The relationship between multidimensional poverty and armed conflict: the case of Antioquia, Colombia

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The relationship between multidimensional poverty and armed conflict: the case of Antioquia, Colombia.

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Abstract

This paper analyzes the relationship between poverty and armed conflict in Antioquia, Colombia. The poverty analysis is framed within Sen's capability approach, which forms the conceptual basis of the multidimensional poverty index (Alkire and Foster, 2011). The MPI is measured with data from a government database called SISBEN, used to target social assistance programs, while the armed conflict is measured through count data about violent events during the period 1996-2010 on each municipality. The possible existence of a relationship between poverty and armed conflict is analyzed through exploratory and non-parametric methods. The results so far suggest that the MPI is robust to the multidimensional cut off. Also, they show that those areas more affected by conflict usually showcase high levels of multidimensional poverty.

Keywords: Multidimensional poverty, capability approach, armed conflict, exploratory data analysis.

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1) Introduction

Armed conflicts cause capability deprivations. Indeed, they put at risk people's most valuable functioning: being alive. And, of course, an armed conflict limits the chances to carry on a dignifying life. It is not necessary to explain what an armed conflict means in terms of capability deprivation, it just suffices to mention some forms of violence that armed groups get to use: massacres, rapes, forced displacement, torture, humiliation and dispossession of land and other resources, all of which cause freedom deprivation. In Colombia, the armed conflict has caused the death of roughly 220,000 people from January the 1st in 1958 to December 31st in 2012, the 81.5% of whom have been civilians and the remaining 18.5% combatants (GMH, 2013). To be alive is the most basic functioning that a person is entitled to when born, and an important feature of the human development process is to allow people to have the capability to live a decent and long life.

The presence or absence of an armed conflict may deteriorate social capital, hence limiting society's ability to transform available resources into valuable functionings (Sen, 2009). However, in Colombia, the social implications on people who live in conflicting areas have not been fully analyzed yet (Arias, et al., 2014). Research, as we will see in the literature review, has concentrated on direct victims, under the sponsorship of government, with the aim of providing a guiding framework to compensate victims and manage post-conflict. Here, however, attention is devoted to the poor population inhabiting the affected territories. More specifically, the aim of this paper is to investigate if there is a relationship between multidimensional poverty– as a measure of societies' capability deprivation –and armed conflict in Antioquia's municipalities, in Colombia. Mutlidimensional poverty will be measured through the Multidimensional Poverty Index (MPI) developed by Alkire and Foster (2011), while armed conflict will be proxied through count data about attacks by illegal groups like guerrillas and paramilitary counterinsurgency groups, between 1996 and 2010. In this sense, this paper also contributes to the empirical literature framed within the capability approach paradigm.

This paper is structured as follows: The second section briefly analyzes some literature related to the relationship between conflict and poverty. The third section explains the methodology. The fourth section shows the results, and is followed by some concluding remarks. In this paper we will concentrate mainly in non-parametric techniques and exploratory assessments able to provide evidence about the existence or absence of a link between poverty and armed conflict for the case of Antioquia. Further work involves the implementation of confirmatory methods. However, this exploratory analysis is mandatory and previous to any confirmatory analysis (i.e. model estimation), as this step allows data to speak for itself and suggest or give clues about relationships worth studying further.

2) Brief review of literature: armed conflict and poverty

The study of the conflict-poverty relationship is a complex one because of the potential feedback between these phenomena, which makes it difficult to asses any causality mechanism. The relationship between violent conflict and poverty can take three forms of interaction: i) the conflict as a cause of chronic poverty, ii) insecurity as a cause chronic poverty, and iii) poverty as a trigger conflict. The academic literature on this topic is recent, and has addressed mainly the following question: ¿how does poverty cause war, and how does war cause poverty? Nevertheless, a review of the literature quickly shows that the causation mechanism that goes from poverty to war has received wider attention in the last decade than the causality direction stemming from conflict to poverty (Justino, 2011).

The pioneering work of Fearon and Laitin (2003) and Collier and Hoeffler (2004) links the level of per capita income with the unfolding of civil wars, pointing that a low income level increases the chances for a violent conflict to occur. Also, Justino (2011) asserts that civil wars are more likely to develop in poor areas. Moreover, Goodhand (2001) reviews literature that in general agrees on a transmission mechanism validating that conflict is triggered by poverty. However, there is no agreement about the implicit assumptions behind this relationship, because modern conflicts are multi-causal, that is, a variety of factors, ranging from short-term to long-term phenomena –such as a sudden economic slowdown, external shocks and a crisis of State– should be taken into account.

The colombian case involves special circumstances that go beyond poverty and economic exclusion considerations, and which in turn are related to the political regime, as the nature of the judicial system and the high degree of impunity for crime (Bonilla, 2009; Yaffe, 2011). In this respect, Yaffe (2011) notes that a correlation between inequality and violent conflict exists, but not a direct causal link; this is explained by the fact that other countries with a similar income distribution as Colombia do not have an insurgency. Therefore, the colombian armed conflict might be better explained by considering other factors such as the political and institutional setting, and even greed. Paradoxically, the traditional literature on political science has attributed participation in violence to material incentives that make it expensive for the people not to participate in this.

With reference to the causal link going from violence and going to poverty, Justino (2011) states that this strand of analysis usually focuses on the destruction of physical capital (assets) and human capital (household characteristics). The effects of the conflict in different types of capital give rise to different approaches with differing views about the depth of those effects (Justino, 2011; Fernández et al., 2011). A first channel or transmission mechanism from violence to poverty manifests itself through households incomes, as a consequence of reduced agricultural production and productive investment, due to an increased uncertainty, which leads economic agents to rely on informal and less dynamic markets. Another transmission channel, places attention to increased production and transaction costs and to

limited transactions in local markets. Furthermore, social networks are weakened, thus debilitating the informal mechanisms of assurance against risk. As a result, households have a decreased number of alternatives to mitigate the economic cost of conflict. However, research is scarce about the effects of war on poverty that operate through other channels such as institutional change, which are produced in two ways: i) changes in social cohesion and cooperation, and ii) effects in political institutions and local governance.

The effects of conflict comprise a complexity of conditions and factors that impact individuals, households and communities at the same time. On the one hand, the destruction of physical and human capital is undeniable, although the emergence of new opportunities arising from the deep local institutional transformation, where peace, order and violence mingle in new quotidian realities. Nevertheless, formal peace agreements do not necessarily represent the end of violence, and sources of instability tend to persist or raise new post-conflict scenarios (Justino et al., 2013).

In any event, Ganepola and Thalayasingam (2004) argue that the negative connotation of the term 'conflict' must be questioned especially since most social changes, including those that are seen as positive, involve the interaction between two ideas competing within a social framework. It is necessary to allow this idea of conflict to be considered in the analysis to explore the relationship between poverty and conflict. The social and political conflicts are not only normal, but they can also serve as a constructive catalyst to achieve a desirable change in society.

3) Methodology

The MPI

Poverty has become a main concern of policymakers, of development economics and of societies in general. However, now it is widely recognized that economic growth and redistributional policies all help but not suffice to overcome poverty, as they put aside other elements of personal well-being. Poverty must be understood as a multidimensional issue, in which income is just an element among many others that help reach a decent life.[2] As Sen (1985, 1996, and 2000) suggests, life quality can be seen through an approach in which it is judged through the capabilities a person has to achieve alternative functionings. From this lens, poverty is seen as a problem of capability-deprivation. That is, poverty is the result of a lack of freedom to achieve valuable functionings. It is plainly obvious that the capability approach pioneered by Sen calls for a multidimensional measurement of poverty.

Indeed, the Multidimensional Poverty Index (MPI) proposed by Alkire and Foster (2011) provides such a measure. In a sense, the MPI is not a novelty: the direct method to poverty

[2] The functionings can be interpreted as a vector which lists all things a person regards as worth ‘doing’ or ‘being’, while the capabilities an individual possesses can be seen as the set of available or achievable functionings among which the person is effectively able to choose.

measurement,[3] which "shows whether people satisfy a set of specified basic needs, rights, or –in line with Sen's capability approach– functionings (Alkire and Foster, 2013, p.5)", has been widely implemented in Latin America, through government backed measurements of Unsatisfied Basic Needs (or *NBI*). In the parlance of the MPI index each functioning is called a dimension. Direct methods to poverty measurement rely on a *dual cut off method* to identify the poor. First, direct methods determine the deprivations of the population, namely, the basic needs or rights that people do not satisfy. Second, among the individuals with any deprivation, the poor are identified. The traditional direct poverty measures usually rely either on the union or the intersection identification methods. The union approach regards as poor the individuals with at least one deprivation or unsatisfied need. The intersection approach regards as poor the individuals with deprivations across all dimensions. Thus, a key contribution of the MPI of Alkire and Foster (2011) resides in the development of a new identification procedure, "that identifies the poor by counting the dimensions in which a person is deprived (Alkire and Foster, 2009, p. 1)."

Let d be the number of dimensions selected to compute a direct poverty measure, and let k be the poverty cut off. In the union approach $k = 1$; in the intersection approach $k = d$. However, the MPI allows k to be such that $1 \leq k \leq d$. Thus the identification method of Alkire and Foster (2011) lays half-way between the two aforementioned identification methods.

Moreover, the MPI satisfies the property of dimensional monotonicity, "which says that if a poor person becomes newly deprived in an additional dimension, then overall poverty should increase (Alkire and Foster, 2009, p. 12)." That's the case with the MPI, but not with poverty measures based on a straightforward headcount ratio, as the Unsatisfied Basic Needs Index. Moreover, the MPI can be decomposed by population groups and by dimensions. In the first case, it allows to see which population groups are hard hit by poverty. In the second case, it allows to determine the contribution of each dimension to poverty. This second property is of utter usefulness from a policymaking perspective, as it makes possible to determine the dimensions which contribute the most to overall poverty, providing valuable information for policy prioritization. Nonetheless, this feature will not be exploited in this paper, as it focuses on studying the relationship between poverty and armed conflict in Antioquia.

Implementation

The implementation of the MPI implies some critical decisions involving its parameters: to define the set of dimensions to include in the index, to choose a set of variables or indicators that reflect each dimension, to set and apply the deprivation cut offs for each indicator, select the weights to assign to each indicator, and set the poverty cut off (Alkire and Santos, 2013). The deprivation cut off refers to "the level of achievement (normatively) considered sufficient in order to be non-deprived in each indicator (Alkire and Santos, 2013, p. 8)", while "the poverty cut off is the proportion of weighted deprivations a person needs to experience in

[3] Indirect methods, on the contrary, are not based on the living conditions, but on the available resources of the individual or household (Boltvinik, 1999).

order to be considered multidimensionally poor (Alkire and Santos, 2013, p. 8)". Of course, the aforementioned decisions are prone to controversy, as they all "embody normative judgements (Alkire and Foster, 2011b, p. 2)." In other words, subjectivities are unavoidable and, hence, always present.

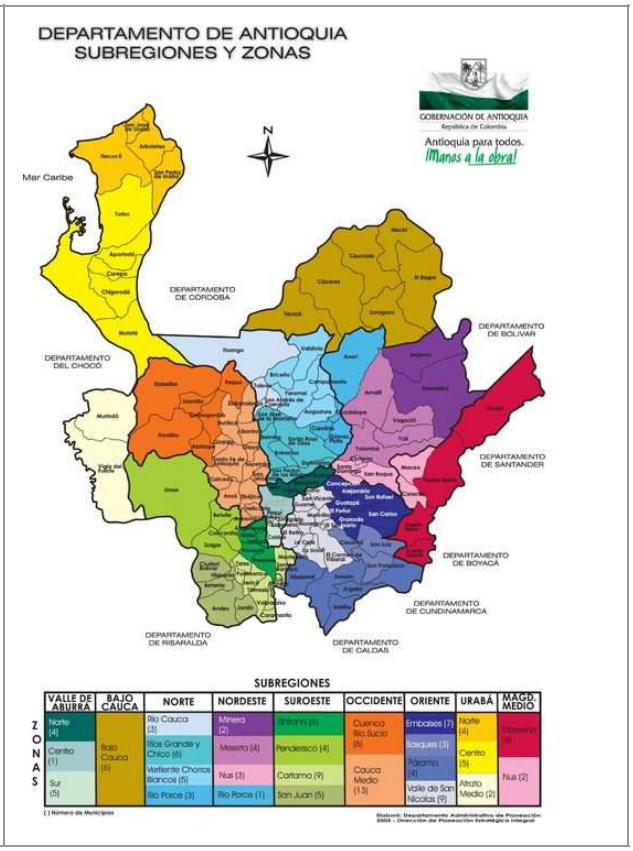
Another difficulty arises from the fact that it is impossible to judge every individual through the same lens, as every individual may value a completely different set of things, that is, each person pursues different functionings. Thus, Sen recognizes that the practical implementation of its capability approach requires to prioritize some deprivations, based on some common values shared by society and chosen through public scrutiny, to determine the kind of needs it considers completely regrettable not to meet (Sen, 1988, 2000). Of course, this is an issue present in the implementation of the MPI. Obviously, the selection of dimensions and cut off's can be guided by the common values shared by society as embodied in its Constitution, its Laws, or based on policy considerations and priorities. However, often the selection of dimensions, as that of related variables or indicators, is also heavily restricted by data constraints (see Alkire and Santos, 2013). Moreover, alternative sets of weights can be given to the selected dimensions, "to indicate the relative importance of the different deprivations (Alkire and Foster, 2011b, p. 6)", which may reflect a sense of hierarchy or priority of a particular set of dimensions (or functionings).

Data

This study employs information about armed actions by both illegal and legal groups in Antioquia, and about internal forced migrants expelled over the period 1996-2010, database provided by "Instituto de Estudios Regionales, Iner", a research center that took part of a nation-wide study on regions affected by armed conflict. Poverty will be measured at the household level for each municipality of Antioquia using the multidimensional poverty index. The source of information to implement this poverty measure comes from a government database called SISBÉN (cross-section 2012), which is used in Colombia as an instrument to target social assistance programs. Then we will provide for each municipality in Antioquia a poverty measure with international standing and closer to the capability approach of Sen.

Geographical Location

Antioquia is a province/department located in the central north-western region of Colombia. Antioquia is the second most important region after Bogotá, as measured by its contribution to Colombia's GDP (around a 13 %). Its population is around 6.300.000 inhabitants distributed among 125 municipalities, with more than a half of the population living in its only Metropolitan Area (9 municipalities), located in the Valle de Aburrá (see the map on next page).



Dimensions and deprivation thresholds

Following the lead of the 2014 UNPD Human Development Report, in this paper the Antioquia's MPI is also composed of three dimensions: health, education and standard of living. These dimensions, which represent functionings socially accepted as valuable, are proxied through nine indicators. These indicators do not necessarily reflect specific functionings, but at least they do reflect circumstances conducive to the realization of a given functioning. Moreover, data limitations are largely responsible for the fact that only three dimensions can be considered and proxied by a handful of indicators. The deprivation cut off's are established following the ones used by UNPD (2014) or those used by DANE in the computation of the Basic Unmet Needs indicator. Moreover, all dimensions are given equal importance, namely, each dimension is assigned a weight of one third (1/3).

The indicator cut off's used to classify a household as deprived are as follows:

- **Living Standards**
    - Electricity: the household has no access to electricity.
    - Water conduit: the household has no access to fresh water through a water conduit.[4]

[4] The information collected by SISBEN does not allow to determine if the household has access to water ready for human consumption.

    - Sanitation: the household does not have access to a non-shared sanitation facility connected to a sewage system or a cesspit.
    - Assets: the household does not own at least two of the following assets: refrigerator, tv, radio, computer, scooter.
    - Households residing in homes built with inadequate materials, i.e. with floor or wall materials like dirt, sand, ill wood, dung, fabric.
- **Health**
    - Health insurance: A household is deprived if any of its members has no health insurance.
    - Permanent disability: A household is regarded as deprived if any of its members has some permanent disability.
- **Education**
    - School attainment: no adult (>18 years old) household member has completed at primary education cycle.
    - School attendance: a school age child is not attending to school. The school age goes from 6 to 12 years old.

Thus, a total of nine indicators are employed. After identifying the deprived households within each indicator, the deprivation share or deprivation score for each household is computed. Then, to identify the multidimensionally poor a multidimensional cut-off is chosen, which is used to filter households according to their deprivation score. Any household with a deprivation score (or share) above the one given by the multidimensional cut-off is regarded as poor. Finally, the MPI for Antioquia's municipalities is computed. The Multidimensional Poverty Index (MPI) or M0 (as it is referred to in Alkire and Foster, 2011) is the product of the average deprivation share and the head count ratio.[5] The headcount ratio is the share of households regarded as multidimensionally poor within each municipality. The average deprivation share is the deprivation score of the typical household, namely, it is the average of the deprivation score.

The MPI vs. the armed conflict

To study the relationship between poverty and armed conflict, this paper uses some basic exploratory tools for spatial data, namely, to display the spatial distribution of the MPI and armed conflict related violence through choropleth maps. A comparison of the resulting spatial patterns may suggest if there is some spatial relationship among the data analyzed. Then, a set of kernel distributions is estimated, that portrays the empirical distribution function of the MPI under the absence and under presence of illegal armed groups such. This allows to determine if the distribution of poverty differs under the presence of such groups. In fact, a higher incidence of multidimensional poverty is found. The following section discusses the results so far obtained.

[5] Also, the MPI can be seen as the weighted average of the censored dimensional head count ratios

4) Results

This study considered several deprivation cut-off's, as a means to address the sensitivity of the poverty measure to the selection of the multidimensional cut off. The results so far obtained suggest that the MPI is fairly robust to the multidimensional cut off. Tables 1, 2 and 3 show alternative correlation coefficients among the MPI measures obtained after applying different multidimensional cut offs. For example, table 1 shows that the Pearson correlation between M0_3 and M0_4 is very high and close to one (0.9856). M0_3 refers to the MPI obtained after applying a multidimensional a cut off of one third (3/9) or 33.3%, that identifies as poor any household with three or more deprivations or, equivalently, with a deprivation share (or score) above 33.3%. Similarly, M0_4 refers to the MPI obtained after applying a multidimensional cut off of 44..4% (4/9), that identifies as poor any household with a deprivation share above 44.4%, namely, deprived in at least four dimensions. Tables 2 and 3 can be interpreted in a similar fashion.

In general, the Pearson correlations are high for all the MPI's computed after applying intermediate multidimensional thresholds. However, the correlations for the MPI's with cut off's under 6 with those with higher cut off's are slightly lower. Nonetheless, this fact should not be a source of concern, because high values of the multidimensional cut off puts the MPI in a field closer to the traditional intersection identification approach. Indeed, when the multidimensional cut off equals nine (9) or -equivalently- 100%, the intersection identification method is obtained. However, as already mentioned, a key feature of the Alkire and Foster (2011) methodology underpinning the MPI is that the identification procedure lays half-way between the traditional union and intersection approaches.

Table 1. ***Pearson correlations among MPI measures***

Pearson	M0_1	M0_2	M0_3	M0_4	M0_5	M0_6	M0_7	M0_8	M0_9
M0_1	1.000								
M0_2	0.999	1.000							
M0_3	0.986	0.983	1.000						
M0_4	0.967	0.965	0.986	1.000					
M0_5	0.927	0.925	0.961	0.975	1.000				
M0_6	0.874	0.872	0.911	0.936	0.950	1.000			
M0_7	0.698	0.700	0.723	0.763	0.763	0.900	1.000		
M0_8	0.754	0.759	0.777	0.784	0.827	0.865	0.792	1.000	
M0_9	0.362	0.362	0.379	0.425	0.462	0.641	0.804	0.696	1.000

Tables 2 and 3 show Kendall and Spearman rank correlations, respectively, among different MPI's. These correlation coefficients also showcase a high correlation among the MPI's obtained after applying a multidimensional cut off under six (6) or 66.6%, but similarly these have a slightly lower correlation with those MPI's computed with a multidimensional cut off above 77.7% or seven (7 dimensions).

Table 2. ***Kendall Rank correlations among MPI measures***

Kendall	M0_1	M0_2	M0_3	M0_4	M0_5	M0_6	M0_7	M0_8	M0_9
M0_1	1.000								
M0_2	0.999	1.000							
M0_3	0.986	0.983	1.000						
M0_4	0.967	0.965	0.986	1.000					
M0_5	0.927	0.925	0.961	0.975	1.000				
M0_6	0.874	0.872	0.911	0.936	0.950	1.000			
M0_7	0.650	0.658	0.653	0.687	0.699	0.749	1.000		
M0_8	0.632	0.634	0.634	0.626	0.678	0.688	0.638	1.000	
M0_9	0.123	0.123	0.157	0.225	0.231	0.276	0.481	0.368	1.000

Table 3. ***Spearman Rank correlation coefficients among MPI measures***

Spearman	M0_1	M0_2	M0_3	M0_4	M0_5	M0_6	M0_7	M0_8	M0_9
M0_1	1.000								
M0_2	0.998	1.000							
M0_3	0.988	0.986	1.000						
M0_4	0.976	0.976	0.987	1.000					
M0_5	0.964	0.966	0.982	0.989	1.000				
M0_6	0.946	0.945	0.964	0.975	0.982	1.000			
M0_7	0.843	0.848	0.846	0.875	0.882	0.914	1.000		
M0_8	0.829	0.833	0.829	0.821	0.861	0.875	0.841	1.000	
M0_9	0.192	0.195	0.239	0.323	0.344	0.410	0.670	0.480	1.000

Although the MPI has been calculated for different multidimensional cut off's, the relative robustness of the measure elicits the results here discussed to concentrate on the MPI obtained from intermediate multidimensional cut offs - not to mention brevity concerns .

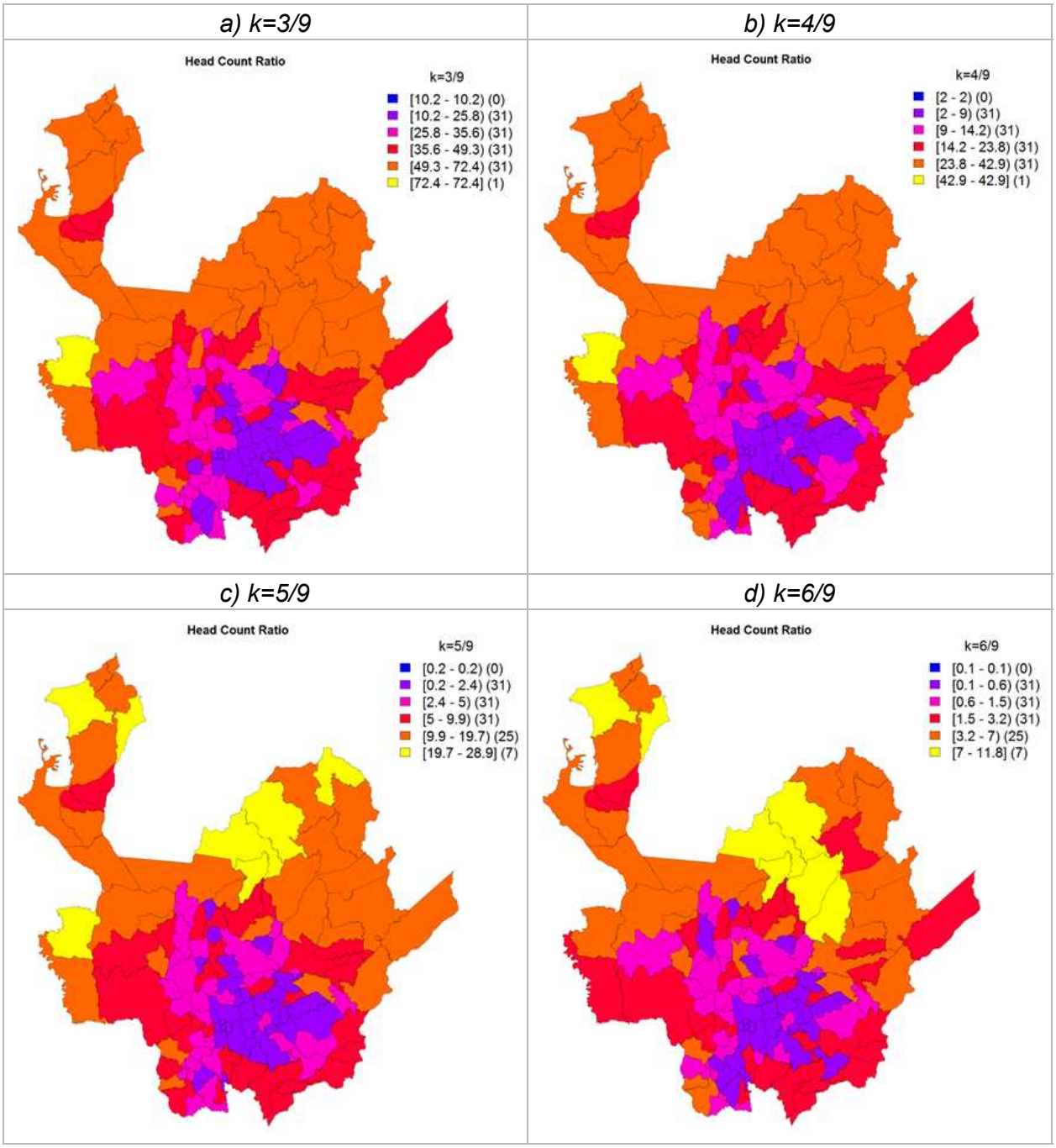
Where are the multidimensional poor people in Antioquia?

Graph 1a shows a box map of the headcount ratio for the multidimensionally poor in at least three indicators (k=3/9). It is apparent that higher headcount ratios are found in what can be called Antioquia's periphery, where above half of the municipal population is classified as multidimensionally poor.

Although, obviously, as the multidimensional threshold increases, the share of population identified as poor diminishes, the spatial patterns exhibited by the headcount ratio are roughly the same (see graphs 1b to 1d). This result is in line with the high correlations among the different MPI's (see tables 1 to 3). However, for multidimensional thresholds above 55.5% (5/9), the share of population identified as multidimensional poor diminishes significantly, with less than 30% of the municipal population classified as poor. Such a low headcount ratio gives an inadequate account of the poor for the case of Antioquia, as it could convey a less somber picture about poverty, which could divert the attention of public opinion and policymakers to less urgent matters. Thus, for the case of Antioquia, it is considered that

multidimensional thresholds below 44.4% (or 4/9) provide a picture of multidimensional poverty that do not subtracts to the public policy urgency of fighting poverty.

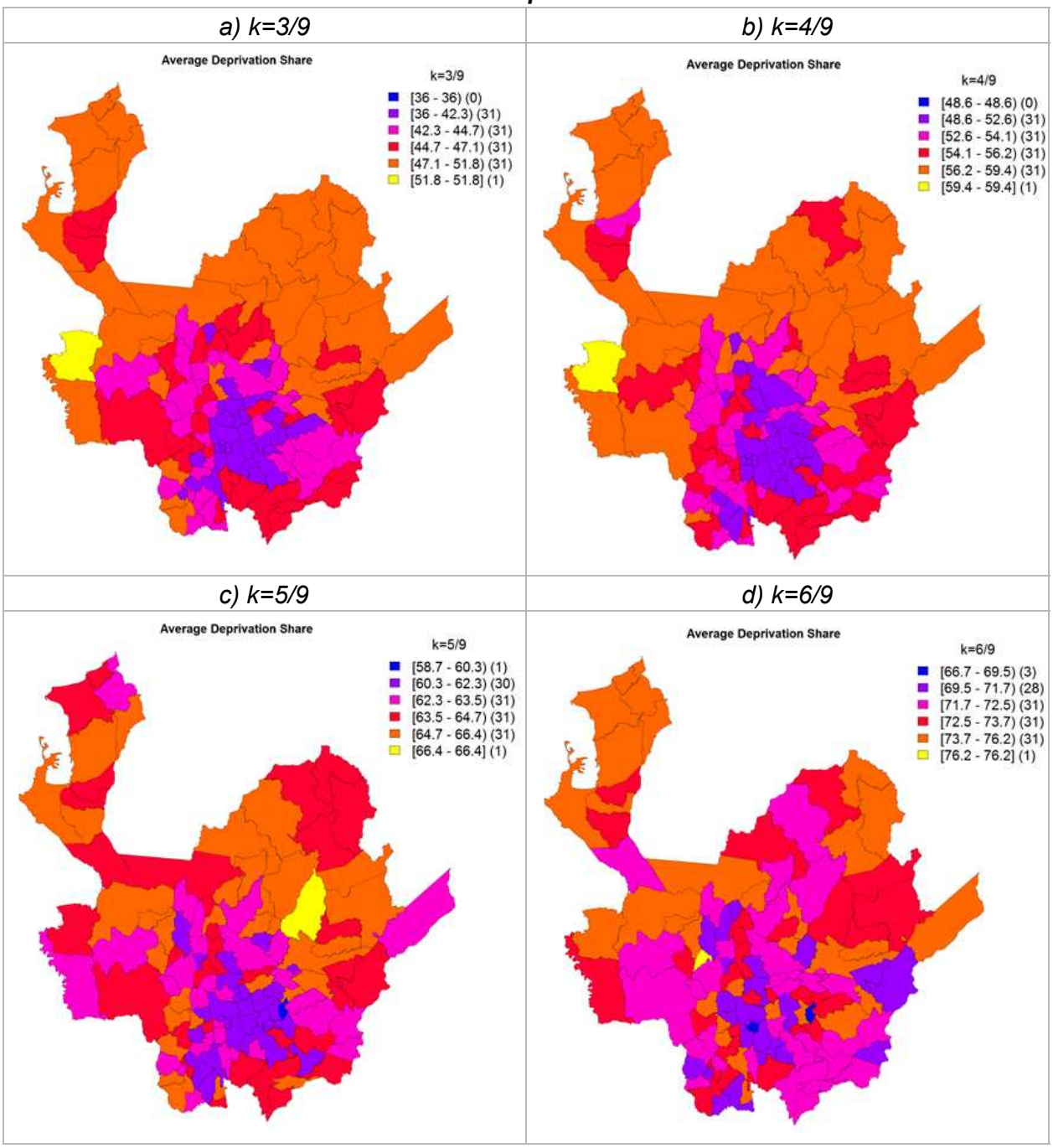
Graph 1. ***Headcount ratios for different multidimensional thresholds - Box maps.***



The average deprivation share, illustrated in the box maps in graph 2, also follows a similar spatial pattern as the headcount ratio in graph 1. Again, the average deprivation share is higher in the northern regions of the province, and lower in the central region, around its only

metropolitan area. For example, for a multidimensional cut off of 33.3% (or 3/9), the average deprivation score of poor households in the northern region is about 50%, which means that a poor household is deprived in 4 or 5 indicators on average.

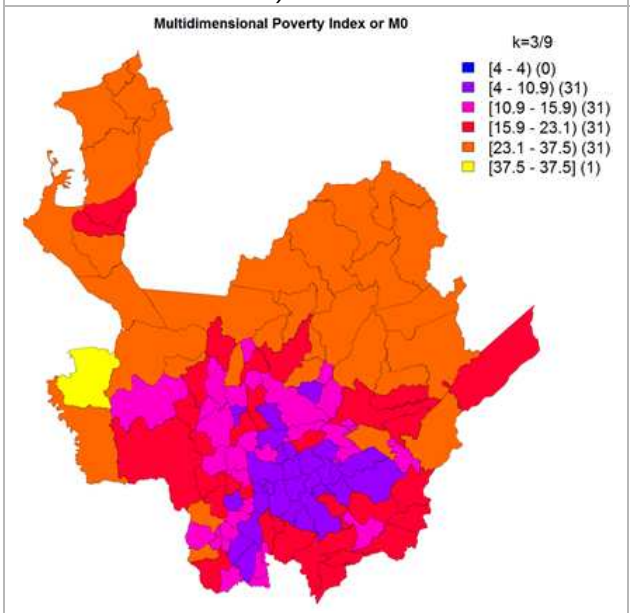
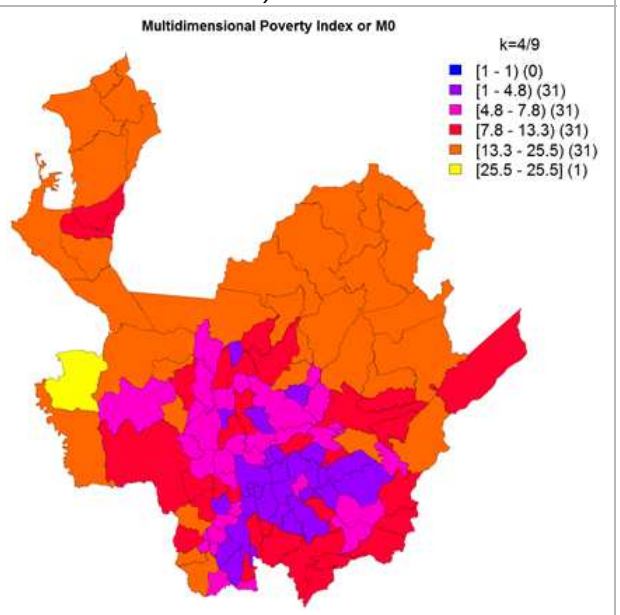
Graph 2. ***Average deprivation share for different multidimensional thresholds - Box maps***



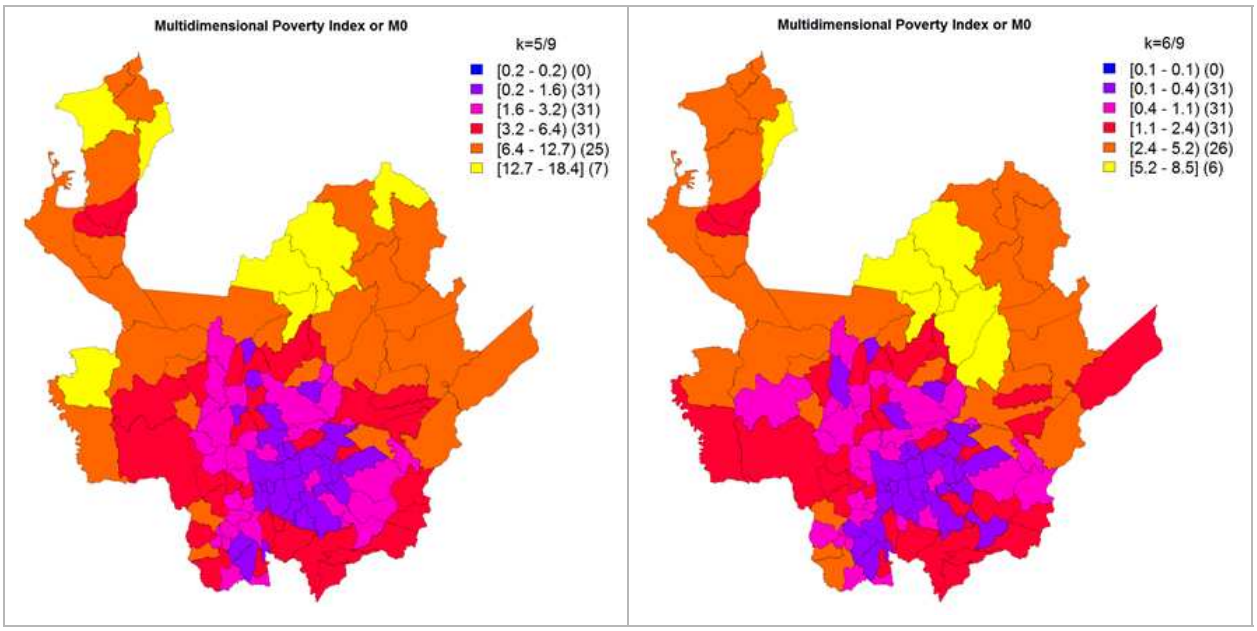
Remember that the MPI can be seen as the product of the previous two indices. Namely, the MPI is the frequency of poverty (the headcount ratio) times the average breadth of deprivation

(the average deprivation share) among the poor or, equivalently, “the aggregate deprivations experienced by the poor as a share of the maximum possible range of deprivations across society (Alkire and Foster, 2009, p. 25)”. So, given the strong spatial patterns exhibited by the headcount ratio and the average deprivation share, it is not surprising that the Multidimensional Poverty Index (MPI) replicates such patterns. Indeed, the MPI provides a sharp picture of the regional development gaps in Antioquia (see graph 3), where Medellin’s metropolitan area -for a wide margin- lays ahead of most municipalities in Antioquia.[6] Thus, Medellín’s metropolitan area, along with the east region, exhibits the lowest levels of multidimensional poverty in the province. These results align with research on poverty using the unsatisfied basic needs indicator (or NBI, see Pérez, 2005, Muñetón and López, 2014).

Graph 3. ***Multidimensional Poverty Index - Box maps***

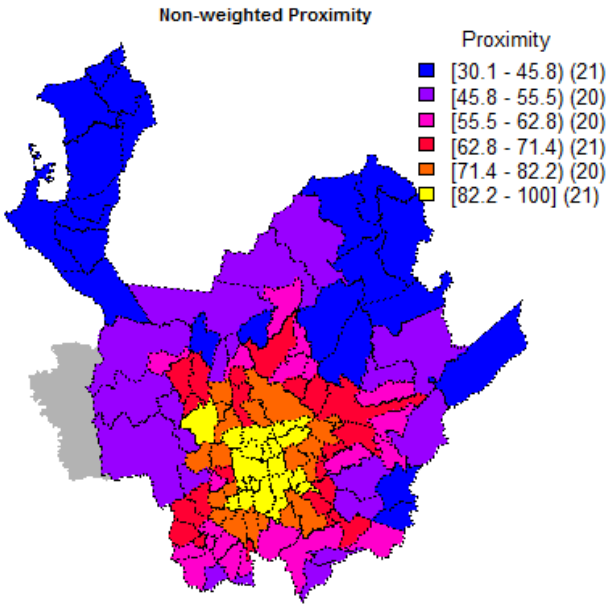
<table>
<tr><td>a) k=3/9</td><td>b) k=4/9</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>c) k=5/9</td><td>d) k=6/9</td></tr>
</table>

[6] Accounts of regional disparities in Antioquia can be found in Loaiza and Moncada (2013).



It should be borne in mind that the east region has a high connectivity with Medellín's metro area, while the northern zone, comprising regions like Urabá, is farther from Medellín and connected through a deficient road network. To illustrate this fact, graph 4 shows a proximity index. The higher the proximity index, the easier it is to communicate through the road network with other municipalities. It is clear that Medellín's metro area, along with some east region towns, is the best connected region in Antioquia.

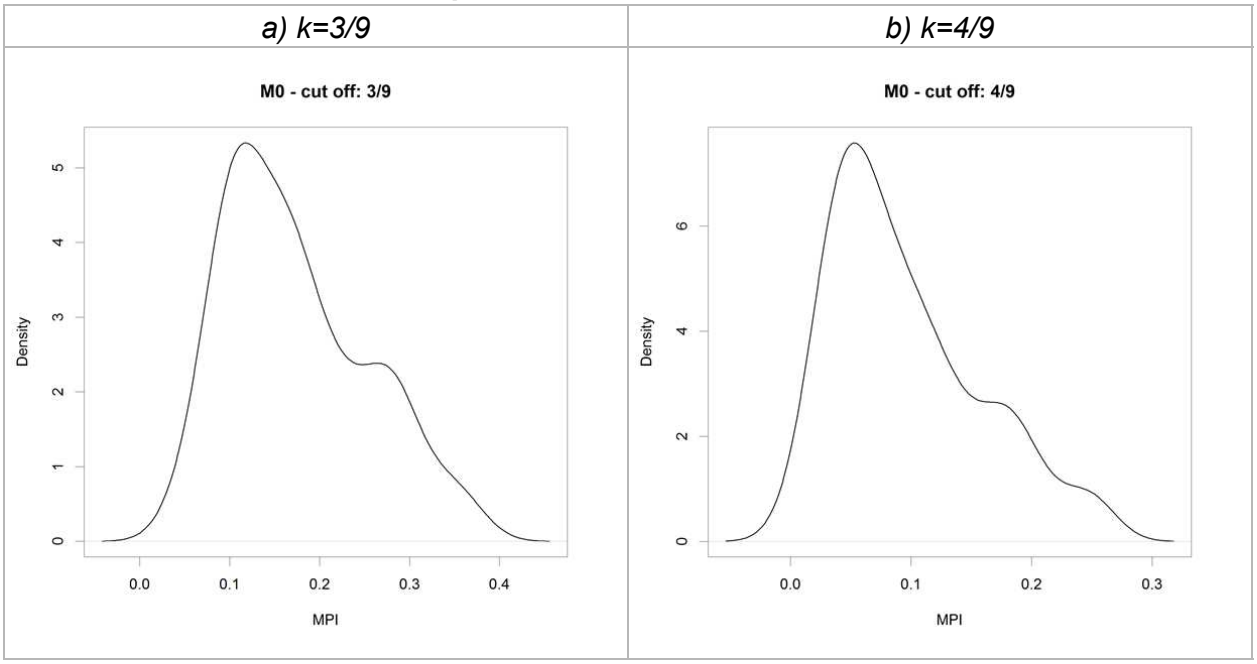
Graph 4. ***Proximity index***



Finally, as an alternative means to illustrate the dual nature of Antioquia's development, as put forward by the MPI, graph 5 shows the kernel distribution (or empirical distribution

function) of the MPI for two different cut off values. In this graph it is evident that the MPI distribution is multimodal, indicating that the municipal multidimensional poverty clusters around two groups, one of them showcasing a high level of poverty.

Graph 5. ***MPI kernel distribution***

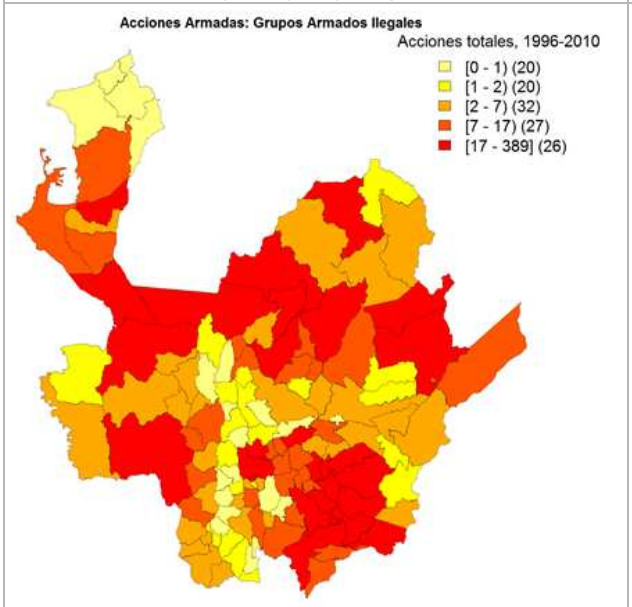


Do conflicting areas and high poverty areas overlap?

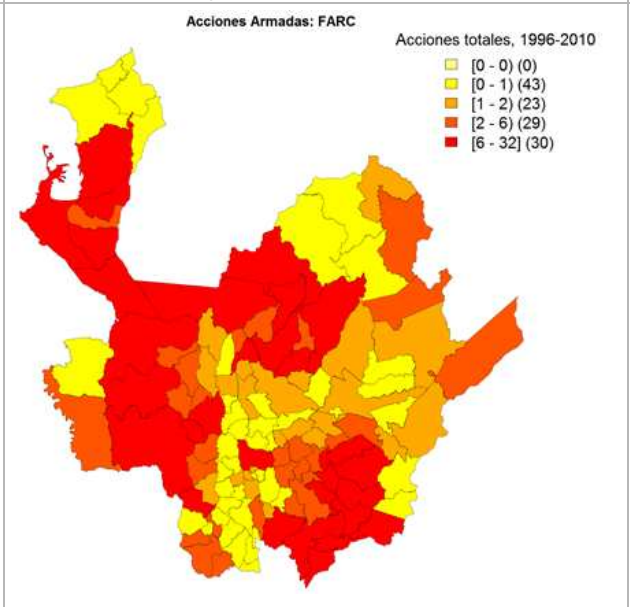
Graph 6a shows the total number of armed attacks by illegal groups for the period 1996-2010. Graph 6a shows that the zones more affected by illegal groups attacks locate in Antioquia's north and southeast regions. Also, graph 6b shows that the FARC guerrilla made an important presence in the north, including the Urabá region, in Antioquia's west, and the southeast. The ELN guerrilla also had stakes in the southeast, almost overlapping with FARC guerrilla, although it had its main niche on the northeast. Although public forces cannot be deemed innocent of abuses, it is fairly clear that armed actions by public forces overlap with these illegal groups past territorial domains and, indeed, they have been quite successful in their recent efforts to retreat the guerrillas.

Graph 6. ***Armed actions, 1996-2010***[7]

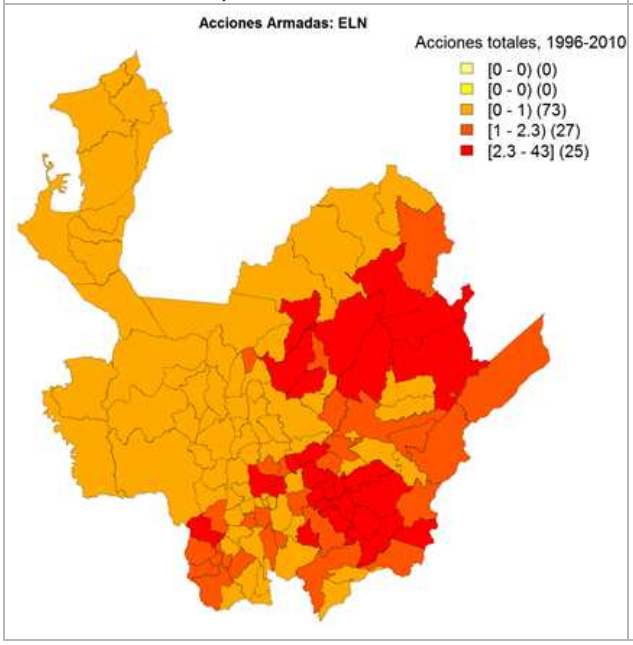
a) Illegal groups



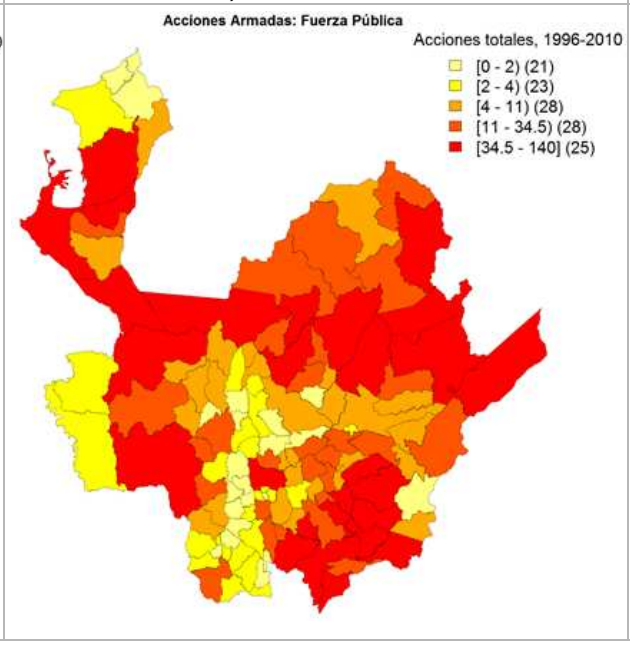
b) FARC Guerrilla



c) ELN Guerrilla



d) Public Force



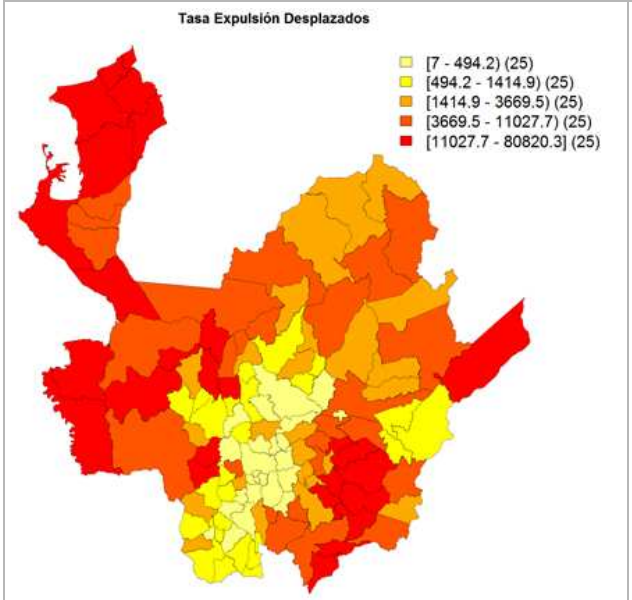
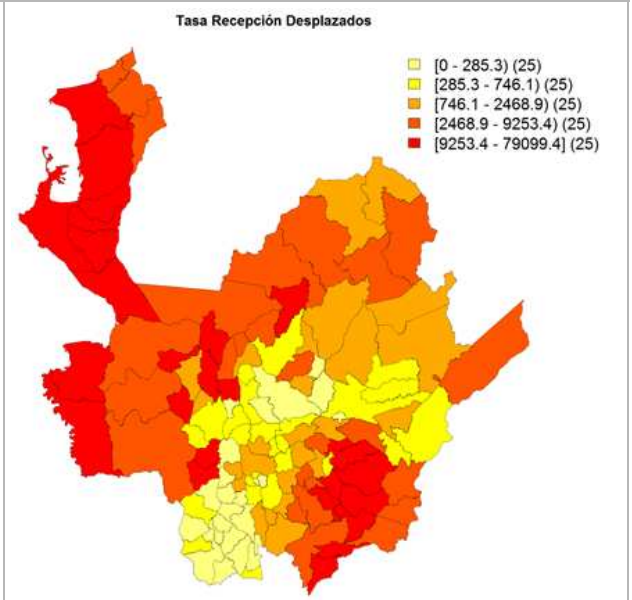
Comparing graph 6 with graph 3, it could be said that there is a fairly good amount of coincidence between those areas with high levels of multidimensional poverty, and those hard hit by Colombia's armed conflict. Moreover, comparison of graphs 6 and 4 also suggests that illegal groups prefer to locate in less accessible areas. However, against this general trend,

[7] Paramilitary groups are not included in this graph, as currently we do not possess reliable information about their actions.

Medellín and some east region municipalities should be put aside: though they exhibit low poverty levels, they were also the scenario of armed actions committed by different groups. Nonetheless, after accounting for population size, the impact of armed conflict is rather low in Medellín – for reasons of space, the corresponding maps are not reproduced here, because putting aside this caveat, they show the same general trends just discussed–.

Graph 7 shows another account of the armed conflict through the expulsion and reception rate of internal forced migrants. In particular, graph 7 shows the maximum municipal expulsion and reception rate realized during the period 1996-2010. It is pretty clear that the expulsion rate of refugees has been relatively low in Medellín's metro area (graph 7a). Indeed, Medellín has been mainly a receptor of forced migrants (graph 7b). The areas more heavily affected by armed conflict forced displacement in Antioquia are the far western region, the southeast region, and Urabá in the north. All this areas show a high MPI according to graph 3, with the exception of some municipalities in the southeast region.

Graph 7. ***Forced Displacement, maximum expulsion and reception rates (x 100 thousand inhabitants): 1996-2010***

a) Expulsion of forced migrants	*b) Reception of forced migrants*
	

As a means to collect further evidence about the possible relationship between poverty and the armed conflict in Antioquia, the MPI distribution is conditioned on the presence or absence of illegal groups, namely, the conditional density function of the MPI is estimated. Graph 8 shows the kernel distribution of the MPI for different multidimensional cut off values. The discontinuous lines represent the distribution of the given MPI under the absence of illegal groups. The solid line shows the opposite situation. For a cut off value of 33.3% or (3/9) it is seen that the distribution of the MPI under the presence of illegal groups is flatter and wider. The flatter and wider distribution shape gives a heavier weight to the tails. Moreover, the

mass of the distribution moves rightward compared to that of the distribution under the absence of illegal groups. So, in this particular case it is clear that the right tail gains probability mass, signaling that municipalities subject to the presence of illegal armed groups tend to exhibit a higher level of multidimensional poverty. For the remaining cut off values values shown in graph 8, it is seen that the MPI conditioned kernel distributions follow a similar pattern. That is, under the presence of illegal groups they are flatter and give a higher probability mass to the right tail.

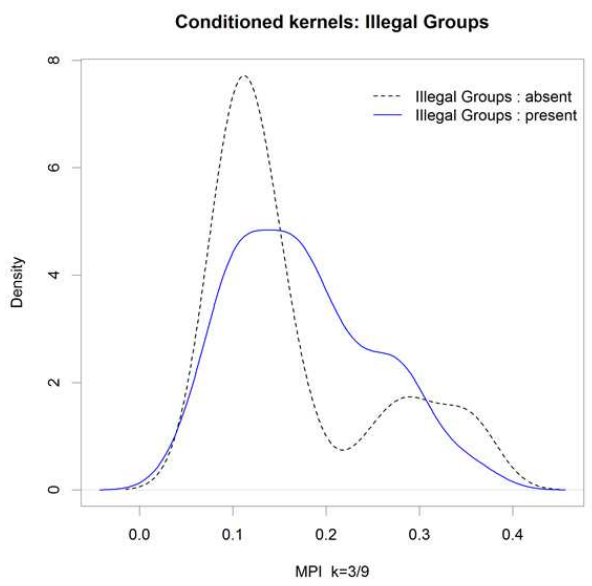
Nonetheless, there is a fact worth mentioning about the kernel densities in graph 9: under the absence of illegal armed groups, the kernel density of the MPI shows a clearly multimodal shape. In particular, the right tail showcases a local mode representing a cluster of municipalities with a very high multidimensional poverty level. Although the right tale of the distribution gains mass under the presence of illegal groups, the rightmost values of the distribution lose importance. Perhaps this is a suggestion that armed groups prefer to avoid or find unattractive those places exhibiting extreme poverty.

Graph 9 shows a breakdown of the picture showcased in the previous graph by armed group. Thus, graph 9 shows the MPI distribution conditioned on the presence of: Farc guerrilla, ELN guerrilla, AUC paramilitary counter-insurgency group, and crime. For the sake of brevity, graph 9 shows the conditioned kernel distributions for the case of the MPI resulting of applying a multidimensional cut off value of 33.3%. Also, graph 8 suggests a robustness of the results to the multidimensional cut off, so that not so much is gained by providing a more detailed picture.

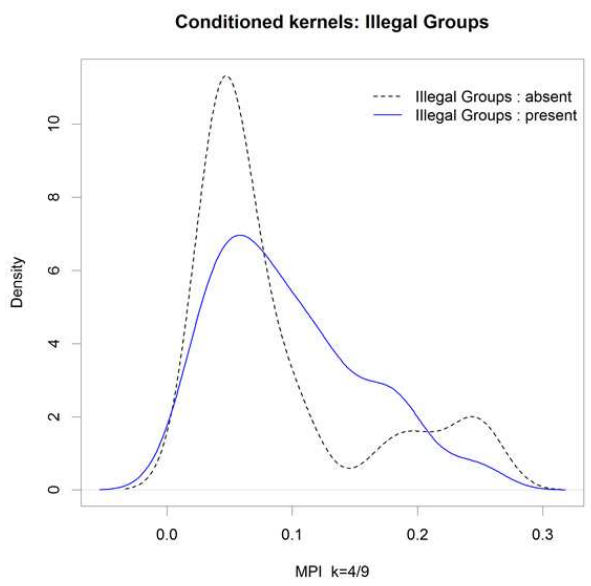
The MPI kernel distribution conditioned on the presence/absence of the FARC guerrilla (graph 9a) portrays a similar story to the already described. Under the presence of the FARC guerrilla, the kernel distribution of the MPI flattens and moves rightward, suggesting that the presence of this group tends to be associated with higher poverty levels, compared to the situation of those municipalities this group didn’t reach. The results for the AUC, paramilitary group, roughly conforms to the same patterns, although with a caveat: the right tail of the MPI distribution under the presence of the AUC is thicker and gives a higher probability mass to extreme values of the MPI, suggesting that the presence of the AUC may be related to extreme poverty.

Graph 8. ***MPI distribution conditioned on illegal groups presence***

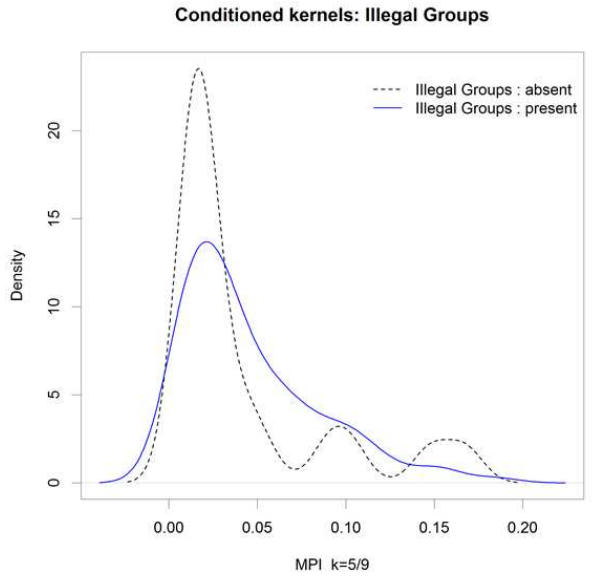
a) k=3/9



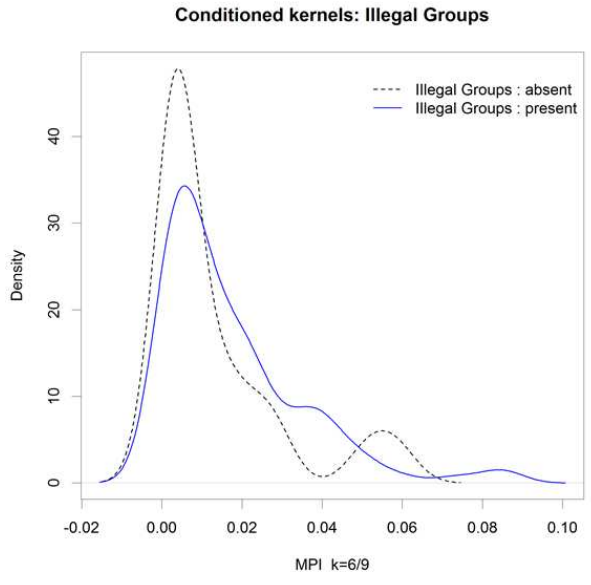
b) k=4/9



c) k=5/9

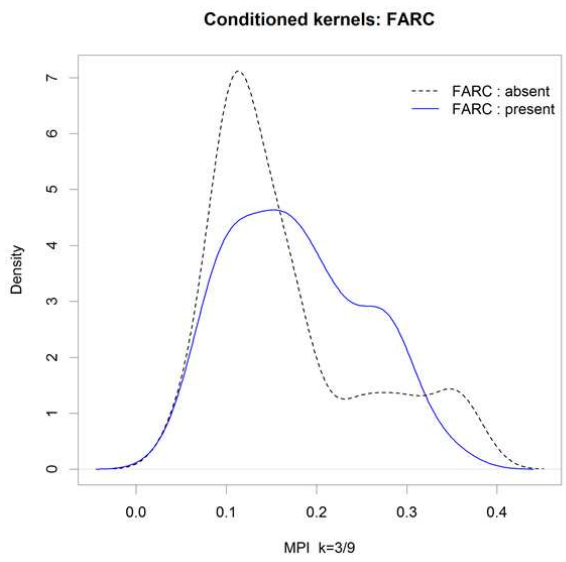


d) k=6/9

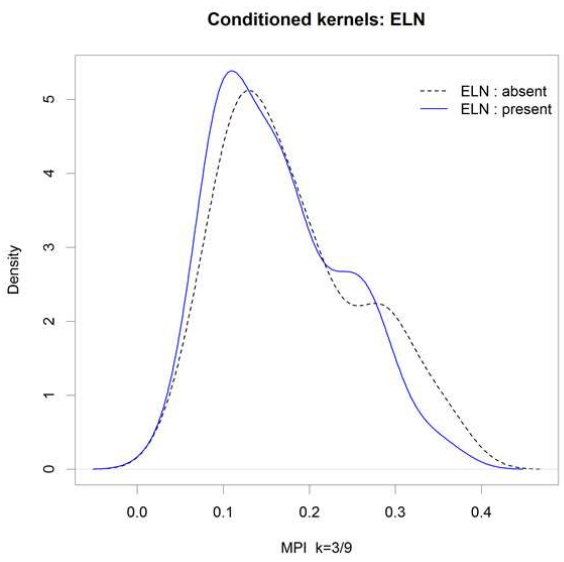


Graph 9. ***MPI distribution conditioned on Farc, ELN, AUC, and Crime presence***

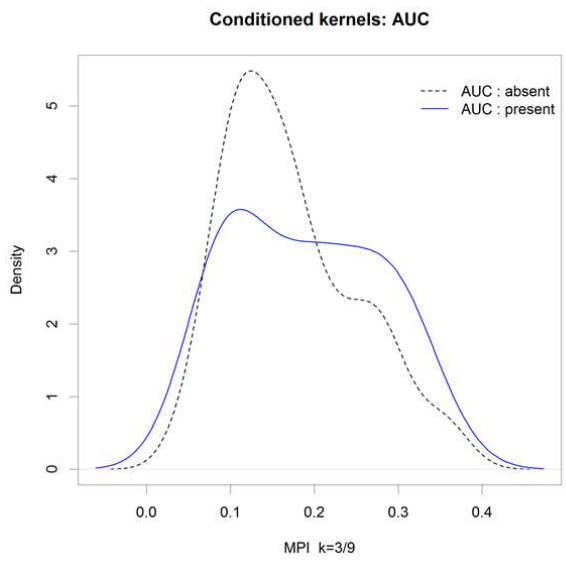
a) Farc



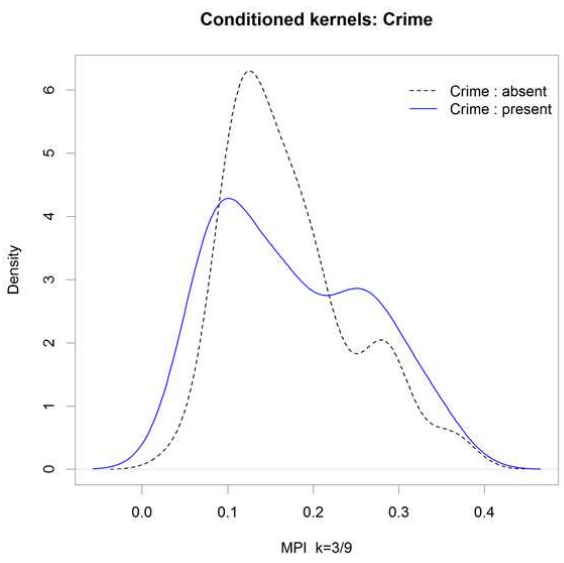
b) ELN



c) AUC



d) Crime



However, for the case of the ELN guerrilla, rather surprising results are found: the MPI kernel distribution under the presence of the ELN barely moves to the left, and the shape remains pretty stable. So, it cannot be said that the presence of the ELN guerrilla is associated with higher levels of multidimensional poverty. Finally, the MPI distribution under the presence of crime violence exhibits greater dispersion, compared to the distribution under the absence of crime violence. In this case, under the presence of crime the MPI distribution flattens, giving

more weight to both tails, meaning that crime can be associated with both low levels and high levels of multidimensional poverty.

Conclusions

The analysis so far suggests that there exists a relationship between poverty and armed conflict in Antioquia. The choropleth maps in graphs 1 to 7 suggest that the MPI and the number of armed attacks by illegal groups follow similar spatial patterns. Put another way, there is a fairly amount of overlap among areas of high multidimensional poverty and areas hard hit by the armed conflict. However, there are some exceptions that do not fit into the hypothesized direct link between these phenomena. Antioquia's east region exhibits low levels of poverty, but at the same time has been hard hit by armed actions and forced displacement. Also, the conditional distribution of the MPI shows that the presence of the ELN guerrilla appears to be unrelated with the level of poverty. Perhaps, the mining resources present in the northeast region where the ELN used to make presence, may help explain this fact, even though further consideration of this issue is required. However, in general, results seem fairly consistent and robust, as the MPI ranks show a high degree of robustness to the multidimensional cut off value, fact that is also reflected by the choropleth maps in graph 3, that showcase the spatial distribution of multidimensional poverty for alternative cut off values.

Also, the conditioned kernel distributions of the MPI portrayed in graph 8 show that the relationship among poverty and armed conflict is barely affected by the particular cut off value employed to determine multidimensional poverty. Thus, the MPI conditional kernel distribution show that, indeed, multidimensional poverty tends to be higher in those areas where any armed group has made presence. However, a more precise quantification of this relationship is required, as it is not possible to infer from the previous analysis to which extent armed conflict tends to increase the municipal level of multidimensional poverty. Indeed, the next step in this research project involves to employ confirmatory analysis tools (i.e, model fitting) to quantify this relationship. Also, further attention should be devoted to data, as this study is relating a cross-sectional measure of poverty with count data on armed attacks and forced displacement for the period 1996-2010. At the very least, having an additional cross-sectional measure of multidimensional poverty for a previous year, should help exploit the temporal dimension of the data set employed to proxy armed conflict in Antioquia, possibly providing insights about the time evolution of multidimensional poverty as a consequence of armed conflict.

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