = 0.84 (**0.80**); DW = 1.61 (**1.24**); F-stat = 44.24 (**39.85**); p-value (F) = 0.0000 (**0.0000**)

For 1950-1991, while the DW-statistic remains low (DW=1.61), neither the Q-tests nor the Breusch-Godfrey Serial Correlation LM Test come close to suggesting serial correlation. The RESET still suggests misspecification but the recursive coefficient estimates now are clean statistically speaking. Unlike RESET, RCE allows us to examine the evolution of the coefficient estimates on a year-by-year basis, and it is our preferred measure of potential misspecification. We therefore decided to accept this model as our final model for the 1950-1991 time period. All coefficients conform to prior expectations, and all are statistically significant. *La Violencia* increased cyclical murder, the National Front years decreased it. The trade balance remains statistically linked, over this time period, to homicide cycles. Increases in social consumption, when adjusted for its break in 1969, are significantly related to downturns in the homicide cycle, and the increased presence of armed forces is significantly related to upswings in the homicide cycle as well. (Recall that we use armed forces as a proxy to stand for all fighting forces in the country.)

We now turn to the numbers reported in **bold typeface** in table 2

and to the question of whether or not the earlier time-period model can be carried over to the longer period, i.e., to the possibility of a structural break. Note that all coefficients are again of the expected sign, and all are statistically significant. The adjusted R^2 is high (0.80) but there now exists severe serial correlation again. The Chow Breakpoint Test could not be run since we have only eight data points for the 1992-1999 period. Thus, we employed the Chow Forecast Test. This runs the 1950-1991 model, forecasts the values of the dependent variable (cvp100), and then compares the forecast with the actual values.

This test rejects the null hypothesis of no structural break (F=2.87, p=0.014; LR=24.65, p=0.0018). It is, however, not clear just what this statistically identified structural break would consist of. Except for rSpcap (because a third dummy value kicks in for 1996), the estimated coefficients between the 1950-1991 and the 1950-1999 time periods are nearly identical. Moreover, as may be seen in figure 5, when we took the shorter-period model and did an ordinary forecast of cvp100 and compared that forecast to the actual cvp100 data, the model certainly captures the Aspirit@ of the post-1991 period.

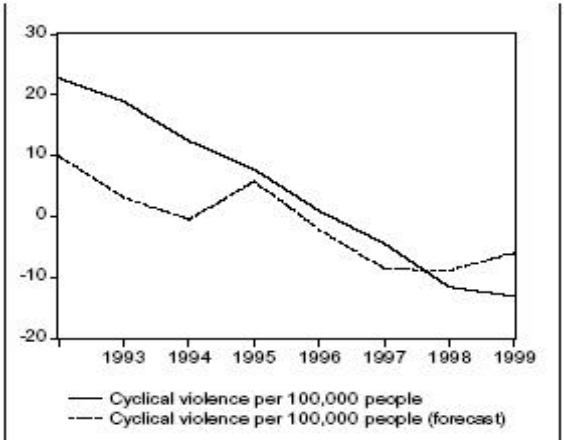

Figure 5

Despite the Chow test we therefore accept our model for the longer period also.[xi,xii] We thus conclude that our model, consisting of variables for *La Violencia*, the National Front years, the real trade balance per capita, real social consumption per capita, and armed force personnel (as a proxy for all armed forces in the country), explains about eighty percent of the observed movement in the cyclical murder variable for the years 1950 to 1999.

Conclusion

Provided with a data series of homicide cycles in Colombia, 1950-1999, we built a structural model to explain the movements in that time series of data. We find that obvious variables, such as coding for the *La Violencia* and the National Front years, are statistically significant (and of the expected sign). Further, we find that increases in real social expenditure (on health and education) reduce murder cycles and that increases in the size of the armed forces (as a proxy for all fighting factions) increase murder cycles. We also find, as the narrative literature suggests, that an increase in the real trade balance leads to upswings in cyclical murder. The underlying hypothesis is that trade balance improvements derive from commodity booms (coffee, cocaine) that make land more valuable and the contest over land more severe. To see if this finding is merely an artifact of statistical modeling is worth investigation in greater detail in separate research.

The methodological approach of separating homicide into trend and cyclical components opens up research possibilities in a number of previously closed off directions. These include a re-examination of (trend) homicide to learn if such a series would now track with economic conditions such as poverty, unemployment, and inequality (recall that the literature currently does not find a link between these variables and overall homicide). Likewise, we have begun to collect homicide data for each of Colombia's 33 *departamentos*, or provinces. We would expect trend homicide to be explained across regions by the same set of variables, but cyclical homicide will probably look very different across regions, especially that part of cyclical homicide

directly associated with political violence which we know is heavily concentrated in particular regions of the country and more likely to be heavily influenced by commodity-booms and the presence of armed forces. The data decomposition technique can also be used to examine non-homicidal crime (e.g., kidnapping, hostage taking) and, indeed, can be used to examine crime data for other countries plagued, as Colombia, with severe unrest.

The results reported in this paper are encouraging as they appear to capture murder cycles in Colombia well and, in particular, give some statistical credence to what commentators in the narrative literature have long suspected, namely that the drug-trade finances the political struggle and that state social expenditure might be an important tool to lessen the violence.

Appendix: data sources

All monetary variables were obtained in nominal terms and converted to inflation-adjusted or real terms with the implicit GDP deflator (1994=100). The deflator is obtained for 1946-49 from CEPAL, for 1950-1980 from *Banco de la República* (Central Bank of Colombia), and for 1981-1999 from *Departamento Administrativo Nacional de Estadística* (DANE). Per capita adjustments are made on the basis of total population (millions) counts coming from the censuses of 1953, 1968, 1973, 1978, 1983, 1985, 1993 and projections by DANE.

Nominal social expenses (in millions of Colombian pesos) consists of health expenditures and education expenditures. For 1946-1970, taken from "Estado y Hacienda Publica en Colombia, 1934-1990," by César Giraldo (*Contraloría General de La Repúbica*); for 1971-1999, taken from financial reports of the General Comptrollers Office of Colombia.

Nominal trade balance data (millions of Colombian pesos) is obtained as the difference of exports and imports of goods and services; *Banco de la República* (Colombian Central Bank), DANE, and calculations by

the *Departamento Nacional de Planeación* (National Planning Department), Macroeconomic Studies Unit. Nominal private consumption (millions of Colombian pesos); *Banco de la República*, DANE, and calculations by the National Planning Department, Macroeconomic Studies Unit. Nominal government consumption (millions of Colombian pesos); *Banco de la República*, DANE, and calculations by the National Planning Department, Macroeconomic Studies Unit.

The data for the total number of personnel of the Colombian police (PF) and for the total number of active members of the armed forces both come from the National Planning Department, Justice and Security Unit.

The coding for the years of *La Violencia* and the National Front years are taken from Bushnell, 1993. Total homicides are the sum of four murder series: murder (*homicidio*), aggravated murder (*homicidio agravado*), murder with terrorist intent (*homicidio con fin terrorista*), and death associated with the exercise of official duties (*homicidio con función, razón cargo o ejercicio de sus funciones*). The data are taken from various issues of *Revista Criminalidad*; Colombian National Police. Finally, the cyclical component of total homicides is reported in Brauer, Gómez-Sorzano, and Sethuraman (2004).

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i. Indeed, Rubio (1997) and others have made persuasive arguments according to which the educated *and* uneducated classes both engage in criminal and violent activity for the simple reason that crime pays well. Income and education are no longer linked, but income and crime are (Rubio, 1997, p. 812). Average annual incomes from crime have been variously estimated at up to $70,000 per person, a huge premium over Colombia's *per capita* 1995 GDP of around $1,800 (Bejarano, 1997, p. 12). The break-down of the Colombian justice system further encourages criminal and violent behavior, as the probability of being caught, tried, and convicted is becoming smaller over time. By 1994, convictions rates had dropped to below four percent (Rubio, 1998a, p. 606), and sentences rarely exceeded six months of jail time (Rubio, 1998b, p. 91).

ii. There is widespread agreement among analysts that Colombia's violence is costly, both at the microeconomic level (e.g., Dinar and Keck, 1997) and at the macroeconomic level, estimated at up to 15 percent of GDP (Bejarano, 1997, p. 10). There is some evidence that major perpetrators of violence B the military and paramilitary forces, the drug-traders, and the various guerrilla groups B act in semi-collusive fashion to keep the spoils of war going (Richani, 1997), evidence in line with the theory suggested by Brito and Intriligator (1992).

iii. For a history of Colombia see, e.g., Bushnell (1993). On the role and links

between and among police, army, and para-military troops in the Colombian conflict see, e.g., Giraldo (1996). For a recent, popular (and personal) account, see Kirk (2003).

iv. According to reports in *The Wall Street Journal* and *The Economist*, numbers for 2002 run at about 22,000 members for FARC and ELN, the two largest rebel groups, perhaps 10,000 to 12, 000 para-military troops, and another 5,000 or so drug-related troops. The Colombian armed forces weigh in at about 150,000 (including 50,000 salaried, professional troops) and the police force at 100,000.

v. We know from the African experience that natural-resource riches attract contestants (see Sambanis, 2002, for a literature review on this and other aspects of the economics of civil wars).

vi. In the statistical work, we used two measures for real social consumption per capita, both derived from Colombian data sources but differing in magnitude. Both resulted in nearly identical coefficients for our models. We therefore report the model results using only one of the two social consumption variables (see appendix).

vii. Note the overlap of the B and CL dummy variables for 1958, 1959, and 1960. For these years, the combined effect on cvp100, relative to the intercept, would be the sum of the coefficients for these two variables (i.e., +5.86 in the 1950-1991 model for the years 1958-1960). To learn what difference the coding might make, we also coded the *La Violencia* years (variable B) to last only until 1957 (i.e., without overlap). Although magnitudes change, the signs of all coefficients are unchanged and, in most cases, their statistical significance is unaffected. In any event, our final coding (with the overlap) follows the descriptive literature on Colombia and is the theoretically preferred measure to use.

viii. Some argue that in Latin America violence inertia is a cultural phenomenon and should be modeled. To accommodate this notion, we modeled a one-period time-lag and examined the statistical results even though the use of lagged dependent variables introduces its own estimation validity problems. In our case, use of the lagged dependent variable drowned out all of the other explanatory variables. We would, in essence, explain today's violence with yesterday's. This is not satisfying from a policy perspective, and we did

not further pursue the use of the lagged independent variable.

ix. The correlation coefficient between these two variables is 0.95, suggesting the presence of a multicollinearity problem in the initial model. Simply dropping a variable in the presence of multicollinearity is inappropriate when the variable in question is theoretically relevant. In our case, though, there is a stronger theoretical case in favor of retaining the social consumption, rather than the private consumption, variable since homicide is a social phenomenon.

x. Coding the step-dummy (DS) as 1, 2, and 3 implies that the effect between the first and second period is the same as that between the second and third period. When using values of 1, 2, and 4 as well as of 1, 2, and 5, we retain all signs as well as, roughly, the magnitudes and statistical significance for all variables except of course for DS*rSpcap (which changes in magnitude only, becoming smaller) and for CL (which changes in statistical significance only, becoming statistically insignificant at DS=5).

xi. For those fearing that we are pulling too many strings, note that it has been shown that the Chow Breakpoint and Forecast tests can lead to inconsistent results (in which one rejects and the other accepts the null hypothesis). For an instructive example see, e.g., *E-Views4 User=s Guide*, pp. 364-366.

xii. It is important to realize that we took the 1950-1991 model B in which DS = 1, 2 B and forecast the cvp100 values for 1992 to 1999. The forecast of downward cyclical violence as depicted in figure 5 is thus not due to a DS =3 coding.