Economic growth in Norte Santander, Colombia, and the effects of the armed conflict

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Abstract: The objective of this work is to estimate the armed conflict effects on the economic growth of Norte de Santander from 1988 to 2012; starting with an economic characterization and some aspects of the armed conflict in the period 1988 - 2012, through an econometric model, according to Cobb-Duglas function from the Solow-Swan model. The Department has experienced volatile economic growth with weaknesses in its productive development, and that has been very important by the armed conflict leaving a humanitarian tragedy. The econometric results show that the appropriation of illegal income by armed groups outside of the law, and the guerrilla attacks on infrastructure have negative effects on economic growth, while public spending has a positive relationship with the growth, it is expected that this work will contribute to the debate for the post-conflict scenario, and that it will serve as input for the development of public policy in the department, and mostly the importance of peace for the economy.

1. Introduction

Colombia in the last decade is the scenario of coexistence between armed conflict and organized crime, under these two dynamics the country has been developing its economy, with negative effects on its economic growth [1], a conflict that has spread from rural to urban areas, with a spur like drug trafficking, which deepens the social crisis, where actors in conflict radicalize their actions [2]. The opportunity to analyze the multiple impacts of violence in all its extension on the regional economy is a booming exercise in Colombia [3], and the actions of groups outside the law, their motives and effects on the territory continue to be the object of study, especially because of the impact on all social spheres and the power relations and territorial dominion that are generated [4].

Conflicts of interest occur in the formal, informal and illegal economy, and factors such as poverty, injustice and social inequality fuel the reasons for the conflict [5], but the permanence of the actors in the conflict lies in the sources of financing [6], in such a way the presence of wealth in the territory is an important condition for its interference, by the dominion over the drug (production, distribution and commercialization), some natural wealth of exploitation or strategic places, which generates confrontation between guerrillas, paramilitaries and other groups to the margin of the law [7]. The search for wealth that guarantees the positions of power in the armed conflict explains the economic behavior of the regions [8], but geographically delimiting the behavior of violence and its impact on the economy does not necessarily imply simplifying its causes and the multiplicity of actors that participate in it.
The effects of the armed conflict in the economic growth have taken great interest, there are works that emphasize in the individual and collective dynamics of appropriation of resources, and as the combatant groups that lack political resources or ideological bases, if it has economic and military muscles it will be able to continue sustaining itself in the war. [9] Other studies quantify security expenditures as a necessary and not sufficient condition for economic growth, and how growth is tied to economic dynamics [10]. The estimation of the costs of the conflict also approximates the amount of resources that are dispersed because of it, and that could potentially be invested in other areas, such as education and health [11]. The department of Norte de Santander has been the subject of studies on issues related to violence and armed conflict, but no work has been done on their effect on economic growth. The participation of Norte de Santander's gross value added to the national is low; behavior attributed to the low participation of the industrial sector within the productive activity of the department [12], the department contributes to the national gross value added by 1.6%, according to data from the “Departamento Administrativo Nacional de Estadística (DANE)”. In addition to the above, its geographical location makes it the scene of different conflicts and forms of expression of violence, on the one hand, the phenomenon of the border and the precarious presence of the State that allows the development of illegal activities and the submerged economy that benefit from the smuggling of gasoline and other goods. On the other hand, different actors of violence operate in the department: guerrillas from the revolutionary armed forces of Colombia, the national liberation army and the popular liberation army. In addition to criminal gangs, common delinquency and drug mafias that generate difficult conditions of growth and economic development in the region. As of January 1, 2017, the number of displaced persons is 238291 and 218677, the first shows a humanitarian tragedy, but also the loss of productive potential, and the second a pressure on urban labor markets, being the areas of Catatumbo the most affected, not only by this scourge, but also by kidnappings, selective murders, etc. The armed conflict and the violence in the department are a key phenomenon to understand also how the economic capacity of the region has been affected and also to foresee in the future the post-conflict scenario. What are the effects of the armed conflict on the economic growth of Norte de Santander in 1988-2012? At the beginning of the 1970s, it was settled around the points of oil exploitation and on the borders with Venezuela. Where Catatumbo's geostategic position was important, allowing it to communicate with the Colombian East [13]. This guerrilla group generates violent actions against the oil and road infrastructure, affecting the environment and the inhabitants of the region. They have presence in Tibú, Teorama, El Tarra, Convención and San Calixto, through the following structures: Frente Camilo Torres, Frente Luis Enrique León and Colectivo Héctor [13].

The revolutionary armed forces of Colombia arrived in the 1980s, dominating the Ecuador-Colombia-Venezuela mobility axis, through the Eastern Cordillera; they sought followers in social organizations [13]. This guerrilla strengthens with the growth of coca crops that served as financing. The confrontation with the paramilitaries generated a negative interaction between the parties, resulting in a "game of mirrors" in which the actions of one party feedback the actions of the other, and vice versa [14], their presence in this region is through the following structures: Frente 33, “Columna Móvil Arturo Ruiz, Columna Resistencia Bari and Compañía Resistencia del Catatumbo, Colombia”. Its actions are developed in Convención, El Carmen, El Tarra, Hacari, San Calixto, Teorama and Tibú [13].

The other group with a presence is the popular liberation Army, which after its demobilization in 1991, some dissident groups continued in illegality, by the Libardo Mora Toro and Ramón Gilberto Barbosa fronts, which dedicated themselves to the lucrative drug business. They are present in the region, in the municipalities of Hacari, La Playa and San Calixto. In the late 1990s, the paramilitaries attacked with three structures, the Catatumbo Block, the Santander and Sur del Cesar Self-Defense Forces, and the Magdalena Medio Self-Defense Forces, and in a short time were able to control some urban headwaters and rural areas [15]. The strategy of these organizations is to quickly gain control of the corridors of entry and exit of supply to the guerrilla of the revolutionary armed forces of Colombia, which until now had a monopoly on coca crops and production, copan the lower Catatumbo, the main communication routes and the urban perimeters of the municipalities. After the demobilization process they mutate and fragment into criminal gangs that fight not only for the drug business, but also for the
smuggling of gasoline in particular. All this confrontation for territorial power, for strategic resources, for drug trafficking, smuggling and total control of the region left a trail of strong violence, blackened by the blood represented by selective murders, massacres, sexual violence, kidnappings and disappearances, which the civilian population suffered, generating an exodus and a humanitarian tragedy that reflected not only the absence of the State, but on many occasions its complicity [16].

2. Methodology
One of the main concerns of economists over time has been the economic growth of countries and their determinants, with the Solow-swan model being one of the most employed. Solow and swan propose an economic growth model that attributes differences between countries’ per capita income levels to physical capital per worker differentials; that is, the country with the highest physical capital accumulation per worker has the highest per capita income [17]. To this end, it is based on five assumptions [18].

a. The population grows at an exogenous and given rate.

b. The output of the economy can be represented through an aggregate production function as a function of the capital (physical and human) and actual labor (which is the multiplication of labor by the technological level) that the economy has. We assume that the production function of the economy has the form Cobb-Douglas.

c. Capital is accumulated according to what is saved in an aggregate manner in the economy, net of the depreciation of capital that has to be replenished in each period.

d. Aggregate savings are a constant fraction of the economy's disposable income.

e. Technology grows at an exogenous and given rate.

Therefore, the difference of capital per worker depends on two forces: investment (construction of new capital) and depreciation (wear and tear of old capital). If the investment is greater than the depreciation there is a positive variation of the capital stock. From there the concept of the stationary state is derived, which reflects the point in the economy where the investment is equal to depreciation and therefore the variation of the capital stock is zero; the capital stock at this point is called the capital stock of the stationary state and the level of production that the country carries out with the capital stock of the stationary state is called the production of the stationary state. It is necessary to emphasize that the Solow model does not provide an explanation for long-term growth, but rather proposes transitory growth, i.e. countries grow while they are in their transitory phase towards the stationary state, but at this point growth tends to zero. Also, the model states that a country that is very below the stationary state, has a significant growth of the capital stock, and therefore will grow very fast; but as it approaches the stationary state, the growth decelerates, approaching zero according to the stationary state, to this behavior the model calls convergence toward the stationary state [17].

Table 1. Modification to the original Solow-swan model.

| Assumption modification                                                                 |
|-----------------------------------------------------------------------------------------|
| First The growth rate is the difference between the birth rate and the mortality rate in the population. Thus, the mortality rate of the population is broken down into two parts: the mortality rate due to conflict and organized crime and the mortality rate due to natural deaths and accidents. |
| A proportion of capital (physical and human) and effective labor is destroyed each period by groups involved in the armed conflict, which captures the idea that armed conflict destroys infrastructure, as well as people's lives, because of the war waged by insurgent groups and the Government. |
| Third No changes.                                                                        |
| Fourth The disposable income corresponds to the net income of the proportion that is paid in taxes and the proportion that is lost due to appropriations of organized crime (kidnappings, extortions, thefts and robberies). |
| Fifth There are no modifications.                                                        |
| Additional assumption: Fiscal balance the total government expenditure on security is equal to the taxes it collects on the economy. |
In order to analyze the effect of the armed conflict on economic growth, propose a series of modifications to the Solow-swan model, adapting the model's assumptions to a context permeated by armed conflict and organized crime, as shown in Table 1.

3. Results

The information from Norte de Santander, Colombia, has been collected from the sources, detailed in Table 2 for the period 1988-2012. Real gross domestic product (GDP) was calculated using the DANE data for base years 2005, 1994 and 1975, spliced keeping the 2005 base. The deaths caused by the conflict group together those caused by selective assassinations, massacres, terrorist attacks, anti-personnel mines, attacks on populations and warlike actions. Attacks are an aggregate of attacks on populations, attacks and damage to civilian property, given that what is important to identify with this variable are the effects on the stock of fixed capital, which is affected by these three modalities of violence. Government fixed capital formation and government expenditure are expressed in real terms using 2005 as the base year.

Table 2. List of variables and sources.

| Variable                        | Source                                                                 |
|---------------------------------|------------------------------------------------------------------------|
| Real GDP base 2005              | DANE departmental national accounts                                    |
| Population                      | DANE population projections                                            |
| Number of kidnappings           | National center of historical memory                                   |
| Number of extortions            | National center of historical memory                                   |
| Deaths caused by the conflict   | National center of historical memory                                   |
| Attacks                         | National center of historical memory                                   |
| Government fixed capital formation | “Departamento Nacional de Planeación (DNP)” budgetary executions   |
| Government expenditure          | DNP budgetary executions                                               |

Table 3. Estimation results.

Dependent variable: LOG(YI).
Method: Square minimums.
Sample: 1989-2012.
Comments included: 23

| Variable         | Coefficient | Standard error | t-Statistical | Prob     |
|------------------|-------------|----------------|---------------|----------|
| Constant         | -5.148897   | 0.206892       | -24.886940*   | 0.000000 |
| LOG(1__K)        | 19.091310   | 8.762550       | 2.178739*     | 0.043700 |
| LOG(1_PI)        | 110.942300  | 49.64343       | 2.234784*     | 0.039100 |
| LOG(1_TI)        | -2.035035   | 0.941671       | -2.161090*    | 0.045200 |
| LOG(SI)          | 0.023464    | 0.018162       | 1.291924      | 0.213700 |
| __NI_CL          | 0.003992    | 0.027185       | 0.146849      | 0.885000 |
| MA (1)           | 1.572479    | 0.623897       | 2.520414*     | 0.022000 |
| R- square        | 0.920351    | regression EE. |               | 0.042974 |
| F- Statistical    | 0.892239    | Prob (F- Statistical) | 0.000000         |

* Significant variables at 95% confidence

Wald test

| Statistical test | Value      | G       | Probability |
|------------------|------------|---------|-------------|
| F-statistician    | 14035.890000 | (6,170000) | 0.000000   |
| Chi-square        | 84215.330000 | 6,000000 | 0.000000   |

According to the proposed methodology, the equation to be estimated is represented by Equation (1),
\[ \ln \left( \frac{P_{1bpec}}{1-\phi_1} \right) = \beta_1 + \beta_2 \ln(1 - \rho) + \beta_3 \ln(1 - \varphi_K) + \beta_4 \ln(1 - t) + \beta_5 \ln(\delta) + \beta_6(0.05 + n - c_L) + u_t \] (1)

The estimated structural equation has the dependent variable and the independent variables at the logarithmic level, which means that the parameters for \( \beta_i = 1, ..., 5 \) are interpreted as elasticities. On the other hand, it should be noted that \( \beta_i = 1, ..., 4 \), represents \((\alpha/1-\alpha)\) and \( \beta_5 \), represents \(-(\alpha/1-\alpha)\); therefore, the sign of the estimated coefficient must be interpreted inversely. The results obtained are presented in Table 3, which were estimated using the ordinary least squares (OLS) method. The statistical package e-Views 7 was used for this.

4. Conclusion
Using Fisher's statistic and Wald's test, the overall significance of the model is corroborated. On the other hand, making use of the Student statistician and starting from the null hypothesis of parameters equal to zero, the results reveal that the parameters \( \beta_1, \beta_2, \beta_3 \) and \( \beta_4 \) are statistically significant to explain the economic growth of the Department, unlike the parameters \( \beta_5 \) and \( \beta_6 \) that do not present statistical significance. In order to achieve a better estimation, White's robustness is applied and after identifying autocorrelation problems of errors, correction of moving averages of order 1 is applied. Based on the assumption of Ceteris Paribus, the model predicts that a 1% increase in the proportion of departmental income by armed groups reduces departmental GDP growth by 19%; likewise, a 110% reduction is predicted with respect to a 1% increase in the proportion of departmental appropriation of departmental income by armed groups.

The GDP growth rate of the Department was estimated using the ordinary least squares (OLS) method. The statistical package e-Views 7 was used for this.

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