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NATIONAL, DEPARTMENTAL AND MUNICIPAL RURAL AGRICULTURAL LAND DISTRIBUTION IN COLOMBIA: ANALYZING THE WEB OF INEQUALITY, POVERTY AND VIOLENCE

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Abstract

Recent literature points to a relationship between inequality, economic growth and socio-economic variables. In order to continue to research the relationship between these factors and inequality in Colombia, it is essential to construct a precise measure of rural land distribution. This paper presents calculations of rural land size and land value Gini coefficients for Colombia at the national, departmental and municipal levels using approximately 2.5 million registries of plot level data supplied by the Instituto Geográfico Agustín Codazzi. In general, value Ginis, where value controls for land quality and improvements, are lower than plot size Ginis, and even after meticulous filtration anomalies remain in the data. Additionally, the relationship between the Gini coefficients and municipal level variables are analyzed to consider the relation between inequality, poverty, rurality and other municipal characteristics. Lastly, earlier results relating Gini to violence are reconsidered. After controlling for other factors, distribution does not explain significantly violence.

Key words: land Gini, poverty, rurality and violence.

JEL classification: D63, Q15

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DISTRIBUCIÓN DE LA TIERRA RURAL AGRÍCOLA AL NIVEL NACIONAL, DEPARTAMENTAL Y MUNICIPAL EN COLOMBIA: UN ANÁLISIS DE LA MARAÑA DE POBREZA, DESIGUALDAD Y VIOLENCIA

Abstract

La literatura reciente indica una relación entre desigualdad, crecimiento económico y variables socio-económicas. Para continuar la investigación de la relación entre estos factores y la desigualdad en Colombia, es esencial construir una medida precisa de la distribución de la tierra rural. Este trabajo presenta los cálculos de los coeficientes de Gini de tierra y avalúo catastral para Colombia al nivel nacional, departamental, y municipal usando aproximadamente 2.5 millones de registros de datos al nivel del predio con información suministrada por el Instituto Geográfico Agustín Codazzi. En general, los Gini de avalúo catastral, donde el avalúo controla por diferencias en la calidad de tierra y mejoramientos, son menores a los Gini de tierra, y después de una meticulosa filtración de datos siguen existiendo anomalías en los mismos. Adicionalmente, se analiza la relación entre el coeficiente Gini y variables municipales para considerar la relación entre desigualdad, pobreza, ruralidad y otras características municipales. Finalmente, se reconsideran algunos resultados previos referentes a la relación entre la distribución de la tierra y la violencia. Después de controlar por otros factores, se encuentra que la distribución no explica la violencia.

Palabras claves: Coeficiente Gini, pobreza, ruralidad y violencia.

Clasificación JEL: D63, Q15

1. Introduction

In Colombia, previous measures of the Gini coefficient have generally been calculated only at the national or departmental level and based on cadastre data summaries supplied by the Instituto Geográfico Agustín Codazzi (IGAC). Recently obtained 2002 IGAC cadastre data, plot level information supplied with state-assessed land value and owner information, permits the calculation of both land size and land value Gini coefficients for land plots at the national, departmental and municipal level.

Land distribution has policy relevance for myriad reasons, and recent literature has found increasing evidence to conclude a relationship between inequality and lower poverty reduction rates and lower levels of economic growth. Without precise estimates of actual land distribution, reaching conclusions about these relationships within Colombia would be impossible. This paper represents an attempt at presenting a detailed analysis of national, departmental and municipal land and land value Gini coefficients, and, at the municipal level, considering the relationship between inequality and other municipality characteristics. The Gini is related to municipal level variables by quintiles and a reduced form regression. Also, particular attention is given to the relationship between land distribution and violence. The paper reconsiders earlier results that suggested land inequality positively explained municipal violence levels.

The paper is divided into the following sections. Section 2 reviews the recent literature concerning the effects of inequality and previous measures of inequality in Colombia. Section 3 presents the methodology for calculating the Gini coefficient and the national, departmental and municipal land size and land value

Ginis, respectively. Section 4 discusses the impact of administrative updating (actualización del catastro) on Gini values, and Section 5 relates land distribution to municipal characteristics. Several reduced form regressions are presented to explore the relationship between Gini, poverty, rurality and violence. The final section concludes.

2. Inequality in recent literature

The measurement of inequality plays a key role in establishing the validity of recent work regarding the importance of income distribution, growth and poverty reduction. Inequality levels have been associated with economic growth, future poverty reduction, formation of human capital, investment, access to credit and violence.

According to Bourguignon (2002), higher levels of economic growth are clearly associated with higher poverty reduction levels, and in countries with less inequality, income growth is converted into greater poverty reduction than in countries with more income inequality. Worsening the problem of the impoverished, growth is more difficult in countries with higher levels of inequality. Bouguignon concludes that policies that help to permanently redistribute income lower poverty and, additionally, contribute to an acceleration in poverty reduction at a given level of economic growth.

Although debate still exists over the impact of inequality and economic growth, at the moment most work has supported the position that higher levels of income or asset inequality are causally related to lower levels of income growth. Two important reasons behind this result are that inequality affects investment opportunities, causing inefficiencies and limiting potential returns, and that elites may have on the political economy. In the case of the latter, powerful elites choose public policy strategies that benefit themselves while harming others.

Given that land represents an important asset when measuring rural household wealth, and that distribution plays an important role in growth and development, an accurate measure of rural land distribution is necessarily valuable. Using land distribution as a proxy, Deininger and Squire (1998) show that the level of asset inequality has a significant impact on a country's economic growth. They explore the possibility of a systematic relationship between initial inequality and subsequent economic growth and find that the existence of inequality in assets has a negative and significant impact on economic growth. This suggests that high levels of land concentration will affect credit or investment, limit the formation of human capital and affect levels of violence.

Evidence suggests that inequality tends to worsen poverty due to its relationship with economic growth and the dispersion of its benefits. In this way, studies that analyze causal factors of poverty often consider inequality as an important component in explaining poverty levels. In Colombia, various authors have attempted to link poverty to macroeconomic, violence and socio-economic indicators. Measurements of inequality play an important role in this literature, at both the household and municipal level.

Carrizosa (1981, 1986) in his analysis of CEDE and DANE[2] surveys associates poverty with household and household head characteristics. In his first study, he

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finds that the poor tend to have fewer years of education and more dependents, but the effects of age and location were not significant. His later study, with more recent surveys, finds the same effects for education and that rurality negatively impacts poverty. May (1996) in his study of poverty in Colombia finds similar results. The probability of being poor is higher for rural households, and poor households tend to have less education and fewer working household members.

Also at the household level, Nuñez and Ramirez (2002) analyze the characteristics of poor households. In addition to finding differences between rural and urban areas, where rural areas are poorer, they observe that poor households had, on average, more household members, were younger and had less education than non-poor. At the macroeconomic level, Nuñez and Ramirez (2002) find that unemployment and inflation increase poverty while improvements in labor productivity reduce it. They also show that during the 1990s income inequality, at a national level, had a positive impact on poverty (greater inequality, more poverty).

In an effort to analyze the relationship between development and geographical characteristics, Sanchez and Nuñez (2002) relate geographic characteristics at the municipal level to per capita income, per capita income growth and municipal inequality. They find that the geographical variables (soil quality, water availability, etc.) affect municipal income and growth, and distance to principal markets and soil quality were the most significant. Furthermore, in the poorest municipalities, geographical variables are more significant, explaining more of the variation in income and growth in per capita income.

Violence in Colombia has also been explained by factors associated with inequality. In general, studies that analyze violence in Colombia take into account the historical trends and relate violence to economic and regional variables, where violence can be associated with guerrilla groups, paramilitaries or common criminals. A driving question in many of these studies is relationship between crime and the guerrilla and paramilitary groups. If the formation of these groups, and their consequences on civil order and economic variables, is related to poverty and inequality levels, then the problem of inequality becomes an important aspect in the resolution of the armed conflict.

Bourguignon, Nuñez and Sanchez (2003) consider the problem of the possible relationship between crime rates and various indicators of inequality. Looking at a specific part of the income distribution in order to explain property crimes, they find that unemployment and the income Gini affect crime in Colombia's seven principal cities.

In the existing literature, mainly focusing on Colombia, an interdependent and circular relationship between poverty, inequality, violence and growth has been suggested. Bourguignon (2002) finds that inequality has a negative impact in reducing poverty. Nuñez and Ramirez (2002) establish that inequality positively affects poverty, and Bourguignon, Nuñez and Sanchez (2003) demonstrate that income distribution can affect crime rates. Querubin (2003) concludes that growth is negatively affected by violence. The evidence suggests a need to resolve the problems of poverty and inequality to alleviate violence and increase growth.

3. Calculating the Gini

The Gini coefficient is one form of measuring inequality. The index varies between zero and one, where zero is a perfectly equal distribution (of land) and one indicates that all of the (land) assets are held by a single person. The land Gini coefficient measures the inequality in land holdings or land values, assuming one owner per plot.

According to Deaton (1997), two methods for calculating the Gini exist, direct and indirect. In the direct form, the Gini is defined as:

$$Gini = \frac{1}{2n^2\mu}\sum_{j=1}^{m}\sum_{k=1}^{m} n_j n_k \left| y_j - y_k \right|$$

where there are m groups and in each group j the number of individuals with this level of land is n_j. Thus, the total number of individuals is $\sum_{j=1}^{m} n_j$. The average land size is μ (total land divided by total population), and), y_j is the land of group j.

In the indirect method, first a Lorenz curve is constructed, with the cumulative percent of land on the vertical axis, and the cumulative percent of population on the horizontal axis. The 45 degree line represents perfect equality and the Gini coefficient is defined as the ratio between the area between the Lorenz Curve and the 45 degree line and the triangular area that represents perfect equality. In this case the formula can be expressed as:

$$Coeficiente\ \ Gini = 1 - \sum_{j=1}^{n} \left\{ L_j + L_{j-1} \right\} * \left\{ N_j - N_{j-1} \right\}$$

where Lj represents the cumulative percent of land in j and Nj is the cumulative percent of owners in j.

The Gini coefficient was calculated at the national, departmental and municipal levels using individual plot areas and their values. Values are assigned by the government for taxation purposes and depend on location and physical characteristics of the plot. In order to calculate the Ginis with the 2002 rural land cadastre data supplied by the IGAC, a filtration process was carried out in order to eliminate non-rural (urban) plots, state owned land and tribal reserves:[3] The complete dataset prior to filtration contained approximately 2.8 million registries with approximately 3.8 million registered owners.

Each plot in the data includes information on the owner or multiple owners, physical characteristics, such as plot size and improvements, and the cadastre values assigned to the land plot by the municipality and the IGAC. Updated cadastre information is reported to the IGAC by the municipality at intervals between five and 40 years. Updating provides the IGAC with information on changes in ownership through sale, inheritance or land reform, and it includes newly assessed land values based on current market conditions or land improvements.

3.1 National rural Gini

After carrying out the data filtration, the first land and land value Gini coefficients calculated were at the national level. Table 1 describes the filtration criteria

[3] It should also be noted that the *catastro* (cadastre or land registry) information excludes the department of Antioquia, and the cities of Bogotá and Calí. The latter two are mainly urban, so do not represent a significant loss for the rural Gini at the national level. Also, the IGAC maintains rural and urban cadastre databases.

presents the national Gini coefficient for land size and land value. The drop in the Gini due to the filtration process emphasizes the importance of analyzing plots by ownership characteristics, and excluding areas not germane to the analysis. The lower land value Gini is expected since the cadastre value should take into account land quality and other improvements that size alone will not capture.

As Table 1 demonstrates, the land Gini is always higher than the value, consistent with the hypothesis that taking into account land quality improves land distribution. The raw data from IGAC produces a land Gini of 92.69 and value Gini of 82.99. Each additional filter includes the previous, and the biggest drop is observed with the elimination of state owned property. The summation across individuals shows the impact of summing across individuals who own more than one plot. If an individual owns more than one plot anywhere in the country, the areas of the plots are summed together. The slight drop in the land Gini suggests that owners of multiple plots have small sized holdings instead of large ranches in various parts of the country. To consider the impact of possible data entry errors outliers were eliminated. The criteria of 1 centavo (one-hundredth of a peso) per hectare and $10 million pesos per square meter were established as "impossible" values, and any plots whose value lied below or above these values were eliminated. The effect on the national Gini was actually quite small.

Concerning the tendency toward land concentration, the Gini "across individuals" reveals that, in general, large landholders do not hold many plots under the same name. If the hypothesis of land concentration during the 1980s and 1990s is to be true, the owners are either swapping smaller plots for bigger ones, integrating smaller plots into larger plots and re-titling the land as a single property, or simply registering plots under different names. The former two possibilities seem unlikely, and the third can not be measured by the Gini. For these reasons, it will be difficult, if not impossible, to use the Gini as a measure of changes in land concentration levels, as some authors have suggested (see Machado (1998)).

Although multiple plots owned by a single individual were summed across owners in the “Across owner” Ginis, a fundamental issue to recall when interpreting the Gini at the national, departmental and municipal levels is that many plots have multiple owners. The Gini treats plots held by multiple-owners as if owned by a single individual. This gives an upward bias to the Gini estimations, and Table 2 demonstrates that the biggest plots have the largest number of owners per plot. In the top centile, plots have nearly two owners per plot, suggesting that the impact of multiple-owners may cause significant overestimation of the Gini. The cadastre data contains information on owner names, but it does not include percentages in order to properly assign land to each individual owner. As a result, the Gini ignores multiple-ownership and treats multiply-owned plots as single-ownership.

Comparing the present estimates to earlier estimates of rural land Gini coefficients, the filtration results in noticeably lower values for the land Gini, but higher for land value. Machado (1998) presents a national land Gini coefficient for Colombia of 0.88 in 1996 and 0.85 in 1984. Although he suggests this may indicate a tendency toward land concentration, as seen above the Gini across individuals does not show this effect and data filtration may account for these changes.

Castaño (1999), using truncated summaries of the IGAC data, calculates a national rural land Gini for Colombia of 0.84 and a land value Gini of 0.60 for 1996.. The data summaries used by Castaño (1999) in her calculations only include the number of rural plots, land owners, total area and total land value in 13 asymmetric land ranges from, for 1 to 3 hectares and 1000 to 2000 hectares. Even though the land Gini is quite similar to the estimate obtained using the plot level data, her value Gini underestimates the plot level Gini by approximately 30%.

3.2 Departmental Gini

The detail of the IGAC information extends the analysis of Gini coefficients beyond previous estimates in the existing literature. Table 3 presents the land and value Ginis with their differences and the area of land represented in the calculation. The average value of the departmental Ginis drops below the national level, but the value Gini still does not reach earlier measures using truncated data.

One important difference between the national and departmental Ginis is that, on average, the value Gini is actually higher than the land Gini. To understand this result, we consider the percent of total land represented in the Gini calculation and the size of the rural population. It becomes clear that in some of the most rural municipalities the land included in the calculation is lowest. For example, the municipalities with the largest negative difference between Gini land and value (Caquetá, Guainia, Guaviare and Vichada) have among the highest levels of rural population and the smallest percent of land included in the calculation (15.45%, 0.004%, 2.11% y 14.11%, respectively). This may occur due to lower levels of land titling in the most rural areas. Since the Ginis are estimated using cadastre data, the non-titled land does not enter the calculation.

Considering a smaller group of departments, including in the departmental Gini averages only departments whose percent land included exceeds 25% of total land, the sign of the average difference changes. Once again, the expected result of a lower land value Gini is obtained (land Gini 77.08 and value Gini 75.46 for 20 departments, see Table 3). We observe the same tendency increasing the cut-off point to 50% of total land. Although the difference between land and value Ginis is much lower than previous studies, in general land Ginis are lower and the percent of total area included affects Gini values.

3.3 Municipal Gini

In the calculation of the Gini at the municipal level, we face a tradeoff between homogeneity of data, in terms of actualization and land value assessment, and the drop in the size of the comparative universe. The land and value Ginis reveal the same trends found at the national and departmental levels, with municipal Ginis being lower.

Given the large number of municipalities included in the data (942 of 1,087), histograms are a convenient means of presenting the municipal land and value Ginis. The histogram in Figure 1 compares the land and value Ginis for 942 municipalities and demonstrates the same tendency toward lower value Ginis. The average land and value municipal Ginis are 68.24 and 66.53, respectively, considerably lower than the national and departmental Ginis.

Another advantage of the municipal Gini is that it allows for more in-depth analysis of possible measurement problems or anomalies in the data that do not appear or are more difficult to identify at the national or departmental level. To consider this aspect of the data, two “top ten” tables are presented. Table 4 presents the ten highest municipal land Ginis and Table 5 over representation.

The ten highest municipal land Ginis reveal that even after filtration suspicious patterns persist. The highest land Gini in Table 5 is 98.36, a Gini that suggests one plot makes up the majority of the rural area in the municipality. Eliminating outliers, whose criteria is the elimination of plots with a value of less than one-hundredth of a peso (centavo) or greater than $10 million pesos per square meter, the two highest municipal Ginis drop to ranges approximating the national average. Concerning the other municipalities, the question of representativity arises again. In the filtered data base, on average, there are 2,414.17 registered plots per municipality and 3,423.54 owners. Several of the highest municipal land Ginis have far fewer plots than the average number of owners and plots. Also, the impact of counting multiple owners as single owners becomes apparent in the highest Ginis. In some of these ten municipalities there are more than 1.5 owners per plot. The Gini does not take into account multiple-owners, possibly worsening the calculated level of land distribution. Finally, in several cases the percentage of total area represented in the data is quite low while the rural population is quite high. This suggests that a small fraction of the rural land is actually included in the rural land Gini.

A further concern that arises upon studying the municipal data is the overall level of representativity of the areas. There are 99 municipalities in which the sum of the filtered area is greater than the area of the municipality itself. The ten highest cases of over-representation are presented in Table 5. In the worst case, the filtered area represents 2,899% of the total municipal area, casting doubt on the measured sizes of the plots and the accuracy of the Ginis. This table also shows that some municipalities with poorly reported plot size have large differences between the land and value Ginis.

Table 6 summarizes the land and value Gini coefficients at the national, departmental and municipal levels. The filtration of Ginis leads to an approximately 8% drop at the national level. The effect of filtering the data is greatest at the departmental level where the difference between the filtered Ginis and unfiltered Ginis approaches 15%.

4. The actualization of the cadastre and the Gini[4]

Actualization of the cadastre influences the Gini calculation through the frequency in which updated information is sent to the IGAC and the estimated values of the plots. According to the 1991 Constitution (Article 287), the municipalities are authorized to administer their own resources and collect the necessary taxes for development programs. Similarly, Law 44 of 1990 established the tax framework for generating the funds for updating the cadastre information.

The creation of the cadastre registries entails three processes at the municipal level. The first phase is the formation of the cadastre, which includes the collection of data on physical, economic and legal variables. The second aspect is the actualization, which consists of periodic updating of information contained in the cadastre. Finally, conservation takes into account changes or “mutations” that individual plots may undergo. In addition, the municipalities update information on land value annually, used in the collection of the plot tax, according to a percent value established by the national government. By law, the municipalities should actualize the cadastre at least every five years.

[4] Some portions of this section rely on information from Offstein, Hillon and Caballero (2003).

Unfortunately, in many municipalities actualization of the cadastre occurs less frequently than every five years because the process is costly and municipalities must appropriate their own funds to carry-out the process. Although there may be potential gains in tax collection and the IGAC offers professionals to assist in the actualization process, some municipalities have not updated the rural cadastre since the 1950s.

A summary of annual actualization by year in Table 7 indicates that at times actualization lagged more than 40 years for some municipalities. The year column reports the year of the actualization information, and the year with the longest average actualization lag is 1989 with an 11.1 year lag. During the 1990s the average lag drops, revealing an effort on the part of the national government to update the cadastre, in keeping with the new Constitution of 1991 and related laws. Nonetheless, several municipalities (various in the department of Nariño) have not actualized the rural cadastre since the 1950s.

Lags in the actualization of the cadastre affect both the land and value Ginis. In the case of the former, an outdated cadastre does not permit the observation of changes in land ownership or division of plots through land reform programs. Even though the IGAC data for calculating the Ginis is 2002, the plot level information is only as recent as the last cadastre actualization. In the case of municipalities that have undergone land reform programs and have not actualized, the land Gini will overestimate inequality. For the value Gini, the land value reported in the cadastre information will not reflect changes in the market values of the plots, due to improvements, population growth, etc. Without actualization, the consumer price index is used to adjust values, and this may not reflect shifts in the land market.

To consider the impact of the actualization on the Gini, Figure 2 presents average land Gini values by actualization year and the 95% confidence interval around the Gini average. The land Gini averages and the confidence intervals show much greater variation prior to 1989. In earlier years, the confidence interval collapses for years with only one observation. Figure 2 indicates that actualization plays an important role in the standard deviation of the land Gini estimates, which should lead to doubts about the reliability of Ginis from municipalities that have not actualized in the past 15 years. Furthermore, the actualization problems mean that it is not possible to think of a national Gini for a given point in time. Even though the data for the Gini calculation comes from the 2002 IGAC database, the estimated Gini is inter-temporal due to heterogeneity in actualization.

In an attempt to test if the land Ginis are significantly different due to actualization year,

Table **8** presents the results from t-tests on mean differences for average land Gini values. The land Gini values were averaged according to year of actualization, and using 2002 as a base a t-test for differences in means was carried out on each of the years in the table. No clear upward or downward temporal tendency appears in terms of average land Gini values, but for some years the averages are significantly different.

5. The Gini and municipal characteristics

After the calculation of the Gini, one of the primary goals is understanding the relationship between land inequality and other economic and socio-economic variables. As mentioned earlier, an important literature has developed around the impact of land distribution on growth and social cohesion, where the latter has been argued to influence violence and civil conflicts. Higher inequality has also generally been associated with higher poverty levels.

There is undoubtedly interest in directly relating economic and socio-economic variables with the Gini in order to better understand the connection between inequality and economic and development indicators. The challenge with a regression based approach attempting to explain the Gini is causality or simultaneity. Estimated parameters of the regression may be inconsistent. In an effort to relate the Gini to municipal-level characteristics, two strategies are implemented. First, a municipal level quintile table is presented to consider the relationship between the land and value Ginis and aspects of rurality, poverty and violence. Second, a subset of variables whose simultaneity may be less problematic is selected to carry out linear regressions explaining land and value Ginis.

Table 9 relates the municipal land and value Ginis quintiles to four categories of municipal characteristics. To simplify the interpretation of the relationship between municipal variables and the Gini quintiles, each of the municipal level variables were normalized by subtracting the mean. The average of each quintile whose value is less than the mean will be negative, and positive in the opposite case. When an increasing or decreasing pattern exists across quintiles, the values of the averages will be increasing or decreasing. Increasing and decreasing relationships are highlighted in bold in Table 9.

In general, the land Gini presents more clear relationships (strictly increasing or decreasing) than the value Gini. This may occur as a result of the variation in cadastre actualization year which affects the reported plot values. The t-statistics report the level of significance of the difference between the first and fifth quintile. Even though many variables do not present clear negative or positive patterns across all five quintiles, many of the differences in average values between the top and bottom quintiles are significant, suggesting significant differences in municipal characteristics depending on the Gini.

The first category, municipal characteristics, includes rurality and infrastructure indicators. Clear trends can be observed in distance to principal markets (greater distance, lower Gini), road density (fewer roads, lower Gini), and value of rural plots (lower value, lower Gini). The direction of the trends suggests that the municipalities that are farther from the principal markets, with fewer kilometers of roads, and lower cadastre land values have lower Ginis, indicating that the more isolated or rural municipalities have more equal land distribution. The negative relationship between distance to principal markets and Gini was also found by Sanchez and Nuñez (2002).

Among the variables included in municipal characteristics are municipal spending patterns, in order to consider whether or not land inequality alters municipal level investment decisions. Some portion of municipal spending is dictated by law (forced) while municipalities also choose to spend some resources freely (free spending). The combined municipal spending (forced + free) per capita in 2000 does not present a pattern, but does have a significant difference between the first and last quintile. "Free" spending on investment (voluntary municipal investment as opposed to forced investment required by law) as a percent of total free spending shows a positive trend in the value Gini, meaning that municipalities with lower value Ginis choose to spend more on investment. This result raises the possibility that land inequality affects municipal spending decisions.

In terms of violence indicators, quintiles suggest that municipalities with more equal land distribution tend to suffer from more guerrilla actions and more kidnappings. Given that the Gini is an inter-temporal measure due to the different actualization years, the violence indicators were taken as averages over the period of available data. ELN actions and kidnappings present clear tendencies: in municipalities with more equal land distribution, there occur more kidnappings and ELN activity per capita. The inverse relationship between guerrilla action and inequity contradicts the traditional hypothesis that more inequity should lead to higher levels of violence. This result may not be surprising if it is assumed that profit motivates guerrilla actions, where activity simply occurs in more rural areas that happen to have more equal land distribution.

The poverty variables, as a group, show the clearest directional relationship among all the variable groups. The NBI, or necesidades básicas insatisfechas, measures the percent of the population in the municipality that does not have "basic needs" met, and the rural NBI is only for the rural segment of the population. Similarly, the misery measure counts the percent of people in the municipality living in conditions of misery. For both NBI and misery, lower Ginis are associated with more persons in these conditions. The same pattern presents itself in measures of water, sewage and phone services outside the municipal head. The last variable in this category, the poverty factor, is a poverty indicator constructed using principal factors to capture combined aspects of rurality and poverty. The factor is composed of two variables indicating service levels (educational infrastructure and health centers and hospitals per capita), and several variables included in the calculation of the NBI, as percent of the population outside the municipal head. Among the latter are percent of housing without basic amenities, percent of persons lacking services, percent of persons in overcrowded conditions, percent of scholastic absenteeism, and percent of persons living as dependents. Just as the other measures of poverty, the poverty factor suggests that municipalities with lower Ginis present higher poverty levels. The quintile analysis suggests that the municipalities that suffer from poverty and violence are the more rural municipalities with more equal land distribution.

Based on the above results, a few variables were chosen to carry out a reduced form regression to explain the variation in the municipal land and value Ginis. The simplest specifications, models (1) and (5) in Table 10, attempt to include only variables that are the most likely to be exogenous. Variables included in the regression, that presumably are not affected by changes in the Gini, are two rurality indicators (distance to principal markets and distance to Bogotá), a poverty measure (NBI from 1973) and two physical characteristics (altitude and municipal area), and regional dummies. In addition, the regression controls for possible fixed effects for actualization year and includes only municipalities that actualized the cadastre in 1989 or later, taking into consideration the confidence intervals discussed earlier.

Supposing a positive relationship between inequality, poverty and rurality, estimated parameters on these coefficients should be positive and significant. In fact, the signs on the poverty and rurality coefficients in the various specifications agree with the patterns observed in the municipal level land and value quintile analysis. The rurality measures have negative signs, indicating that the municipalities that are farther from the capital and farther from principal markets tend to have more equal land distribution. The negative and significant sign on 1973 NBI suggests that the more equally distributed municipalities face higher levels of unmet basic needs, for both the land and value Ginis. Overall, the simple specifications explaining land and value Ginis demonstrate a negative relationship between inequality, poverty and rurality.

To consider the possibility that less equal land distribution has affected poverty reduction in municipalities with higher land and value Ginis, the 1973 NBI is replaced with the change in NBI (NBI 1985 minus NBI 1973), regressions (2) and (4) in Table 10. In the municipalities where the percent of households facing NBI has decreased, the difference in NBI will be negative. The negative and significant coefficient on the NBI difference in both the land and value regressions implies that the municipalities that have made progress in reducing the NBI are those with higher land inequality.

The models (3), (4), (7) and (8) in Table 10 introduce additional variables that more likely generate endogeniety problems. Supposing that these variables are exogenous, the violence indicator number of ELN attacks per capita is not significant in either the land or value regression and road density has a positive and significant sign, in keeping with the results in Table 9. The significant and positive coefficient on rural plot value suggests that municipalities whose land values are higher have greater inequality, once again confirming the negative relationship between Gini and rurality.

5.1 Gini and violence

Previous studies have presented arguments attempting to develop a causal relationship between levels of land inequality and violence, an issue of particular importance for Colombia given that it possesses among the highest levels of violence throughout Latin America (and the world). The suggestion is that higher land inequality will worsen social polarization and weaken the consensus for policy changes or other non-violent reform. Thus, the less-fortunate are more willing to join illegal armed groups and escalate violence (World Bank (2003)).

This argument was previously tested using data from Los Andes and a reduced form specification, and the results indicated that higher levels of violence are positively and significantly affected by the land Gini.[5] Other explanatory variables included in the model are population density, distance to Bogotá, and road density, where the first two are generally positive and significant and the latter negative and less significant. The signs and significance levels of the coefficients on land Ginis help drive the conclusion that high levels of land inequality play an important role in determining municipal violence levels.

These results raise an interesting difference between some civil conflict literature and literature specifically analyzing the Colombian violence. The former has associated violence with social inequality (Collier and Hoeffler (2000) and Deininger (2003)), while the latter tends to explain violence as a result of profiteering, illicit crop cultivation, opportunities for extortion or battles for transit corridors (Sanchez, Diaz, and Formisano (2003); Diaz and Sanchez (2003); Sanchez and Nuñez, (2001)).[6]

Further, the municipal land and value Ginis analyzed by quintiles in Table 9 and the reduced form regression explaining Ginis in Table 10 also tend to deviate from

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[5] See *Colombia: land policy in transition*, Table 1.6 p.16, World Bank (2003) or "Colombia: una política de tierras en transición," Table 1.4, p.23, Documento CEDE, No. 29, Universidad de los Andes, August 2004.
[6] Sanchez and Nuñez (2001) present an extended discussion of the debate about the causes of violence and their application to the Colombian case.

the aforementioned violence regression results. One possibility is that the regressions finding a positive relationship between Gini and violence could suffer from omitted variables problems. The quintile findings presented earlier indicate that Gini and poverty appear to be linked. Including a more direct measure of poverty may help explain the finding that greater land inequality increases violence. In addition, following the result that rurality is associated with Gini, rurality is also controlled for. Finally, based on the argument that violence stems from activities associated with illegal activity, area of coca plants is included as an indicator of illicit enterprises.

The construction of the regressions supposes that violence in the municipalities depends on land distribution, rurality and criminality. Including poverty and rurality variables along with the Gini is fundamental in controlling for these other factors and establishing that land distribution itself explains violence, and not other variables associated with land distribution (such as poverty and rurality, as shown in the quintile table, Table 9). Without controlling for poverty or rurality, it is not clear that the significance of the Gini in the violence regression is due to an intrinsic characteristic of land distribution.

Using data supplied by the Centro de Estudios sobre el Desarrollo Económico (CEDE) at the Universidad de los Andes, the regressions explaining violence are estimated using a Tobit, as suggested by Wooldridge (2002) given the data structure. The results are divided into groups according to the dependent variable, where each table contains models to estimate the average, total and most recent year of data. The violence variables estimated are number kidnappings, number of massacre victims, and number of guerrilla actions (FARC and ELN combined). Each table follows the same sequence. For each variable, first the same violence regressions discussed above are run, and then the additional explanatory variables are included. The unconditional marginal effects E(y|x) evaluated at the mean values are also reported.

The regressions in Table 11, Table 12 and Table 13 show several patterns consistent throughout the data, for all violence measures. First, as may be expected, the averages are best explained by the independent variables characterizing the municipalities. Second, in general the results indicate that land Gini is not a significant factor in explaining municipal violence levels.[7] Third, in all cases the regressions that include additional variables to capture aspects of poverty and rurality perform better in terms of pseudo R^2 and likelihood ratio tests than their restricted counterparts. Finally, the most important factor throughout all of the regressions, in terms of marginal effect and significance, is area of coca cultivated. All types of violence increase with the presence of coca.

Generally, violence appears to be greater in municipalities with higher population density, more kilometers of roads and a smaller percentage of the population outside the municipal head. The effect of distance to the capital Bogotá is ambiguous. In the total and average kidnappings regressions, land Gini loses significance after the inclusion of variables that more directly measure poverty. This suggests, as mentioned above, that land Gini alone captures aspects of poverty and rurality. Once accounting for these effects, distribution itself does not appear to play a significant role in determining kidnapping levels.

[7] In regressions where the dependent violence variable is transformed into per capita values (not reported), the land Gini coefficient is not significant either.

Even though in the 1999 kidnapping and 2000 attack regressions the land Gini is positive and significant, the single year data for both variables has a large number of zero observations and the pseudo-R^2 is considerably lower than the average and total regressions. The overall results suggest that land distribution does not play an important role in determining violence measures at the municipal level, and instead illegal crop production results in frighteningly higher violence.

6. Conclusions

Calculating the Gini at the national, departmental and municipal level in Colombia using plot level information from the 2002 IGAC cadastre data shows that land distribution shifts depending on data filtration and geographical universe. In addition, the cadastre data allows for the calculation of land value Ginis to account for land quality in the distribution measure.

The national, departmental and municipal land size and land value Ginis reveal that accounting for land quality does reduce the inequality measure. After meticulous data filtration to eliminate state-owned plots, tribal reserves and non-rural land, the national Gini drops below earlier estimates. More detailed analysis at the departmental and municipal levels reveals that the percent of total area included in the Gini calculation affects the land distribution measure, and even though the data has been filtered, errors in the cadastre remain. These errors include plot size and plot value. At all three levels calculated Gini coefficients should be taken as an upper bound because plots owned by multiple individuals are treated as singly-owned plots, and the plot-level data reveals that the largest plots are more likely to have multiple owners. Ginis also may be affected by the actualization year of the cadastre due to unreported land transactions and outdated value assessments.

Overall, the national and departmental Ginis are likely less reliable due to problems with the creation, actualization and maintenance of the cadastral data. Problems include measurement error at the plot level, differing municipal valuation criteria, and systematic data errors. The detailed plot-level data contained in the 2002 IGAC cadastre database allows for deeper analysis at the municipal level where data characteristics may be more homogeneous.

Although higher poverty levels and lower growth rates have been associated with higher inequality, the Colombian municipal level data reveal a negative relationship between poverty and land distribution. For Colombia, it appears that municipalities that are more rural and have more people living in conditions of poverty actually present lower land size and land value Gini coefficients. Further study is needed in order to understand the complexities of this relationship and how the role of land titling programs, land reform or historical context may explain this result.

Using a simple reduced form equation to explain the municipal land size and value Ginis, the results demonstrate a negative relationship between inequality, poverty and rurality. This confirms the direction of the relationship identified in the analysis of Ginis by quintiles. A negative and significant coefficient on the NBI difference in both the land and value regressions suggests that the municipalities that have made progress in reducing the NBI are those with higher land inequality.

Given earlier results that explain violence levels with land distribution, the same reduced form regressions are constructed, and controls for poverty, rurality and criminality are added. Including poverty and rurality variables along with the Gini is fundamental in controlling for these other factors and establishing that land distribution itself explains violence, and not other municipal characteristics that Gini may capture. In general, violence appears to be greater in municipalities with higher population density, more kilometers of roads and a smaller percentage of the population outside the municipal head, while land Gini is not significant. This suggests that land Gini alone in the regression captures aspects of poverty and rurality, and after accounting for these effects the land distribution does not appear to play a significant role in determining violence levels.

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Tables and Figures

Table 1 Gini filtration definition

Filter		Gini land area	Gini land value	Description
1	All plots	92.69	82.99	Raw data as supplied by IGAC
2	Ag. and rural only	91.05	81.94	Elimination of non-rural and non-agricultural plots
3	Private only	87.78	81.66	Elimination of state owned plots
4	Final filtered	85.46	81.02	Elimination of indian reserves, public lands, and other non-rural and non-ag properties
5	Across owners	85.38	81.63	Summing property across owners
6	No outliers	85.08	80.99	Elimination of properties whose value is less than 1 centavo per hectare or greater than $10 million pesos per square meter

Table 2 Characteristics top decile and centile

	Average area (ha)	% of total area	Total value (%)	Av. value (millions of pesos)	Total owners	Owners (% total)	Number of plots	Plots (% total)	Owners/plots
Decile	635.5	77.80%	50.30%	41.4	344,074	10.70%	227,776	10%	1.51
Centile	6,259.8	40.20%	16.30%	133.2	40,284	1.20%	22,780	1%	1.77

Table 3 Departmental Ginis

Departament	Gini land	Gini value	Difference (GL-GV)	Population outside municipal capital (%)	Land included in calculation (% of total)
Antioquia	-	-	-	-	-
Atlantico	72.25	79.33	-7.07	24.25	10.62
Bogota D.C.	-	-	-	-	-
Bolivar	70.21	75.51	-5.30	55.89	67.91
Boyaca	78.91	73.10	5.80	76.92	78.44
Caldas	80.45	78.84	1.60	57.80	86.48
Caqueta	50.54	69.52	-18.98	67.97	15.45
Cauca	80.91	83.12	-2.21	78.32	42.03
Cesar	65.25	74.42	-9.18	50.32	73.43
Cordoba	74.83	75.51	-0.68	64.03	85.48
Cundinamarca	76.63	79.61	-2.99	68.25	91.28
Choco	79.88	76.08	3.80	71.32	4.64
Huila	76.39	72.20	4.19	60.03	61.90
La Guajira	67.14	73.58	-6.45	34.01	21.95
Magdalena	68.75	70.84	-2.09	56.88	76.27
Meta	86.16	78.19	7.96	63.25	56.26
Narino	78.76	73.46	5.30	76.49	30.65
Norte de Santander	69.73	69.97	-0.23	64.85	55.66
Quindio	78.94	67.52	11.42	37.78	93.24
Risaralda	77.16	79.60	-2.44	51.56	68.76
Santander	77.41	75.29	2.11	72.29	87.09
Sucre	77.34	76.64	0.70	46.35	80.61
Tolima	76.78	77.02	-0.24	58.66	81.87
Valle del Cauca	83.07	84.57	-1.50	44.59	54.01
Arauca	83.29	67.89	15.40	53.91	80.57
Casanare	80.95	75.93	5.02	66.65	62.52
Putumayo	73.97	69.86	4.11	67.41	7.59
San Andres	65.64	66.62	-0.99	45.76	-
Amazonas	-	-	-	-	-
Guainia	24.64	40.90	-16.26	96.94	0.004
Guaviare	43.20	59.75	-16.55	79.68	2.11
Vaupes	-	-	-	-	-
Vichada	41.96	56.01	-14.05	80.73	14.11
Average	71.07	72.44	-1.37	61.13	55.22
Average > 25% land	77.09	75.46	1.63	60.24	70.72
Average > 50% land	76.79	75.15	1.64	58.33	74.54

Figure 1 Municipal Gini histogram

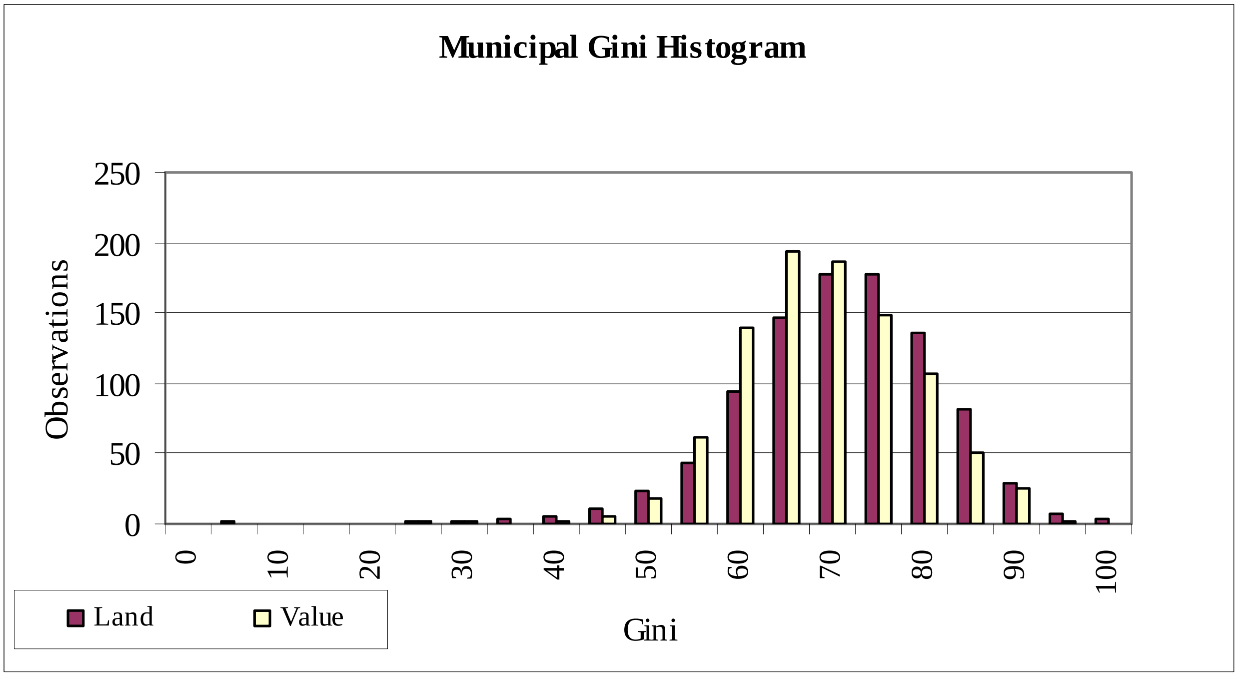

Table 4 Ten highest municipal land Ginis

Municipality	Department	Plot area / municipal area (%)	Population outside muni. capital (%)	# plots	# owners	Gini land	Gini land no outliers	Gini value
Mosquera	Narino	66.22	73.50	680	706	98.36	86.43	77.55
Bahia Solano	Choco	47.76	65.11	657	706	97.48	83.24	77.42
Guican	Boyaca	38.03	84.14	719	1292	96.91	96.99	63.71
Candelaria	Valle	48.22	68.62	1544	2353	91.62	91.60	89.59
Paez	Cauca	34.94	89.99	644	759	91.37	91.37	85.06
Villamaria	Caldas	74.17	28.77	2803	4327	90.75	90.75	72.44
Palmira	Valle	59.64	17.19	5426	7548	90.62	90.60	90.36
Giron	Santander	64.37	11.85	4582	6329	90.45	90.45	80.19
Mallama	Narino	87.50	92.54	2938	4250	90.30	90.29	70.58
Puerto Colombia	Atlantico	10.95	42.60	188	250	90.15	90.15	86.57
Average		53.18	57.43	2018.10	2852.0	92.80	90.19	79.35

Table 5 Highest land representation

Municipality	Department	Plot area / municipal area (%)	Gini land	Gini value
Santa Rosalia	Vichada	2899.32	50.17	62.84
Cravo Norte	Arauca	1691.72	63.65	59.78
Cordoba	Bolivar	674.31	69.36	70.65
Pasca	Cundinamarca	586.46	69.06	56.00
Solita	Caqueta	345.98	34.48	42.56
Florian	Santander	314.21	52.64	57.84
Paez	Boyaca	288.41	89.41	55.81
Santamaria	Boyaca	269.03	62.45	57.33
Guayata	Boyaca	212.13	80.65	77.43
Matanza	Santander	202.93	68.14	56.59
Average		748.45	64.00	59.68

Table 6 National, departmental and municipal Ginis

Gini	Unfiltered		Filtered		Owners	
	Land	Value	Land	Value	Land	Value
National	92.69	82.99	85.46	81.017	85.378	81.627
Department (Average)	82.33	77.60	71.07	72.44	72.03	73.75
Municipal (Average)	72.48	69.05	68.24	66.53	-	-

Table 7 Cadastre actualization

Year (actualization data)	Observations	Average	Year - average	Standard Deviation	Minimum
1984	836	1975.1	8.9	5.56	1949
1985	839	1975.8	9.2	6.19	1949
1986	839	1976	10	6.27	1949
1987	839	1976.3	10.7	6.5	1949
1988	841	1977	11	7.26	1949
1989	843	1977.9	11.1	7.6	1949
1990	843	1979.6	10.4	8.31	1949
1991	847	1982.1	8.9	8.99	1949
1992	846	1984.1	7.9	9.11	1949
1993	850	1986.7	6.3	8.56	1949
1994	853	1989	5	7.69	1954
1995	859	1990	5	7.59	1954
1996	863	1991.2	4.8	7.41	1954
1997	865	1991.7	5.3	7.38	1954
1998	872	1992.8	5.2	7.79	1954
1999	887	1993.3	5.7	7.54	1954
2000	887	1993.6	6.4	7.52	1954
2001	902	1993.8	7.2	7.57	1954
2002	906	1994.2	7.8	7.58	1954

Figure 2 Actualization and land Gini

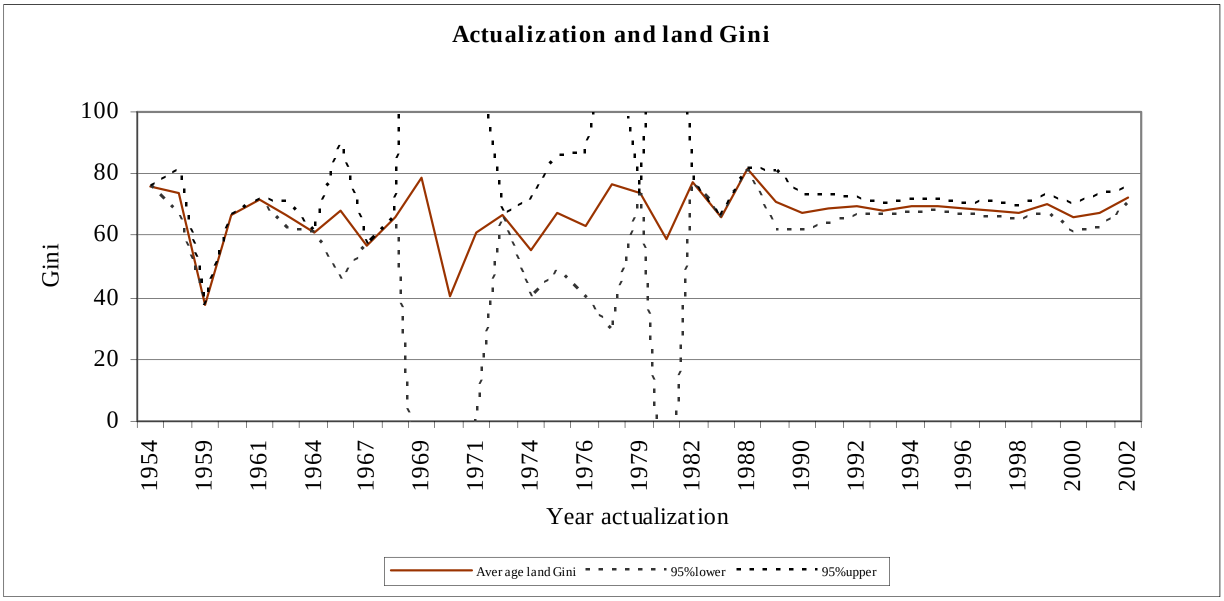

Table 8

Year	Obs.	Average land Gini	Standard Error
2002	39	72.60	1.33
1998	129	67.46	0.94***
1996	118	68.47	0.78***
1994	129	69.50	0.93*
1993	105	68.44	0.88***
1992	43	69.80	1.40

*** Significant 1%
* Significant 10%

(SEE NEXT PAGE FOR TABLE 9)

Table 9 Land and value Ginis by quintiles

Municipal variables	Quintil land Gini						Quintil value Gini					
	1	2	3	4	5	t-stat	1	2	3	4	5	t-stat
Gini	55.29	64.43	69.74	74.88	82.44	-47.14	55.18	61.79	66.57	72.03	80.43	-58.00
Observations	133	133	133	133	133	-	133	133	133	133	133	-
Municipal characteristics												
Distance to Bogotá (km.)	12.67	4.04	17.80	-5.26	-29.25	4.10	19.88	8.64	-9.47	-2.27	-16.78	3.16
Distance to principal markets (km.)	**36.35**	**18.57**	**-0.79**	**-27.06**	**-27.07**	3.51	-20.18	1.92	14.66	11.06	-7.46	-0.83
Road density (km.), 1995	**-183.57**	**-140.84**	**-34.51**	**113.31**	**245.61**	-4.23	**-273.77**	**-213.39**	**-44.84**	**213.22**	**318.78**	-5.85
Professors in municipal head per 10,000	-0.04	0.18	-0.42	0.57	-0.29	0.70	0.30	-0.61	-0.22	0.73	-0.20	1.43
Health centers and hospitals per 10,000	-0.08	-0.06	0.06	0.08	0.00	-1.28	-0.03	0.01	0.03	0.03	-0.03	0.01
Area included/total municipal area (%)	-5.78	-1.32	6.15	3.59	-2.64	-0.68	5.51	-3.13	1.05	-0.52	-2.91	1.39
Value urban plots (1,000 pesos), 2000	-807.57	-993.47	-760.20	-144.71	2705.96	-3.17	-1520.66	-579.99	-776.19	613.95	2262.89	-5.19
Value rural plots (1,000,000 pesos), 2000	**-3.25**	**-1.96**	**-1.51**	**0.87**	**5.85**	-4.31	**-5.77**	**-4.83**	**-1.50**	**2.32**	**9.78**	-7.69
Invest. spend. (free+forced, 1,000 pesos), 2000 per cap	16.82	24.09	-15.14	5.25	-31.02	3.22	31.35	-0.65	-20.28	-6.02	-4.40	1.46
Investment spending, % free, 2000	0.01	0.00	0.01	0.00	-0.02	5.13	**0.02**	**0.01**	**0.00**	**-0.01**	**-0.02**	6.55
Violence												
Actions FARC, average 1985-2000 per capita	1.53	0.56	-1.00	-0.43	-0.65	2.97	1.71	0.08	-0.73	0.19	-1.25	3.49
Actions ELN, average 1985-2000 per capita	**15.70**	**-7.06**	**-2.40**	**-0.72**	**-5.52**	2.20	**11.04**	**4.46**	**-2.68**	**-6.00**	**-6.82**	2.08
Kidnappings, average 1993-1999 per capita	**0.72**	**0.52**	**0.09**	**-0.25**	**-1.09**	1.76	0.32	-0.03	-0.64	0.73	-0.38	0.68
Poverty												
Persons rural NBI (%), 1993	**4.95**	**3.95**	**0.56**	**-3.33**	**-6.12**	5.23	1.04	2.01	1.02	0.43	-4.51	2.75
Persons in misery, rural (%), 1993	**4.55**	**3.35**	**-0.07**	**-2.37**	**-5.47**	5.49	0.09	1.75	0.61	0.12	-2.57	1.51
Non-muni head with water service (%), 1993	**-11.51**	**-3.72**	**-1.90**	**5.66**	**11.49**	-7.88	**-9.75**	**-2.93**	**1.78**	**3.85**	**7.06**	-6.04
Non-muni head with sewage service (%), 1993	**-7.20**	**-4.11**	**-0.90**	**4.68**	**7.52**	-7.73	-6.63	-2.52	2.35	2.14	4.66	-6.03
Non-muni head with phone service (%), 1993	-0.81	-1.06	-0.83	0.81	1.89	-4.74	-1.05	-0.97	0.32	0.26	1.44	-4.86
Poverty factor	**0.39**	**0.20**	**0.02**	**-0.15**	**-0.46**	7.75	**0.20**	**0.19**	**0.03**	**-0.10**	**-0.33**	4.80
Population												
Population (10,000)	-0.77	-0.71	-1.35	-0.18	3.01	-2.66	**-1.88**	**-1.57**	**-0.87**	**0.57**	**3.75**	-4.02
Population ratio non-muni head/total (%)	8.01	3.22	3.55	-3.34	-11.43	6.14	**13.82**	**8.48**	**0.84**	**-6.18**	**-16.97**	11.31
Population density per km2	13.37	-16.89	-47.44	1.07	49.89	-0.55	-60.42	-37.77	8.58	-6.44	96.04	-2.55

Note: NBI is *Necesidades Básicas Insatisfechas*, a measure of the percent of the population that cannot satisfy basic needs
Spending is free and forced, where free is determined at the municipal level and forced by federal law.

Table 10 Land and value Gini regressions

	Land Gini				Value Gini			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Distance to Bogotá (100 km)	-0.831	-1.269	-0.709	-0.81	-0.833	-1.231	-0.669	-0.8
	[2.53]*	[3.65]**	[2.20]*	[2.47]*	[2.43]*	[3.39]**	[1.98]*	[2.35]*
Distance to principal markets (100 km)	-1.97	-1.906	-1.803	-1.779	-1.743	-1.649	-1.518	-1.44
	[5.17]**	[5.01]**	[4.58]**	[4.62]**	[4.89]**	[4.61]**	[4.10]**	[3.96]**
Altitude (1,000 m)	-0.788	-0.873	-0.574	-0.631	-2.589	-2.649	-2.431	-2.341
	[1.51]	[1.61]	[1.09]	[1.21]	[5.24]**	[5.17]**	[4.96]**	[4.78]**
Municipal area (1,000 km2)	0.85	0.838	0.12	0.817	0.568	0.529	-0.08	0.516
	[1.85]+	[1.71]+	[0.28]	[1.77]+	[1.26]	[1.16]	[0.13]	[1.11]
Roads (1,000 km), 1995			0.019				0.017	
			[4.05]**				[2.92]**	
ELN av 1985-2000 per cap			0.00				-0.007	
			[0.02]				[1.60]	
Rural plot value (millions of pesos), 2000				0.061				0.096
				[3.14]**				[3.42]**
Households NBI 1973	-0.227		-0.199	-0.199	-0.223		-0.194	-0.178
	[6.94]**		[5.86]**	[5.89]**	[7.32]**		[6.17]**	[5.40]**
NBI 1985-1973 difference		-0.165				-0.177		
		[4.42]**				[5.17]**		
Dummy Caribe region	6.415	7.71	5.347	6.463	3.81	5.016	2.391	3.886
	[3.56]**	[4.24]**	[2.87]**	[3.61]**	[2.39]*	[3.03]**	[1.43]	[2.39]*
Dummy Andina region	4.326	5.9	4.203	5.266	-1.2	0.145	-1.55	0.287
	[2.51]*	[3.40]**	[2.49]*	[3.01]**	[0.77]	[0.09]	[0.99]	[0.18]
Dummy Pacifica region	11.415	13.408	10.993	12.026	6.254	8.015	5.507	7.221
	[6.44]**	[7.63]**	[6.20]**	[6.78]**	[3.75]**	[4.74]**	[3.27]**	[4.33]**
Constant	90.912	67.792	87.021	86.388	94.386	71.453	90.892	87.229
	[26.95]**	[26.78]**	[24.35]**	[23.24]**	[30.95]**	[32.38]**	[28.22]**	[23.80]**
Observations	724	720	724	724	724	720	724	724
Adjusted R-squared	0.214	0.174	0.23	0.222	0.248	0.22	0.263	0.271

Robust *t* statistics in brackets
+ significant at 10%; * significant at 5%; ** significant at 1%
Base region is Oriental

Table 11 Tobit kidnapping regressions

	Tot. kidnpngs, 1993-99			Av. kidnpngs, 1993-99			Kidnpngs, 1999		
Model	(1)	(2)		(3)	(4)		(5)	(6)	
	Tobit	Tobit	E(y|x)	Tobit	Tobit	E(y|x)	Tobit	Tobit	E(y|x)
Land Gini	16.214	4.88	2.837	2.316	0.697	0.405	14.07	12.665	4.481
	[1.71]+	[0.52]	[0.52]	[1.71]+	[0.52]	[0.52]	[2.61]**	[2.09]*	[2.09]*
Population density	23.537	18.151	10.554	3.362	2.593	1.508	10.577	8.016	2.836
	[9.81]**	[7.53]**	[7.53]**	[9.81]**	[7.53]**	[7.53]**	[8.03]**	[5.87]**	[5.87]**
Distance to Bogotá	-22.072	-16.775	-9.753	-3.153	-2.396	-1.393	-11.208	-6.252	-2.212
	[2.60]**	[2.00]*	[2.00]*	[2.60]**	[2.00]*	[2.00]*	[2.39]*	[1.21]	[1.21]
Road density	8.81	7.713	4.485	1.259	1.102	0.641	3.152	2.389	0.845
	[9.03]**	[8.19]**	[8.19]**	[9.03]**	[8.19]**	[8.19]**	[6.04]**	[4.47]**	[4.47]**
Coca, total 1999 m2		49.669	28.879		7.096	4.126		-0.008	-0.003
		[3.49]**	[3.49]**		[3.49]**	[3.49]**		[0.08]	[0.08]
Rural/Total population (%)		-0.316	-0.184		-0.045	-0.026		21.241	7.516
		[6.85]**	[6.85]**		[6.85]**	[6.85]**		[2.70]**	[2.70]**
NBI, 1993		0.058	0.034		0.008	0.005		-0.131	-0.046
		[0.83]	[0.83]		[0.83]	[0.83]		[4.04]**	[4.04]**
Constant	-2.947	19.105	11.108	-0.421	2.729	1.587	-13.629	5.082	1.798
	[0.25]	[1.50]	[1.50]	[0.25]	[1.50]	[1.50]	[1.85]+	[0.46]	[0.46]
Observations	880	880	880	880	880	880	880	766	766
Log Likelihood	-2934.4	-2901.13		-1729.88	-1696.62		-1599.12	-1457.7	
Pseudo R2	0.06	0.07		0.09	0.11		0.07	0.08	

Absolute value of t statistics in brackets; absolute value of z statistics in brackets for unconditional values
+ significant at 10%; * significant at 5%; ** significant at 1%
Departmental dummies included but not reported

Table 12 Tobit massacre regressions

	Massac. victims, tot. 1995-2001			Massac. victims, av. 1995-2001			Massacre victims, 2001		
Model	(1)	(2)		(3)	(4)		(5)	(6)	
	Tobit	Tobit	E(y|x)	Tobit	Tobit	E(y|x)	Tobit	Tobit	E(y|x)
Land Gini	9.07	9.97	2.378	1.296	1.424	0.34	17.783	13.334	0.54
	[0.77]	[0.85]	[0.85]	[0.77]	[0.85]	[0.85]	[1.36]	[1.03]	[1.03]
Population density	10.49	7.918	1.889	1.499	1.131	0.27	5.902	3.439	0.139
	[4.06]**	[3.11]**	[3.11]**	[4.06]**	[3.11]**	[3.11]**	[2.12]*	[1.32]	[1.32]
Distance to Bogotá	-20.223	-21.643	-5.163	-2.889	-3.092	-0.738	-23.434	-21.175	-0.858
	[1.97]*	[2.12]*	[2.12]*	[1.97]*	[2.12]*	[2.12]*	[2.03]*	[1.87]+	[1.87]+
Road density	7.181	6.362	1.518	1.026	0.909	0.217	3.465	2.741	0.111
	[6.83]**	[6.32]**	[6.32]**	[6.83]**	[6.32]**	[6.32]**	[3.44]**	[2.82]**	[2.82]**
Coca, total 1999-2001 m2		27.591	6.582		3.942	0.94		14.688	0.595
		[5.14]**	[5.14]**		[5.14]**	[5.14]**		[3.02]**	[3.02]**
Rural/Total population (%)		-0.164	-0.039		-0.023	-0.006		-0.156	-0.006
		[3.02]**	[3.02]**		[3.02]**	[3.02]**		[2.73]**	[2.73]**
NBI, 1993		0.082	0.02		0.012	0.003		0.067	0.003
		[0.96]	[0.96]		[0.96]	[0.96]		[0.74]	[0.74]
Constant	-10.589	-12.864	-3.069	-1.513	-1.838	-0.438	-18.263	-15.044	-0.609
	[0.82]	[0.93]	[0.93]	[0.82]	[0.93]	[0.93]	[1.54]	[1.13]	[1.13]
Observations	880	880	880	880	880	880	880	880	880
Log Likelihood	-1406.43	-1387.18		-890.76	-871.52		-481.60	-472.65	
Pseudo R2	0.07	0.09		0.11	0.13		0.10	0.11	

Absolute value of t statistics in brackets; absolute value of z statistics in brackets for unconditional values
+ significant at 10%; * significant at 5%; ** significant at 1%
Departmental dummies included but not reported

Table 13 Tobit FARC and ELN attack regressions

	Total attacks, 1985-2000			Average attacks, 1985-2000			Attacks 2000		
Model	(1)	(2)		(3)	(4)		(5)	(6)	
	Tobit	Tobit	E(y|x)	Tobit	Tobit	E(y|x)	Tobit	Tobit	E(y|x)
Land Gini	-8.66	-7.997	-4.934	-0.271	-0.250	-0.154	7.729	9.307	3.423
	[0.70]	[0.64]	[0.64]	[0.70]	[0.64]	[0.64]	[1.65]+	[1.94]+	[1.94]+
Population density	9.56	7.421	4.579	0.299	0.232	0.143	2.862	2.794	1.028
	[2.89]**	[2.18]*	[2.18]*	[2.89]**	[2.18]*	[2.18]*	[2.11]*	[1.97]*	[1.97]*
Distance to Bogotá	2.27	-4.012	-2.475	0.071	-0.125	-0.077	-1.728	-3.876	-1.425
	[0.20]	[0.36]	[0.36]	[0.20]	[0.36]	[0.36]	[0.43]	[0.94]	[0.94]
Road density	8.948	8.021	4.949	0.28	0.251	0.155	1.942	1.795	0.66
	[6.74]**	[6.10]**	[6.10]**	[6.74]**	[6.10]**	[6.10]**	[4.13]**	[3.82]**	[3.82]**
Coca, total 1999-2000 m2		36.04	22.236		1.126	0.695		8.739	3.214
		[3.92]**	[3.92]**		[3.92]**	[3.92]**		[2.85]**	[2.85]**
Rural/Total population (%)		-0.243	-0.15		-0.008	-0.005		-0.03	-0.011
		[3.78]**	[3.78]**		[3.78]**	[3.78]**		[1.26]	[1.26]
NBI, 1993		0.252	0.155		0.008	0.005		0.061	0.022
		[2.66]**	[2.66]**		[2.66]**	[2.66]**		[1.72]+	[1.72]+
Constant	9.453	1.567	0.967	0.295	0.049	0.03	-2.942	-7.546	-2.775
	[0.61]	[0.09]	[0.09]	[0.61]	[0.09]	[0.09]	[0.55]	[1.24]	[1.24]
Observations	880	880	880	880	880	880	880	880	880
Log Likelihood	-3444.79	-3428.90		-1039.57	-1023.68		-1637.00	-1630.93	
Pseudo R2	0.05	0.05		0.14	0.15		0.07	0.07	

Absolute value of t statistics in brackets; absolute value of z statistics in brackets for unconditional values
+ significant at 10%; * significant at 5%; ** significant at 1%
Departmental dummies included but not reported; Attacks are FARC and ELN only