



## VIOLENCE AND GROWTH IN COLOMBIA: A REVIEW OF THE QUANTITATIVE LITERATURE

Alvaro J. Riascos  
Juan F. Vargas

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# Violence and growth in Colombia: A review of the quantitative literature<sup>†</sup>

Alvaro J. Riascos\*  
*Universidad de los Andes*

Juan F. Vargas<sup>◦</sup>  
*Universidad del Rosario*

## Abstract

This is a critical review of the empirical literature on the relationship between violence and economic growth in Colombia: an interesting case study for social scientists studying violence, conflict, crime and development. We argue that, despite the rapid development of this literature and the increasing use of new techniques, there is still much room for research. After assessing the contribution of the most influential papers on the subject, we suggest directions for future research.

Keywords: Colombia, Violence, Economic Growth

JEL codes: D74, K14, O4

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\* Contact: [ariascos@uniandes.edu.co](mailto:ariascos@uniandes.edu.co).

◦ Contact: [juan.vargas@urosario.edu.co](mailto:juan.vargas@urosario.edu.co).

## **Introduction**

Colombia is an exceptional case study for social scientists interested in conflict, crime, and violence in general. It is a country that suffers not only from a civil conflict but also from high levels of criminality, forced displacement, kidnappings and narcotraffick. In the last two decades economists working on Colombia have turned increasing attention to the analysis of the causes and costs of crime and conflict and the academic output is now abundant. Yet, this literature is almost unknown to the international academic community.<sup>1</sup> The aim of this essay is to provide a brief review of the evolution and state of art of the research on the relationship between violence and economic growth in Colombia. We hope to be able to make the case of Colombia as an interesting case study and contribute to the diffusion of this literature among academics and policy makers working on the field of violence.

In writing this review, we have followed three guidelines. First, we focus on quantitative studies on the effect of violence of economic growth.<sup>2</sup> Second, we do not distinguish among works using conflict or criminality variables, nor we differentiate between forms of criminality or ask about their origins. The majority of the papers we

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<sup>1</sup> One recent exception is a forthcoming Colombia special issue in *Defence and Peace Economics*. However none of the papers included in that issue study the relationship between violence and economic growth directly.

<sup>2</sup> A separate question that has also received large attention in the last few years is that of the economic determinants of violence in Colombia. Relevant studies in this field include Comisión de Estudios sobre la Violencia (1988); Gaitan (1995 and 2001); Sarmiento (1999); Sánchez and Nuñez (2001) and more recently Rodríguez and Daza (2011). Without denying the importance of this question, for the sake of space we overlook it in the present survey. For a short review of the determinants of violence in Colombia see Martínez (2001).

refer to, focus on criminality figures. Still, some of them also use data on the internal conflict. Crime and conflict are two different phenomena, even if they could be interrelated in specific contexts. However such relationship, which is in nature complicated, has yet not been studied carefully.<sup>3</sup>

Throughout the review we will stick to the concepts used in the specific papers by the different authors. Otherwise we will use the word *violence* to refer to both criminality and conflict, though we recognize this definition is also problematic.<sup>4</sup> Moreover, the concept of criminality is itself quite broad. It is sometimes associated with the homicide rate, manslaughter, street crime, crime against property, drug trafficking, kidnapping or a mixture of some or all of these actions. Again, we will use *violence* although we believe that a clear distinction of the different activities and their impact on the economic growth should be at the top of any research agenda.

The third guideline is our emphasis on the rate of growth of the economy as the outcome of interest. That is, we abstract from the long-term relationship between violence and the economy and focus on the short-term relationship, leaving aside studies that have had as their variable of interest the level of output.<sup>5</sup> These are indeed very different research questions, as illustrated by Figure 1. The figure shows the evolution of the real GDP per capita (left axis) and its rate of growth (right axis) for the period 1950-2005. After a short episode of negative growth in 1958 the country grew steadily (and with low volatility) until de mid 1970s. The rate of growth was again

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<sup>3</sup> An exception of this is Sánchez, Díaz and Formisano (2003), who use spatial econometrics to explore the link between crime and conflict in Colombian regions.

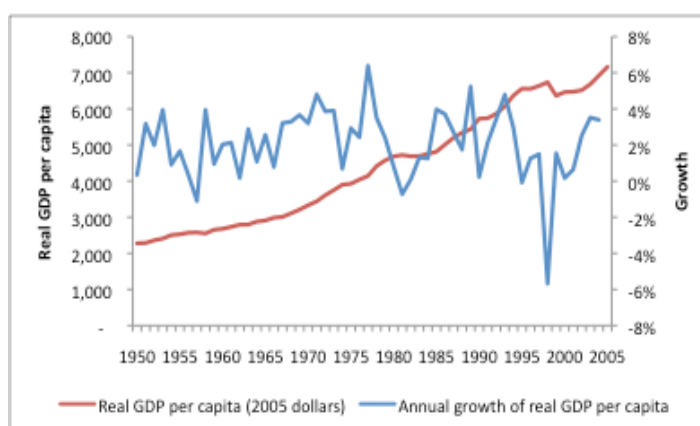
<sup>4</sup> The World Health Organization (WHO, 2002) differentiates among self-harm (e.g. suicide), interpersonal violence, and collective violence. While only the latter has systematically been studied by social scientists interested in civil war, the study of interpersonal violence is often limited to crime economists. Our revision of contributions in both fields responds to our personal belief that these have much to learn from each other.

<sup>5</sup> Also, we do not review studies that look at the effect of violence on intermediate outcomes that may have in turn an impact on economic growth. Indeed, the research on the transmissions mechanisms linking violence and growth in Colombia is rather scarce, one exception is Dinar and Keck (1997) who argue that conflict affects private irrigation investments in rural Colombia, and through that channel it harms economic growth.

negative in 1982 but, in contrast to the rest of the Latin America region, then hit by the “debt crisis”, Colombia rapidly reached its growth path, albeit with a perceptible increase in volatility. In 1999, an unprecedented domestic crisis made the Colombian growth rate hit its all-time bottom: per capita growth rate was almost -6%. After a large bounce in 2000 the growth rate recovered gradually.

While the large changes in the growth rate of the economy have left they trace in the real GDP level, Figure 1 shows that the latter has increased steadily during the whole period, if fact the average income per person more than tripled during that period.

Figure 1: Real per capita GDP and GDP growth, Colombia, 1950-2005



Source: GRECO (2002) for period 1950-2000 and DANE for 2001-2005.

While the present review might not be exhaustive, we have made an effort to survey the most important studies given the topic-limitations that we have imposed to ourselves. The empirical literature on violence and Economic growth in Colombia has evolved in less than two decades from simple comparisons and cost-accounts, to more sophisticated techniques and the use of specific theoretical frameworks. This coincides with the recent trend of the international literature, which is increasingly making use of modern techniques to grasp a better understanding of the dynamics of violence, crime

and conflict.<sup>6</sup> Our contribution is then documenting the evolution and current state a research agenda pursued by economists and other social scientists interested in Colombia as a case study of a violent country.

### **Violence and Economic Growth in Colombia**

Economists in Colombia became interested in studying violence using quantitative approaches some 15 years ago. The first few papers were conceived as a reaction to a study by a multidisciplinary group of social scientist that related the Colombian growing record of violence to variables associated with economic deprivation.<sup>7</sup> A few years later, in 1995, three independent quantitative studies by Gaitán, Rubio, and Montenegro and Posada questioned this hypothesis, which by the time was already part of local ‘conventional wisdom’. In contrast to the qualitative approach of the 1988 interdisciplinary study, the 1995 articles were at the time novel in their quantitative approach and should be identified as pioneers in the empirical analysis of the relationship between violence and the economy in Colombia.

While Gaitán (1995) focuses on the determinants of violence incidence, Rubio (1995) and Montenegro and Posada (1995) do tackle the problem of its consequences on economic growth. We then exclude the former from the survey.

Focusing on the 1980s and early 1990s, Rubio (1995) explores the correlation between the aggregate homicide rate (killings over 100,000 people) and GDP growth. The author concludes that the persistently high homicide rate during that period prevented the economy from growing 2 additional percentage points per year. In contrast, Montenegro and Posada (1995) [hereafter MP] find a positive relationship between the homicide rate and GDP growth at the regional level during the late 1970s

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<sup>6</sup> See Blattman and Miguel, 2010 for a recent comprehensive review.

<sup>7</sup> Comisión de Estudios sobre la Violencia, 1988.

and the 1980s. The authors argue that the high level of violence during that period was the result of the rapid economic growth of some regions that did not have the institutional strength (e.g. protection of property rights) required to transform this growth into a virtuous circle of development without crime. In turn, the fast output growth created wealth easy to predate and disrupt. Rubio (1995) shows that the results of MP are not robust to changing the estimation period and provides in turn evidence consistent with the idea that more violent periods unambiguously coincided with lower growth rates.

From a methodological point of view, MP's findings come from estimating an econometric model in which the dependent variable is the regional growth rate and the main explanatory variable is the homicide rate. The latter is included both in levels and squared to explore potential non-linearities. The authors find indeed a non-monotonic (inverted-U) relationship. Their interpretation is that when violence reaches some critical threshold, the positive correlation between crime and growth reverses and crime starts hampering economic growth. In short, the story that MP put forward is rather idiosyncratic: at lower levels of violence causality runs from economic growth to violence: high economic growth causes violence to increase; however, when violence is high enough causality runs in the other direction: higher violence causes economic growth to slow down. While such story illustrates the classic endogeneity problem of reverse causality, MP makes no attempt to deal with the identification issue.

On the other hand in Rubio (1995), the analysis of the relationship between growth and violence goes beyond the observation of simple correlations. The author investigates for the 1980s the relationship between the declining levels of Colombia's total factor productivity (TFP) and violence levels, which increased during the same period. By running an OLS regression of the Colombia time series of these variables

(controlling for the then high and volatile inflation rate), Rubio finds that the increase in the homicide rate during the 1980s was directly responsible for an aggregate growth loss of about 2 percentage points per year.

Rubio explores a potential indirect channel as well and OLS-regresses aggregate investment on the homicide rate. Controlling for more traditional determinants of investment decisions, the author finds that the increasing homicide rates hampered private investment costing an additional 0.7% of GDP growth per year.

The overall conclusion of Rubio (1995) is that, in the counterfactual situation in which criminality had not increased so much in the 1980s, annual economic growth in Colombia would have been over 2.5 percentage points higher. It is worth noting that this figure is very similar to the one provided by Collier (1999). Collier looks at the relationship between civil conflict and economic growth in the second half of the 20th century for a sample of countries and estimates that the incidence of war is associated with a growth rate reduction of 2.2 percentage points. How big are these figures? Note that an economy growing at a real rate of 2.5% will double its size in just less than 30 years.

Rubio's paper inspired various researchers who endorsed his methodology. One example is Parra (1998), who deepens into the burden of violence on investment. Another is Cardenas (2007), whose motivation is actually the same as that of Rubio: the decline in TFP experienced during the 1980s in Colombia. In addition to violence, Cardenas (2007) explores the role of inequality in explaining that fact.

Parra (1998) regresses the aggregate investment rate in the second half of the 20<sup>th</sup> century on a number of variables including proxies of the cost of capital, a measure of economic activity, a proxy of aggregate human capital, and the (lagged) growth of



the homicide rate as a proxy of the overall violence of the country.<sup>8</sup> Parra finds that if violence levels were equal to the Latin-American average during the 1990s (which implies a reduction of 75% on the actual Colombian rates), the investment rate would be 50% higher, boosting economic growth. Put in another way, given the period-average share of investment on GDP, a reduction of 10% in the homicide rate would have translated into additional 1.2% in the annual rate of economic growth.

Cardenas (2007) econometric analysis is motivated by a comparative description of Colombia against a large sample of countries in terms of size, macroeconomic performance, trade and indebtedness, geography and health, income and wealth inequality and population fragmentation, political institutions and the incidence of violence. In such comparison Colombia shows up as an “average” country in all but two measures: economic inequality and violence. Colombia’s income-Gini (0.51) is higher than the world average; and the land-Gini (0.86) is one of the highest of the world. Moreover, Colombia is a world outlier in terms of violence, ranking first among 80 countries in 1995 according to the homicide rate, with 80 killings per 100,000 inhabitants.

Such comparisons motivate Cardenas’ hypothesis on the role of inequality and violence as obstacles for Colombia’s economic performance. The author runs an autoregressive model of the growth of GDP for the period 1950-2000 and incorporates year-specific dummies to uncover potential structural changes in the country’s economic growth. He finds one such shift taking place in 1979: Colombia’s economic growth fell from an average of 5% in the period 1950-79 to an average of 3% in 1980-2000.

Using a neoclassical constant returns to scale production function with human capital, Cardenas performs a growth accounting exercise to explore the factorial sources

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<sup>8</sup> The paper lacks a convincing justification for using the growth rate rather than the level of the homicide rate in a regression of the burden on private investment.

of the structural change. The estimated Solow residual suggests what the author calls an implosion of Colombia's TFP: During the period 1950-1979 TFP growth rate was on average 1.01%; in contrast, between 1980 and 2000 it was -0.95%.

Cardenas' hypothesis is that the productivity slowdown is explained by both the huge increase in crime and the growing inequality: On the one hand production of cocaine rose from an annual average less than 100 tons before 1980, to more than 500 tons in 1999 and illicit crops increased from 20,000 to 140,000 hectares in the same period. The homicide rate increased monotonically from 23 killings per 100,000 inhabitants in the 1970s to 41 in the 1980s and 62 in the 1990s. Kidnappings increased from an annual average of 44 in the 1980s to 3,706 in 2000. On the other hand, starting in 1980 the income-Gini increased steadily from 0.46 in 1982 to 0.53 in 2000, offsetting a downward trend that started at the beginning of the 1960s.

Cardenas also explores potential transmission mechanisms. He argues that crime and violence destroy the 'social infrastructure' (a concept motivated by Hall and Jones, 1999) and hence damage productivity by encouraging predatory behaviors that divert capital and labor to unproductive activities. To test these arguments the author runs an OLS regression of the previously estimated Solow residual on the homicide rate and the Gini coefficient, finding evidence of a negative correlation of both factors with the dependent variable.

Cardenas (2007) was an influential paper among younger Colombian economists who started studying the relationship between violence and economic growth in Colombia in the early 2000s. One example is Vargas (2003), who distinguishes criminality from conflict-specific events and takes advantage of a unique dataset on the latter to focus, for the first time, on the effects of the Colombian internal conflict on the country's economic performance. Previous studies had used the homicide rate, the best

proxy of criminality<sup>9</sup> but poorly correlated with the dynamics of the conflict itself.<sup>10</sup> Vargas proposes a systematic way of thinking of the channels through which the conflict may affect the rate of economic growth. He argues that in the context of a simple production function conflict intensity can affect the growth rate of output both directly, by shifting downwards productivity, and indirectly, by hindering the accumulation of factors of production (i.e. both physical and human capital). Thus, the author develops a neoclassical growth model in which both total factor productivity and the accumulation of physical and human capital are affected by the intensity of conflict.

To quantify the impact of conflict on growth, Vargas estimates by 3SLS a system of equations using quarterly data from 1988 to 2001. In the first equation, the GDP growth is a function of physical and human capital as well as the intensity of conflict.<sup>11</sup> The second and third equations capture respectively, by using autoregressive processes, the dynamics of physical and human capital. Also measures of the intensity of the conflict are added on both equations. This strategy allows Vargas to capture the direct impact of conflict on economic growth (through the coefficient of the conflict-proxy in the first equation) as well as the indirect impact. The latter is the effect of conflict on the accumulations of factors of production times the contribution of each factor to the growth rate of output, as captured by the first equation.

Vargas estimates that the increase in the intensity of the Colombian conflict since the late 1980s slowed the per capita economic growth rate in 0.3 percentage points on average during the 1990s. In particular the large upsurge of conflict activity starting in the late 1990s was responsible for about 1 percentage point loss in the per capita growth rate. Most of this impact (90%) is a direct impact via TPF growth, and the rest is indirect via the accumulation of physical capital.

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<sup>9</sup> E.g. Rubio, 1995.

<sup>10</sup> Restrepo et al., 2004.

<sup>11</sup> For this, Vargas uses different measures that go from clashes and attacks to casualty rates.

While it appeals to a simple but formal theoretical framework to organize the empirical strategy, Vargas study has a major shortcoming that is common to all the papers reviewed so far: It does not address the problems of simultaneity and omitted variables bias. In this respect, the paper by Querubin (2003) stands out. The author exploits the panel structure of the available data (department-level variation over time), which contrasts with the dominant time-series approach.<sup>12</sup> The author takes into account the potential for omitted variables, especially given the lack of regional data on important economic variables; as well as the difficulty in finding reasonable instruments to solve the endogeneity between violence and growth. Because both the rate of growth and the growth of violence change over time as opposed to most of the other determinants of regional growth, Querubin argues that taking the first difference of the growth equation eliminates all the departmental-specific fixed effects.

While this methodology solves the omitted variables problem for time-invariant controls, the reverse-causality issue is still at play and hence conclusions in this case also have to be taken with caution.<sup>13</sup> Controlling for other time-varying growth rate variables (transfers from the central government and income from illegal drugs), Querubin estimates the panel by GLS. His measure of violence is a three-dimensional vector including the homicide rate, the number of kidnappings and the number of actions of illegal armed groups. The three measures of violence turn out to be significant at 1% and have the expected sign.

According to the results, an increase of 10 percentage points in the rate of growth of the homicide rate implies an annual reduction of 0.37 percentage points in the

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<sup>12</sup> Rubio (1995), Parra (1998), Cardenas (2007), Vargas (2003) – MP's approach is a regional-pooled OLS regression.

<sup>13</sup> While the author refers to his as a difference-in-difference (DD) methodology, this is really not so at least in the sense DD is traditionally understood in microeconometrics, i.e., one in which an indicator of the treatment group is interacted with one of the post-treatment period, which generates a natural counterfactual difference to compare outcome-gains in the treatment group with. Rather, Querubin's regression is one of acceleration rates (second differences) of the variables of interest.

GDP growth rate. Similarly, the effect is 0.13 if the increase is on the rate of growth of the kidnapping rate, and 0.07 in the case of illegal attacks.

Querubin (2003) is the last paper in our survey that looks at the direct relationship between violence and economic growth. We speculate that, by acknowledging the existence of potential endogeneity between the incidence of violence and economic performance, Querubin paved the road for the more recent generation of empirical studies on the effects of violence in Colombia. Indeed these more recent papers have focused on the impact of violence on specific mechanisms that in turn may affect economic growth, while at the same time making explicit efforts in making causal statements. These include the accumulation of human capital<sup>14</sup>, the micro decisions of the productive firms<sup>15</sup>, early childhood development<sup>16</sup>, and the sovereign risk.<sup>17</sup> We do not review these contributions in detail because while the channels are made explicit, the ultimate effect on economic growth remains speculative. However, These are certainly topics and papers that deserve at the very least another review of their own.

## **Discussion**

Since the mid 1990s the literature on conflict and crime in Colombia has expanded rapidly, being now one of the main research agendas of local social scientists. One of the topics of this agenda is the relationship from violence, broadly understood, to economic performance. While this particular topic was largely studied in the late 1990s and first 2000s, very little research has been done since then and the currently

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<sup>14</sup> Rodriguez and Sánchez, 2011.

<sup>15</sup> Camacho and Rodriguez, 2011.

<sup>16</sup> Camacho, 2008.

<sup>17</sup> Castañeda and Vargas, 2011.

predominant research questions focus on different topics: the determinants of violence incidence<sup>18</sup> and its duration;<sup>19</sup> the determinants and the spatial dynamics of illicit crops;<sup>20</sup> and the effect of violence on specific channels that are thought to affect economic performance (see footnotes 14 to 17). But the general point is that the last two decades have witnessed a boom in the economic analysis of violence and conflict in Colombia.

We focus this review on the relationship between violence broadly understood and the rate of growth of the economy. Nevertheless we believe that the final word about the effect of violence on economic performance is far from been said. Besides the fact, already mentioned, that all the papers surveyed lack a convincing identification strategy, the bulk of the literature has focused on the short-term relationship with economic performance, overlooking how violence shapes long-term economic performance. Indeed, this is the variable more closely associated with the what is likely to be the main motivational driver of all these type of studies: sustainable economic development.

We suggest that the future research on the topic has at least three fronts with large potential room for contribution: thinking of clever identification strategies that allow causal inference statements on the relationship between violence and economic performance; linking the channels identified as conflict affected and that are likely to have an impact on economic performance with the actual ultimate outcome; and looking at how violence affects long-run development, and (related to the second front), through what mechanisms this happens. In addition, we also expect to see the introduction of more structural and game theoretic modeling strategies with an eye on empirical applications.

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<sup>18</sup> Nuñez and Sánchez, 2001 and Dube and Vargas, 2008.

<sup>19</sup> Vargas, 2011.

<sup>20</sup> Díaz and Sánchez, 2004.

We believe this is an ambitious agenda, but we anticipate that it will not remain unfulfilled. In fact the pool of economists (both local and foreigners) interested on the topic is growing every day. We foresee that studies in the areas suggested will soon proliferate: As a case study that combines a long-lasting history of violence with the availability of reliable micro data, Colombia can become a source of the academic output that can guide how research on conflicts, crime and civil wars shifts from cross-country correlations to micro-level analyses. This is a process that already started.

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