

Labor informality and monetary and multidimensional poverty in Bogotá and the Metropolitan Area

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Abstract

Labor informality, associated with low income, increases a household's likelihood of being poor and experiencing precarious living conditions. The aim of this article is to study the relationship between labor informality and both monetary and multidimensional poverty in Bogotá, the capital of Colombia, and its Metropolitan Area (MA). Based on the Multipurpose Survey, the article estimates levels of labor informality and pay gaps, as well as indicators of monetary and multidimensional poverty. This article also simulated various scenarios to identify the levels of poverty reduction as a result of a potential formalization and closing of gaps by segmentation, highlighting the heterogeneities between areas of Bogotá and its Metropolitan Area (MA).

Keywords: labor informality; quality of life; segmentation; multidimensional poverty; monetary poverty.

1. INTRODUCTION

Labor informality is a manifestation of structural problems that limit the improvement of living conditions in a society. Faced with limited labor opportunities, millions of workers enter low-productivity and low-paying occupations for a daily income subject to wide-ranging contingencies, amid unstable, precarious conditions, and often within personal or disempowering relationships. This leads to low-income occupations and a greater likelihood of falling below the monetary poverty line, in addition to barriers to reaching minimum standards in different aspects of well-being, consequently resulting in a higher incidence of multidimensional poverty.

Bogotá, the capital of Colombia, and its Metropolitan Area (MA) is home to the 20% of the country's population who concentrate 32% of the national income; its informal employment rate is 41%, while, according to official figures and methodologies, in 2018 the incidence of monetary poverty was 12.4% and multidimensional poverty was 4.3% (National Administrative Department of Statistics [DANE], 2019). This data indicates higher levels of well-being and better living conditions compared to the national averages, where the informality rate of the 13 main cities is 46.8%, and urban multidimensional poverty reached 13.8% (DANE, 2019). However, these seemingly encouraging figures hide large disparities and severe vulnerabilities among Bogotá residents: some localities of the city and areas of the MA live in conditions below the national average. Against this backdrop, the present article seeks to explore labor informality and monetary and multidimensional poverty in the city of Bogotá and its MA by disaggregating by localities and zones.

The article consists of five sections, in addition to this introduction. The first section defines Bogotá's MA and categorizes the city's localities by zones. Next, the second section estimates informality rates and the associated wage gaps, while the third section analyzes poverty from the monetary and multidimensional perspectives. The fourth section then examines the link between informality and both monetary and multidimensional poverty in Bogotá and its MA. Finally, the last section offers some conclusions.

2. BOGOTÁ AND ITS MA

One important aspect of human welfare in Bogotá is the wide level of spatial segregation and geographic inequality in the quality of life (Torres *et al.*, 2013). Specifically, households in the periphery have higher levels of poverty and their members have greater employment problems, such as unemployment and informality. In light of this, this article highlights the need to recognize the inequalities between various localities and areas of Bogotá, which are often left undetected in the aggregate figures of the city, thereby providing a more thorough diagnosis of the population's welfare.

The notion of a metropolitan area or region refers to an economic, social, and political fabric in which administrative decision-making, planning, and even taxation can be closely articulated. An MA is a continuous geographic area with a large urban agglomeration with characteristics such as a diversified labor market, strong relationships of mutual dependence, and a prominent or even dominant position (Vinueza, 1975).

There is currently no MA defined for Bogotá. The recent amendments to Article 325 of the Political Constitution of the Republic of Colombia created the possibility of politically and administratively formalizing the metropolitan region of Bogotá-Cundinamarca. However, during the last two decades the city

has expanded and urbanized beyond its borders and an MA has begun to form which incorporates various municipalities from the department of Cundinamarca.

This article proposes a "Bogotá MA" consisting of municipalities closely situated to, connected to, and interdependent with the economic and social dynamics of the country's capital. Following on from previous studies, a further objective is to identify the nature of the MA's economic links with Bogotá, based specifically on the magnitude of the exchange of labor force, understood as the displacement of workers who live in municipalities of Cundinamarca and work in Bogotá, and vice versa.

Using data from the 2017 Multipurpose Survey (*Encuesta Multipropósito*, EM17), workers' commuting habits were analyzed by studying commutes between Bogotá and the 37 municipalities of Cundinamarca included in the survey. The findings were then used to determine the municipalities to include within MA. The municipalities selected are, in the first instance, those deeply integrated with the city: Cajicá, Chía, Cota, La Calera, Mosquera, Sibaté, Soacha, Tenjo, and Tocancipá. In the second instance are those municipalities with lower levels of integration but which are considerably affected by the economic and social dynamics of the country's capital or any of the municipalities highly integrated with it; these municipalities of medium integration are Bojacá, Funza, Gachancipá, Madrid, Sopó, Tabio, and Zipaquirá.

Based on this taxonomy, this article proposes a Bogotá MA consisting of four regions, each integrated by geographically co-adjacent municipalities, and with relatively similar socioeconomic characteristics. These regions are as follows: Sur Occidental (SUR OCC) (Sibaté and Soacha); Sabana Occidente (S. OCCIDENTE) (Bojacá, Funza, Madrid, and Mosquera); Norte Limítrofe (Cajicá, Chía, Cota, La Calera, and Sopó); and Norte Periferia (Gachancipá, Tabio, Tenjo, Tocancipá, and Zipaquirá).

As can be seen in Table 1, the region with the highest population density is SUR OCC, which is characterized by low educational levels, low socioeconomic stratification,¹ and lower income levels. In contrast, the Norte límite region has high educational levels and a greater share of high strata households, figures higher than those of Bogotá as a whole.

Table 1. Socioeconomic characteristics of the municipalities of the Bogotá Metropolitan Area

| Grouped zones | Population | Total Metropolitan Area % | Professionals % | EHousehold socioeconomic stratum (%) | | | |
|------------------|------------------|---------------------------|-----------------|--------------------------------------|----------------|--------------|-----|
| | | | | Low (0, 1 y 2) | Medium (3 y 4) | High (5 y 6) | |
| Sur Occidental | Sibaté | 23 579 | 1.8 | 12.2 | 87.1 | 12.8 | 0.1 |
| | Soacha | 640 143 | 47.6 | 8.7 | 55.6 | 44.3 | 0.1 |
| Sabana Occidente | Bojacá | 7 650 | 0.6 | 7.9 | 94.0 | 5.9 | 0.1 |
| | Funza | 88 598 | 6.6 | 16.2 | 57.4 | 42.6 | 0.1 |
| | Madrid | 100 746 | 7.5 | 14.9 | 62.7 | 37.2 | 0.1 |
| | Mosquera | 128 893 | 9.6 | 17.0 | 51.2 | 48.7 | 0.1 |
| Norte límite | Cajicá | 53 611 | 4.0 | 27.5 | 52.2 | 45.4 | 2.4 |
| | Chía | 104 527 | 7.8 | 31.2 | 52.9 | 38.7 | 8.4 |
| | Cota | 20 215 | 1.5 | 23.7 | 75.0 | 23.9 | 1.0 |
| | La Calera | 13 342 | 1.0 | 25.4 | 74.5 | 25.1 | 0.4 |
| | Sopó | 17 213 | 1.3 | 17.9 | 43.4 | 56.5 | 0.1 |
| Norte periferia | Gachancipá | 11 174 | 0.8 | 9.6 | 94.2 | 5.8 | 0.0 |
| | Tabio | 6 301 | 0.5 | 23.3 | 41.4 | 58.1 | 0.5 |
| | Tenjo | 8 560 | 0.6 | 21.6 | 65.0 | 34.9 | 0.1 |
| | Tocancipá | 15 281 | 1.1 | 13.3 | 68.1 | 31.9 | 0.1 |
| | Zipaquirá | 106 083 | 7.9 | 19.1 | 65.7 | 34.2 | 0.1 |
| Total | 1 345 916 | 100.0 | 14.6 | 57.8 | 41.3 | 0.8 | |

Source: Compiled by the authors based on the National Population and Housing Census (Censo Nacional de Población y Vivienda, CNPV) 2018 (DANE, 2021).

Following this same taxonomy, the same exercise was repeated for the localities of Bogotá, based on similarities in terms of population composition and socioeconomic stratification (see Table 2). This yielded the following categories: Usme and Sumapaz (US-SUM); Tunjuelito and Rafael Uribe (TUN-RU); Puente Aranda, Antonio Nariño, and Los Mártires (PA-AN-MAR); San Cristóbal, Santa Fé, and La Candelaria (CRIS-SFE-CAN); Engativá and Fontibón (ENG-FON); and Barrios Unidos and Teusaquillo (BU-TEU) were grouped together. The 20 localities of the city were grouped into 12 zones, and the 16 municipal capitals of the MA into four zones (all subsequent estimates in this article will be made using this categorization). The educational level of the population in each zone is clearly related to stratification. The zones with the highest share of high strata (and the lowest share of low strata) have the highest educational levels.

Table 2. Socioeconomic characteristics of localities in Bogotá

| Localities | Population | Bogotá total % | Professionals % | Household socioeconomic stratum (%) | | | |
|--|-----------------|----------------|-----------------|-------------------------------------|----------------|--------------|------|
| | | | | Low (0, 1 y 2) | Medium (3 y 4) | High (5 y 6) | |
| Usme - Sumapaz | Usme | 351 836 | 4.8 | 6.8 | 99.1 | 0.8 | 0.0 |
| | Sumapaz | 424 | 0.0 | 15.9 | 86.8 | 13.2 | 0.0 |
| Ciudad Bolívar | | 590 967 | 8.1 | 8.7 | 92.1 | 7.8 | 0.0 |
| Tunjuelito - Rafael Uribe Uribe | Tunjuelito | 167 385 | 2.3 | 16.0 | 63.7 | 36.3 | 0.1 |
| | Rafael Uribe U. | 349 843 | 4.8 | 13.1 | 57.4 | 42.6 | 0.1 |
| Bosa | | 686 263 | 9.4 | 8.9 | 97.4 | 2.5 | 0.0 |
| Kennedy | | 1 012 329 | 13.8 | 20.8 | 54.7 | 45.2 | 0.1 |
| Los Mártires, Antonio Nariño and Puente Aranda | Los Mártires | 72 727 | 1.0 | 24.0 | 12.6 | 87.3 | 0.1 |
| | Antonio Nariño | 78 203 | 1.1 | 25.9 | 8.1 | 91.9 | 0.1 |
| | Puente Aranda | 234 758 | 3.2 | 26.4 | 2.3 | 97.6 | 0.1 |
| Santa Fé, San Cristóbal, and La Candelaria | Santa Fé | 105 223 | 1.4 | 21.9 | 71.5 | 28.1 | 0.4 |
| | San Cristóbal | 377 909 | 5.2 | 11.1 | 87.2 | 12.8 | 0.1 |
| | La Candelaria | 16 591 | 0.2 | 30.1 | 77.2 | 22.4 | 0.4 |
| Fontibón - Engativá | Fontibón | 363 879 | 5.0 | 31.8 | 24.4 | 74.2 | 1.4 |
| | Engativá | 784 016 | 10.7 | 27.6 | 27.5 | 72.4 | 0.1 |
| Barrios Unidos-Teusaquillo | Barrios Unidos | 131 611 | 1.8 | 38.6 | 3.4 | 94.2 | 2.4 |
| | Teusaquillo | 145 367 | 2.0 | 58.6 | 2.8 | 90.8 | 6.4 |
| Chapinero | | 162 030 | 2.2 | 58.0 | 23.1 | 31.9 | 45.0 |
| Usaquén | | 536 140 | 7.3 | 46.7 | 14.7 | 57.7 | 27.5 |
| Suba | | 1 145 963 | 15.7 | 32.0 | 41.2 | 47.2 | 11.6 |
| Bogotá D.C. | | 7 313 464 | 100.0 | 24.1 | 51.6 | 43.3 | 5.1 |

Source: Compiled by the authors based on CNPV 2018 (DANE, 2021).

3. LEVELS OF LABOR INFORMALITY AND PAY GAPS IN BOGOTÁ AND ITS MA

Notion of labor informality

Labor informality is an intrinsic problem of labor markets in developing countries (Fields, 2011). Specifically, in Colombia, there is a lack of labor demand combined with an excess of labor force, the consequence of rural-urban migration, displacement, and demographic growth. The informality has resulted in small businesses, employment conditions which violate legislation, scavenging activities, and self-employment with very low levels of productivity becoming short-term solutions for generating sufficient income to subsist (Sanchez, 2020).

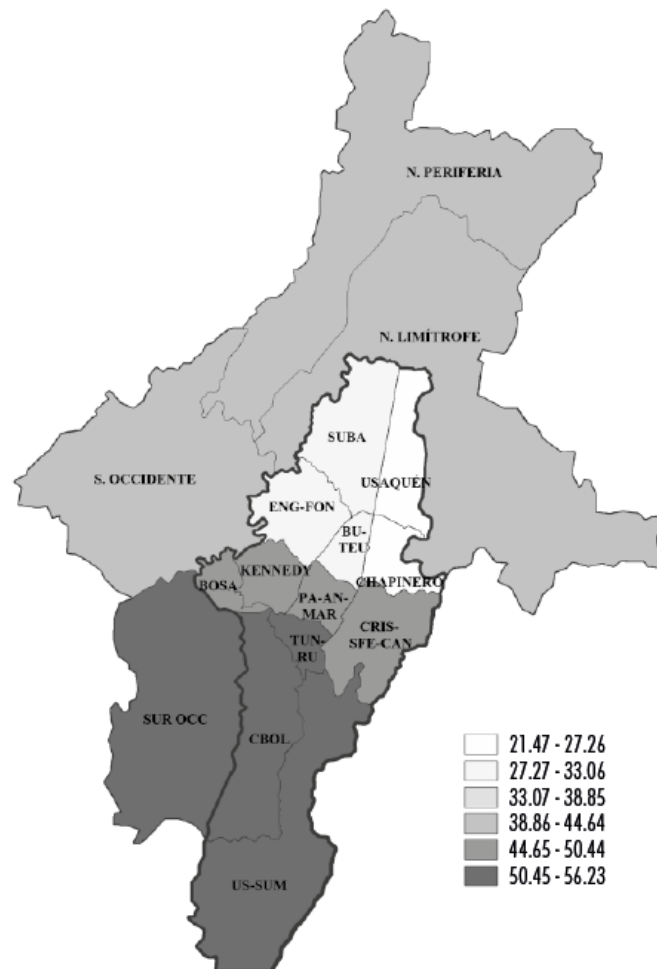
There are several approaches for measuring labor informality, using various units of measurement and often arbitrary criteria. This article adopts the approach proposed by the International Conference of Labor Statisticians (International Labor Organization [OIT in Spanish], 2003), which distinguishes between “Informal Employment” and “Employment in the Informal Sector.” The former relates to the type of employment relationship and compliance with labor regulations (institutionalist perspective), while the latter concerns economic activities and their accumulation capacity (structuralist perspective). Estimates were made according to each perspective. However, for reasons of space and given the number of estimates to be presented for each zone of Bogotá and its MA, all findings and calculations presented relate to Informal Employment, consisting of the following:

- Salaried employees of private and government companies without benefit coverage as a worker (without contribution to the social security pension system).
- Non-professional self-employed workers.
- Employers of small enterprises (five or fewer employees), non-professional.
- Unpaid workers in families or businesses.
- Domestic service workers, day laborers, and agricultural laborers.

Levels of labor informality

In Bogotá and its surrounding area, 41.1% of employment is informal. Figure 1 shows informality levels by zone; it should be noted that this figure illustrates the percentage of informal employment relative to the total number of workers living in each zone, given that many workers commonly do not work in the same locality in which they live.

Figure 1. Informality rates by zone of Bogotá and its MA



Source: Compiled by the authors based on EM17 (DANE, 2020).

Gaps due to informality: methodology and findings

Labor informality is not only a problem linked to the vulnerability in employment continuity and security and the lack of protection resulting from precariousness in labor relations; it is also a situation that constricts living conditions due to the lower levels of income derived from these activities.

Table 3 shows the informality rate and the observed and estimated gaps in the average hourly labor income of formal and informal workers. In general terms, what is observed in income levels and their inequality is verified: the areas with the highest income and heterogeneity of strata present the highest gaps in remuneration observed due to informality.

Table 3. Incidence of and gaps in informality in areas of Bogotá and MA

| Localities & grouped zones | Rate of informality | Gaps in hourly remunerations due to informality* | |
|----------------------------|---------------------|--|----------------------------------|
| | | Observed | Estimated average individual gap |
| US-SUM | 56.2 | -23.1 | -22.1 |
| CBOL | 53.9 | -35.4 | -25.5 |
| TUN-RU | 51.8 | -30.6 | -20.4 |
| BOSA | 50.3 | -19.7 | -20.5 |
| KENNEDY | 44.9 | -48.0 | -20.0 |
| PA-AN-MAR | 46.7 | -40.5 | -18.4 |
| CRIS-SFE-CAN | 49.6 | -40.9 | -26.3 |
| ENG-FON | 32.3 | -46.0 | -20.2 |
| BU-TEU | 28.4 | -47.8 | -16.8 |
| CHAPINERO | 21.5 | -58.2 | -14.7 |
| USAQUÉN | 23.2 | -53.4 | -10.9 |
| SUBA | 32.8 | -49.5 | -17.0 |
| SUR OCC | 52.0 | -36.3 | -29.4 |
| S. OCCIDENTE | 41.0 | -26.1 | -25.0 |
| N. LÍMITROFE | 40.1 | -50.6 | -25.9 |
| N. PERIFERIA | 40.6 | -27.0 | -22.5 |
| Bogotá D.C. & AM | 41.1 | -51.4 | -21.6 |

Notes: *average percentage difference relative to the average formal labor income.

Source: Compiled by the authors based on EM17 (DANE, 2020).

This article estimates the individual gaps as proposed by Jenkins (1994), as well as those estimated for some Latin American countries in the studies by Beccaria and Groisman (2008) and Maurizio (2015). Mincer (1974) equations corrected for selection bias are estimated using the two-stage methodology of Heckman (1979). In this case, these are estimated separately for formal and informal employment, and therefore the selection correction must factor in that each estimation omits either formal or informal employment, as well as the non-employed who could potentially be so. Consequently, in the first stage of the Heckman approach, a multinomial logit model is estimated as in [1], where the dependent variable is the probability that the individual is formally employed, informally employed, or not employed (Pradhan and Van Soest, 1995). The vector of covariates included (s_i) in this estimation are age, age squared, categorical variables of educational levels, sex, categorical variables of position in the household, existence of children under 5 years old, and existence of children and young people between 5 and 15 years old; in other words, variables are included that affect the probability of belonging to any of the three activity conditions.

$$Pr(y_{ji} = 1 | x_i) = \frac{\exp(s_i' \gamma_j)}{\sum_{k=1}^3 \exp(s_i' \gamma_k)} \quad (1)$$

In the second stage, the inverse of the Mills ratio is included as a new dependent variable in the income equation, estimated, following Lee (1983), from the cumulative density and distribution function, calculated from the results of [1]. Thus, the second stage is the estimation of the income equation [2]:

$$\ln w_{i,j} = x'_{i,j} \beta_j + \hat{\lambda}_{i,j} \psi_j + e_{i,j} \quad (2)$$

In this case, the dependent variable is the logarithm of hourly labor income and the independent variables are the same as those included in [1], plus seniority in the occupation and $\hat{\lambda}_i$, the Mills quotient. Once the Mincerian equations for formal and informal workers have been estimated, the estimated income of each group is calculated, as is the simulated income of informal workers as if they were paid as formal workers; thus, the individual gap that explains the magnitude of the potential penalization of the worker for being informal is estimated. Equation [3] illustrates the simulated labor income for an informal worker, considering both the vector of remunerations of the formal workers and their selection process.

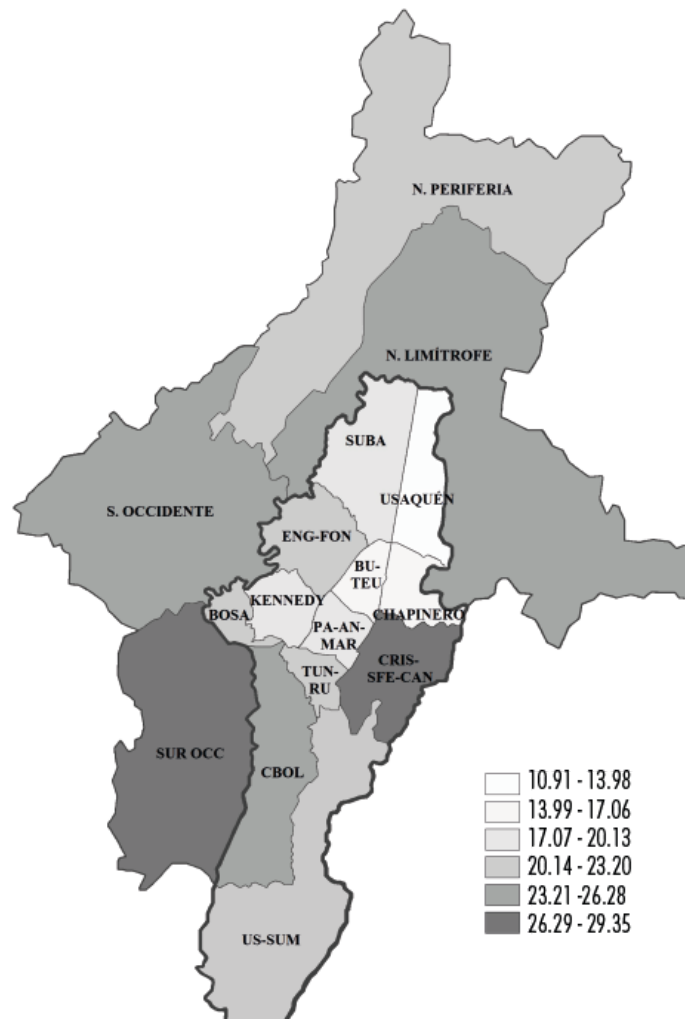
$$\ln(\hat{r}_{i,l}) = x'_{i,l}\hat{\beta}_F + \tilde{\lambda}_{i,l}\hat{\psi}_F \quad (3)$$

The individual pay gap [4] is the difference between the labor income of informal workers and the income they would have if they were paid as formal workers, as a proportion of the latter.

$$b_{i,l} = \frac{\hat{w}_{i,l} - \hat{r}_{i,l}}{\hat{r}_{i,l}} \quad (4)$$

Figure 2 and Table 3 illustrate the levels of pay gaps associated with informality by zone in and around Bogotá. The findings indicate that the highest observed differences in remuneration between formal and informal workers are found in the localities with the lowest gaps, Usaquén and Chapinero. This finding can effectively be explained by the phenomenon of labor segmentation due to informality. This, in turn, is explained by the fact that in these areas informal workers have pro-productive characteristics negatively associated with high salaries, limited education and experience, and household characteristics that affect their productivity (greater number of children in the household, higher share than other members).

Figure 2. Pay gaps by informality: zones of Bogotá and its Metropolitan Area

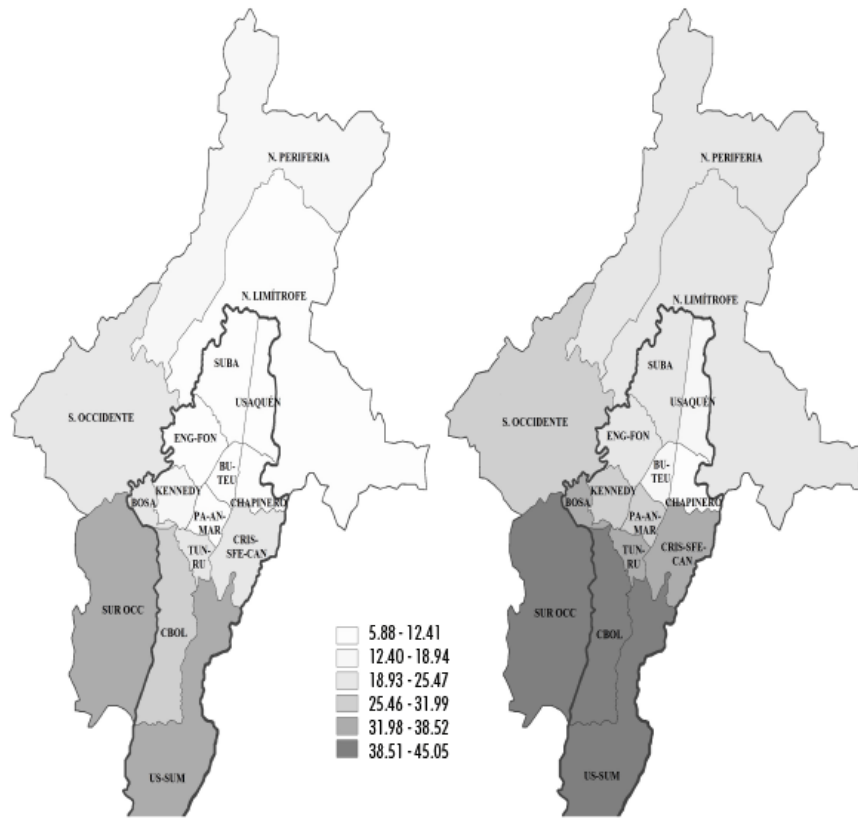


Source: Compiled by the authors based on EM17 (DANE, 2020).

4. LIVING CONDITIONS AND MONETARY AND MULTIDIMENSIONAL POVERTY

The levels of poverty and low living standards are concentrated in certain localities of Bogotá and its MA. Nevertheless, poverty exists in all areas studied. Even in Chapinero, which has the highest income levels, 7.4% of the population is poor (in monetary terms) and 9.5% is multidimensionally poor. Figure 3 shows that poverty is much higher in localities in the south of the city and in the Sabana Sur and Sabana Occidental of the MA. The 2017 monetary and multidimensional poverty indicators for Bogotá and the areas considered within the MA are presented in detail below.

Figure 3. Monetary and multidimensional poverty: zones of Bogotá and its MA



Source: Compiled by the authors based on EM17 (DANE, 2020).

Monetary poverty

Monetary poverty refers to the low income of the population, which prevents them from accessing a basic set of food and non-food goods and services (ECLAC, 2019). Although this perspective is an important point of reference, it should be complemented by the multidimensional perspective analyzed in the following section, which includes other essential aspects of well-being.

The source of information for this research (the EM17) allows us to calculate, with a broad set of questions, the levels of labor and non-labor income of households. The Per Capita Household Income (PCHI) is calculated for all households based on this figure. The PCHI is then compared with the October 2017 Bogotá poverty line (270,782 pesos), given that the EM17 was conducted between September and November 2017.

To measure monetary poverty, the Foster, Greer, and Thorbecke (FGT) (1984) indicators were used, which are traditionally used in unidimensional approaches to poverty. Equation [5] shows this family of indicators. The indicator is the sum of the gaps of the PCHI (x_i) relative to the poverty line (z_i), for the case of poor individuals or households ($x_i < z_i$) relative to the total population N . The FGT indicator depends on the coefficient α , which measures the levels of poverty aversion, when it is 0 all gaps equal 1. The indicator, meanwhile, is the proportion of poor, when it is 1, it is the average gap relative to the poverty threshold (line). If this is 2, it is an indicator known as poverty severity that weights each gap by itself.

$$FGT(\alpha) = \frac{1}{N} \sum_{i=1}^N k_i \left(1 - \frac{x_i}{z_i}\right)^\alpha, \quad k_i = 1 \text{ si } x_i < z_i, \quad (5)$$

$$k_i = 0 \text{ si } x_i \geq z_i, \quad \alpha \geq 0$$

Table 4 shows the estimated FGT indicators for each zone of Bogotá and its MA. It can be seen that US-SUM is the area of Bogotá with the highest poverty levels considering all indicators, as more than a third of its inhabitants live with less income than necessary to access a basic set of goods and services; SUR OCC has a similar level, although the latter presents lower levels of poverty gap and severity, which confirms US-SUM as the locality with the highest chronicity of poverty, with figures that exceed even those of the national average (DANE, 2019).

Table 4. Monetary poverty indicators in Bogotá and the MA

| <i>Localities and grouped zones</i> | <i>Incidence</i> | <i>Gap</i> | <i>Severity</i> |
|-------------------------------------|------------------|------------|-----------------|
| USSUM | 34.8 | 16.1 | 11.0 |
| CBOL | 27.6 | 11.5 | 7.3 |
| TUN-RU | 20.5 | 9.3 | 6.7 |
| BOSA | 22.8 | 8.7 | 5.4 |
| KENNEDY | 15.9 | 6.4 | 4.3 |
| PA-AN-MAR | 10.6 | 5.0 | 3.7 |
| CRIS-SFE-CAN | 22.3 | 9.5 | 6.5 |
| ENG-FON | 9.5 | 4.6 | 3.5 |
| BU-TEU | 5.9 | 3.3 | 2.7 |
| CHAPINERO | 7.4 | 4.8 | 4.2 |
| USAQUÉN | 8.2 | 4.3 | 3.4 |
| SUBA | 10.9 | 4.7 | 3.3 |
| SUR OCC | 33.3 | 12.8 | 7.4 |
| S. OCCIDENTE | 20.5 | 7.1 | 4.3 |
| N. LÍMITROFE | 12.1 | 4.8 | 3.2 |
| N. PERIFERIA | 18.6 | 6.6 | 4.1 |
| Bogotá D.C. & AM | 15.2 | 5.0 | 2.6 |

Source: Compiled by the authors based on EM17 (DANE, 2020).

In several areas of Bogotá, more than one-fifth of the population is poor (CBOL, BOSA, and CRIS-SFE-CAN), as well as the S. OCCIDENTE MA. These areas are also where the highest proportion of informal workers live and where the informality gap is greatest. In light of this, as presented in the following section, reducing informality would have a notable impact on improving the income levels of households living in poverty.

Multidimensional poverty

The most widely used methodology for measuring multidimensional poverty is the approach devised by Alkire and Foster (2011); however, there are other methodological proposals, such as that of Bourguignon and Chakravarty (2003), which use the union criterion to define poverty, i.e., the individual or household can be classified as being poor if it is deprived in at least one dimension. Likewise, this last proposal incorporates various degrees of substitution between dimensions, a parameter that modifies the sensitivity of the indicator to higher deficits in certain dimensions; the lower the substitution, the greater the impact of dimensions with greater levels of deprivation.

Bourguignon and Chakravarty's [BYCH] (2003) approach utilizes the FGT indicators [5], adapting them to the multidimensional approach [6], thus allowing the calculation of adjusted incidence indicators ($\alpha = 0$), adjusted gap ($\alpha = 1$), and adjusted depth ($\alpha = 2$), adding different degrees of substitution between dimensions ($\theta=1$), perfect substitution; $\theta = 2$, moderate substitution; and $\theta = 5$, low level of substitution among dimensions. Thus, the multidimensional poverty indicator is given by:

$$ByCH_{\alpha}^{\theta} = \frac{1}{N} \sum_{i=1}^N \left[\sum_{j=1}^J w_j (g_{ij}(k))^{\theta} \right]^{\frac{\alpha}{\theta}} ; \alpha \geq 0, \theta \geq 1 \quad (6)$$

This article factors in several variables, dimensions, and thresholds, adjusted to the specific circumstances. Table 5 details how these criteria are operationalized, following on from Sánchez *et al.* (2020) which proposes an alternative measurement of multidimensional poverty for Colombia. Five dimensions of well-being (housing, education, work, health, and perceptions) were considered, consisting of 29 variables. Using this estimate, each qualitative variable of housing, work, health, and perceptions is classified with achievement (1) or deficit. The dimensional threshold, meanwhile, indicates the minimum number of variables that a household must attain achievement to not be considered deprived in that dimension. Understood in this light, the gaps are between dimensions rather than variables, meaning they quantify the number of variables for which a household has a deficit (or the distance from the threshold, similar way to the monetary measurement).

Table 5. Proposal for defining multidimensional poverty: dimensions, variables, and thresholds

Table 2. Proposal for defining multidimensional poverty: dimensions, variables, and thresholds

| <i>Dimension</i> | <i>Num-ber of variables</i> | <i>Dimensional threshold</i> | <i>Variables</i> | <i>Achieved/attained</i> |
|------------------|-----------------------------|---|---|--|
| Housing | 8 | No deprivation with achievement in five or more variables | Water connection | The household has a continuous supply of piped water. |
| | | | Sewage system | The house has a sewage system. |
| | | | Floors | The predominant flooring material is not dirt or sand. |
| | | | Walls | The predominant wall material is cinder block, brick, stone, polished wood, rammed earth, adobe, or prefabricated material. |
| | | | Overcrowding | In the household there are less than three people per room. |
| | | | Electricity | The household is connected to electricity. |
| | | | Access to water | The water used to prepare food in the household is obtained from the public water connection, community water connection, tank car, or bottled or bagged water. |
| | | | Cooking fuel | The main energy or fuel used to prepare food is electricity, natural gas connected to the public grid, petroleum, gasoline, kerosene, alcohol, cooking oil, or propane gas/LPG (in cylinders or pipettes). |
| Education | 1 | No deprivation if the head of household and their spouse have an average of five years or more of education | Average years of education for head of household and their spouse | |
| Work | 7 | No deprivation with achievement in four or more variables | Informal employment | No household members are employed in informal employment |
| | | | Labor income | All employed persons in the household earn an income that exceeds the equivalent of the minimum hourly wage. Non-wage-earners are excluded. |
| | | | Intensity of work | No household member works more than 48 hours per week; works between 40 and 48 hours; or works less than 40 and does not want to work more hours. |
| | | | Unemployment | No household members are unemployed. |
| | | | Commuting time to work | All employed household members commute for less than 90 minutes to arrive at work. |
| | | | Economic dependency | There are less than five members per wage earner per household. |
| | | | Treatment at work | No employed person in the household has had an accident at work, received discriminatory treatment or comments about his or her private life, or had a threat of dismissal during the last year. |
| Health | 7 | No deprivation with achievement in four or more variables | Affiliation | All members of household are affiliated to one of the following Health Promotion Entity (HPE) or Subsidized Regime Administrator (SRA). |
| | | | Access | When health problems arise, members of the household go to a health care provider, general practitioner, specialist, dentist, therapist, or independent health therapist (privately). |
| | | | Health status | Household members' overall health condition is assessed as good or very good. |
| | | | Environment | All household members feel that the place where they live is not harmed by waste in the streets or air pollution. |
| | | | Regular attendance at System | All household members attend a general medical consultation at least once a year. |
| | | | Physical activity | In the last month all household members practiced sport or some physical activity at least once, with health not an impediment to doing so. |
| | | | Diet | In the last month, no member of the household missed a meal for financial reasons. |
| Perceptions | 6 | No deprivation with achievement in three or more variables | Poverty | If the head of household or spouse do not consider themselves poor. |
| | | | Sufficient income | Household income is sufficient to cover minimum expenses, according |

to the perception of the head of household or their spouse.

| | |
|------------------------------|--|
| Safety | The head of household or their spouse feels safe in the neighborhood, town, or village where they live. |
| Living conditions | The head of household or their spouse generally considers their current living conditions to be good or very good. |
| Long-term progress | The head of household or their spouse believes that the household's current economic condition is equal to or better than that of the home where they grew up. |
| Progress during recent years | The head of household or their spouse believes that the household's current economic condition is equal to or better than five years ago. |

Source: Compiled by the authors based on EM17 (DANE, 2020).

The housing dimension consists of eight variables that seek to evaluate housing conditions and access to household public services. Education is measured using a continuous variable, which aims to capture the educational level of the responsible members of the household, based on the education level of the head of household and their spouse.

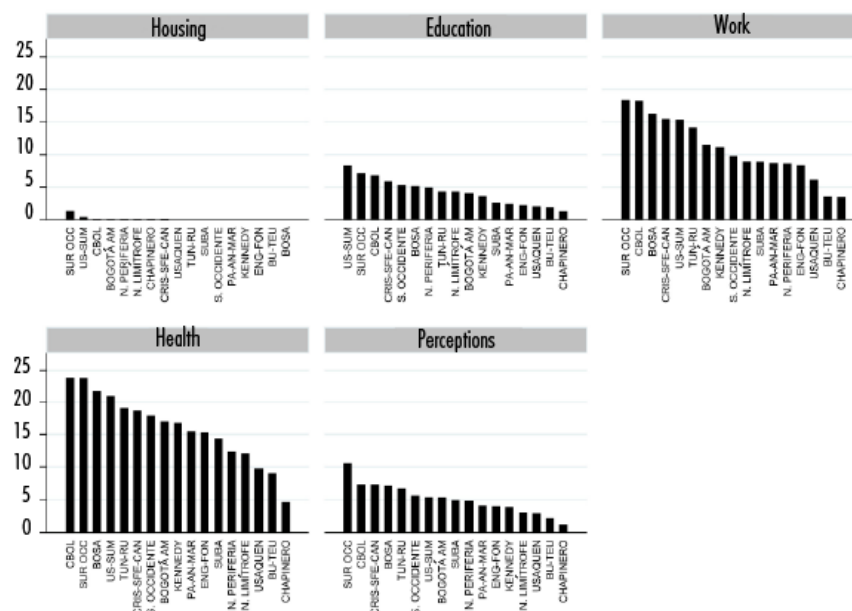
The work dimension consists of seven variables, two of which are directly related to labor informality, namely "informal employment" and "labor income," and others that seek to evaluate different labor problems such as unemployment, economic dependence, and well-being at work. The health dimension was constructed by dichotomizing seven variables, including affiliation to the health system, regular attendance, physical activity, and diet.

Finally, perceptions consist of six variables designed to evaluate the internal experience of how individuals understand their material conditions; despite being a subjectively-evaluated dimension, it is important to understand how the heads of household or their spouses perceive their material living conditions regarding security, poverty, income sufficiency, and evaluations in the face of changing living standards.

As Table 5 illustrates, the thresholds refer to the minimum level of achievement for not being poor in each dimension (as in monetary poverty); in turn, given that a household is poor if it is deprived in at least one dimension (union criterion), those who are identified as deprived in one dimension have high degrees of deprivation, which is why the thresholds are relatively low.

Figure 4 shows the incidence of unidimensional poverty, that is, the percentage of households that are deprived according to each dimension. Results indicate that the housing and education dimensions present the lowest incidence percentages; for housing, most zones do not exceed 1% deprivation, with the exception of SUR OCC MA, while for education, the average household deprivation is 5%.

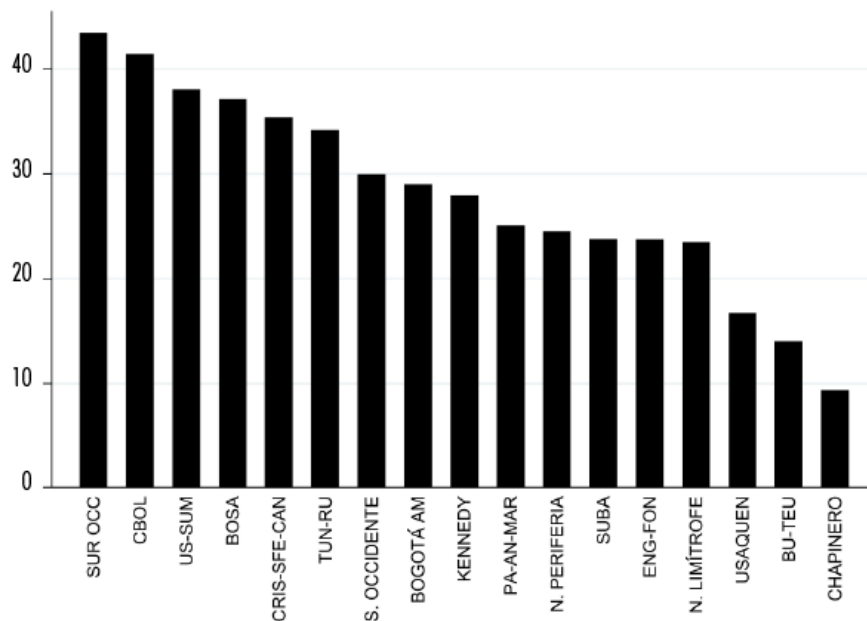
Figure 4. Deprivation by dimension and area of Bogotá and MA



Source: Compiled by the authors based on EM17 (DANE, 2020).

From the multidimensional perspective, one aspect of Figure 5 which stands out is that the SUR OCC zone has the highest poverty incidence rates relative to the other zones; meanwhile, the Bogotá CBOL, US-SUM, BOSA, CRIS-SFE-CAN, and TUN-RU zones present rates of over 30%.

Figure 5. Incidence of multidimensional poverty by area of Bogotá and MA



Source: Compiled by the authors based on EM17 (DANE, 2020).

Regarding the gap and severity of multidimensional poverty, it should be noted that, in general, Bogotá and the MA do not exhibit particularly high percentages of gap and severity (compared to the other regions of Colombia). It can therefore be hypothesized that people living in multidimensional poverty may be on the path towards breaking out of this situation. Table 6 indicates that the SOUTH OCC zone of the MA and the Bogotá zones of CBOL, BOSA, and US-SUM show high gap and severity rates when considering low levels of substitution; thus, poor households in these domains are farther away from leaving this condition in comparison to the rest of the domains.

Table 6. Gap and severity of multidimensional poverty in Bogotá and MA

| <i>Localities and grouped zones</i> | <i>Gap ($\alpha = 1$)</i> | | | <i>Severity ($\alpha = 2$)</i> | | |
|-------------------------------------|--------------------------------------|--------------|--------------|---|--------------|--------------|
| | <i>Substitution level</i> | | | <i>Substitution level</i> | | |
| | $\theta = 1$ | $\theta = 2$ | $\theta = 5$ | $\theta = 1$ | $\theta = 2$ | $\theta = 5$ |
| US-SUM | 3.6 | 7.0 | 10.7 | 0.5 | 1.7 | 3.8 |
| CBOL | 4.2 | 7.8 | 11.9 | 0.6 | 1.9 | 4.4 |
| TUN-RU | 3.2 | 6.2 | 9.6 | 0.4 | 1.5 | 3.4 |
| BOSA | 3.6 | 6.7 | 10.2 | 0.5 | 1.6 | 3.6 |
| KENNEDY | 2.5 | 4.8 | 7.4 | 0.3 | 1.1 | 2.5 |
| PA-AN-MAR | 2.0 | 4.1 | 6.3 | 0.2 | 0.8 | 2.0 |
| CRIS-SFE-CAN | 3.5 | 6.6 | 10.1 | 0.5 | 1.6 | 3.7 |
| ENG-FON | 2.1 | 4.1 | 6.3 | 0.3 | 0.9 | 2.1 |
| BU-TEU | 1.2 | 2.5 | 3.8 | 0.2 | 0.6 | 1.4 |
| CHAPINERO | 0.7 | 1.5 | 2.4 | 0.1 | 0.3 | 0.8 |
| USAQUÉN | 1.5 | 3.0 | 4.6 | 0.2 | 0.7 | 1.6 |
| SUBA | 2.1 | 4.1 | 6.3 | 0.3 | 0.9 | 2.1 |
| SUR OCCIDENTE | 4.6 | 8.4 | 12.7 | 0.8 | 2.3 | 4.9 |
| S. OCCIDENTE | 2.7 | 5.4 | 8.3 | 0.4 | 1.2 | 2.9 |
| N. LIMÍTROFE | 2.0 | 4.0 | 6.2 | 0.2 | 0.8 | 2.0 |
| N. PERIFERIA | 2.2 | 4.3 | 6.6 | 0.3 | 1.0 | 2.3 |
| Bogotá D.C & AM | 2.7 | 5.2 | 8.0 | 0.4 | 1.2 | 2.8 |

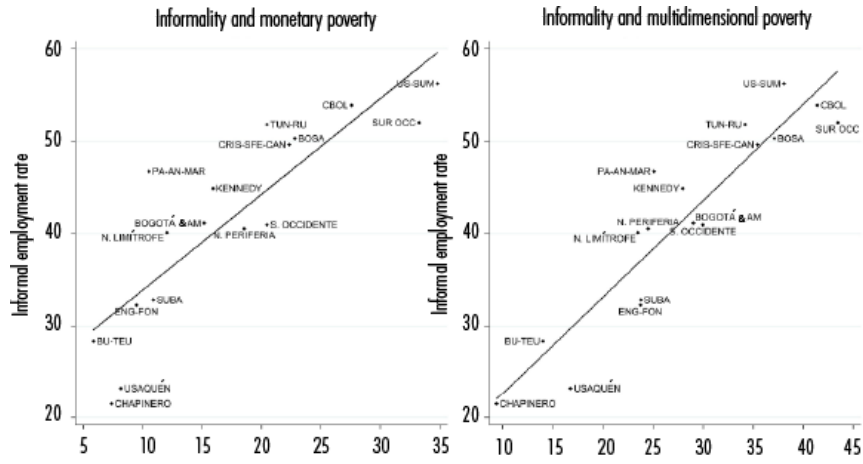
Source: Compiled by the authors based on EM17 (DANE, 2020).

5. RELATIONSHIP BETWEEN INFORMALITY AND MONETARY AND MULTIDIMENSIONAL POVERTY

Work is undoubtedly essential to the well-being of individuals in a society; in turn, the majority of the population depends on income from employment. Therefore, analyzing the relationship between labor informality and poverty in its monetary and multidimensional aspects is crucial for the effective diagnosing necessary to formulate more adequate public policies. Reducing informality necessarily involves a reduction in poverty under the two approaches considered. However, it is crucial to contrast the levels of reduction between localities and geographic zones, as well as the differentiated effect on the various indicators of monetary and multidimensional poverty.

Figure 6 shows the levels of monetary and multidimensional poverty relative to labor informality. The methodology used in this study, yields findings that indicate that levels of multidimensional poverty are higher than those of monetary poverty. Additionally, despite the ordinal changes, high levels of poverty are verified in areas such as CBOL, SUR OCC, and US-SUM, according to both approaches.

Figure 6. Incidence of informality and monetary and multidimensional poverty by zones of Bogotá and MA



Source: Compiled by the authors based on EM17 (DANE, 2020).

Labor informality and monetary poverty

This section analyzes the potential effect that closing the informal labor informality pay gap would have on changes in income, and the consequent reduction in monetary poverty. The first step is to consider the income estimates of equation [2] and the simulated income of informal workers, assuming that they were paid like formal workers (equation [3]). Based on these estimates, the PCHI is calculated and the FGT indicators are estimated (equation [5]). The estimated $(PCHI_{Est}^h)$ will be the sum of all the labor income of the estimated formal and informal workers, and the non-labor income of all household members; finally this total family income is then divided by the number of household members. On the other hand, to observe the effect that the elimination of informality gaps, the simulated $(PCHI_{Sim}^h)$ is calculated, assuming that all informal workers in all households are remunerated based on the vector of coefficients of formal workers, maintaining the characteristics of informal workers.

Consequently, the effect of formalization on the FGT indicators of poverty is presented in equation [7]. Based on this, it can be hypothesized that the improvement in income derived from the remuneration of informal workers as if they were formally employed, implies a decrease in the FGT indicators. Therefore, the reduction in poverty due to the change from the estimated PCHI to the simulated PCHI would be the potential effect of the closing of segmentation gaps (Maurizio, 2015; Sanchez, 2020).

$$Formalization\ effect = FGT(PCHI_{Sim}^h, z_i, \alpha) - FGT(PCHI_{Est}^h, z_i, \alpha) \quad (7)$$

Table 7 presents the results of this hypothetical scenario of closing informality gaps for each zone of Bogotá and all monetary poverty FGT indicators. As is to be expected, the zones that would see the greatest reduction in monetary poverty are those where the informality gap and poverty itself are highest. Particularly noteworthy are the reductions in poverty in CRIS-SFE-CAN, SUR OCC, and S. OCCIDENTE. By contrast, the localities with higher income levels and less poverty, and which are also those with lower differences in remuneration due to informality, would witness an effect that was quantitatively very low, indicating that the existing poverty (which is between 5% and 8%, lower than other localities) is due to informality, but rather other factors such as low educational levels, unemployment, and the high rate of economic dependency in households.

Table 7. Effect of formalization on monetary poverty indicators in Bogotá and MA

| <i>Localities & grouped zones</i> | <i>Change</i> | <i>Incidence</i> | <i>Gap</i> | <i>Severity</i> |
|---------------------------------------|---------------|------------------|------------|-----------------|
| US-SUM | Indicator | -6.7 | -2.3 | -1.1 |
| | Change % | -21.4 | -19.5 | -16.3 |
| CBOL | Indicator | -5.5 | -2.1 | -1.0 |
| | Change % | -21.1 | -22.2 | -19.6 |
| TUN-RU | Indicator | -3.6 | -1.1 | -0.5 |
| | Change % | -20.7 | -16.9 | -12.5 |
| BOSA | Indicator | -4.1 | -1.4 | -0.6 |
| | Change % | -19.0 | -7.6 | -13.2 |
| KENNEDY | Indicator | -3.2 | -0.9 | -0.4 |
| | Change % | -22.2 | -15.2 | -10.3 |
| PA-AN-MAR | Indicator | -1.5 | -0.4 | -0.2 |
| | Change % | -15.4 | -8.6 | -4.3 |
| CRIS-SFE-CAN | Indicator | -5.0 | -1.7 | -0.8 |
| | Change % | -25.6 | -24.6 | -20.3 |
| ENG-FON | Indicator | -1.3 | -0.4 | -0.2 |
| | Change % | -18.0 | -14.8 | -10.3 |
| BU-TEU | Indicator | -0.6 | -0.2 | -0.1 |
| | Change % | -17.0 | -11.4 | -7.0 |
| CHAPINERO | Indicator | -0.4 | -0.1 | 0.0 |
| | Change % | -9.4 | -4.2 | -3.0 |
| USAQUÉN | Indicator | -0.7 | -0.2 | -0.1 |
| | Change % | -13.8 | -9.8 | -8.2 |
| SUBA | Indicator | -2.0 | -0.5 | -0.2 |
| | Change % | -23.5 | -16.4 | -11.5 |
| SUR OCCIDENTE | Indicator | -9.0 | -3.9 | -2.1 |
| | Change % | -28.2 | -34.2 | -35.3 |
| S. OCCIDENTE | Indicator | -5.1 | -1.5 | -0.6 |
| | Change % | -28.0 | -28.7 | -24.5 |
| N. LÍMITROFE | Indicator | -2.5 | -0.7 | -0.4 |
| | Change % | -23.4 | -19.6 | -15.9 |
| N. PERIFERIA | Indicator | -3.4 | -1.3 | -0.5 |
| | Change % | -20.7 | -22.7 | -15.9 |
| Bogotá D.C & AM | Indicator | -3.0 | -1.0 | -0.5 |
| | Change % | -20.7 | -18.9 | -14.8 |

Source: Compiled by the authors based on EM17 (DANE, 2020).

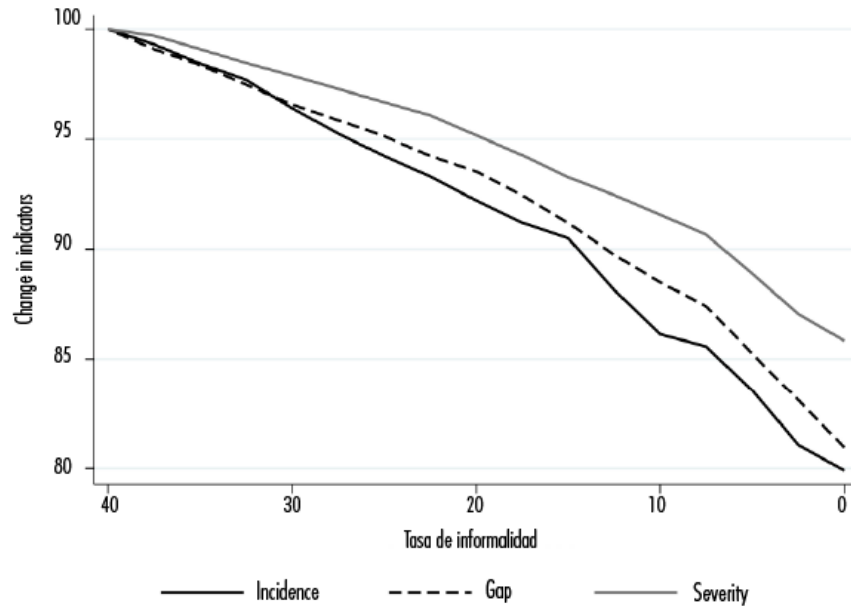
There is a pattern common among most areas of formalization having a greater impact on reducing the incidence of poverty rather than gaps or severity of poverty. This is because this hypothetical situation would help households to surpass the poverty line, but would have a lesser effect on improving the income of those households that continued to be poor.

The scenario hypothesized above assumes a complete closing of informality gaps; however, any potential formalization policy would have a gradual effect that would affect workers with different characteristics in various ways. In light of this, a scenario with progressive formalization was simulated, considering the three monetary poverty indicators and all zones of Bogotá and the MA. The estimation approached the formalization process using the estimations from the multinomial model (equation [1]), and specifically the probability that an individual is informally employed (assuming that they are currently informally employed). Thus, the simulation of the formalization and gap closure process began with workers with the lowest probability of being

informally employed, and progressively increased the number of formalized workers until reaching total formalization (see Table 7), with the last worker to be formalized being the one with the highest probability of being informal.

Figure 7 shows how poverty indicators would change with progressive formalization for the total of Bogotá and the MA. The initial scenario assumes current levels of poverty and informality and, as formality decreases, poverty indicators also decrease. However, it is important to highlight that even without gaps in remuneration due to informality, the incidence of poverty would still be above 10%, and despite being the indicator that decreases the most, it does not show a significant decrease (barely 20% lower). The severity of poverty is less affected by the formalization process, implying the existence of other factors that affect the persistence and depth of poverty.

Figure 7. Changes in poverty indicators due to progressive formalization in Bogotá and MA



Source: Compiled by the authors based on EM17 (DANE, 2020).

Labor informality and multidimensional poverty

To evaluate changes in the dynamics and relationship between labor informality and poverty from a multidimensional perspective, this section calculates all multidimensional indicators for the 16 geographic domains and Bogotá and the MA, for three simulated labor scenarios: incidence elimination, gap elimination, and joint effect. To examine the potential effect of these scenarios on the living conditions of the population, the multidimensional poverty indicators are calculated using the BYCH methodology (equation 6).

Initially, the real informality and income gaps and the multidimensional poverty index are estimated based on the BYCH methodology, after which variable 1 (Informal Employment) of the work dimension is modified, thus constructing the "Formalization Incidence Effect" [8], where the entire population is formalized so that no individual is deficient in this variable.

$$\begin{aligned} \text{Formalization Incidence } E. &= \text{ByCH}_\alpha^\theta(\alpha, \theta, J, INF_{sim}, BR_{est}) \\ &- \text{ByCH}_\alpha^\theta(\alpha, \theta, J, INF_{obs}, BR_{est}) \end{aligned} \quad (8)$$

The next step is the elimination of wage gaps between formal and informal workers. To achieve this, variable 2 (Labor Income) of the work dimension is modified by assigning remunerations to informal workers as if they were formal, thus creating the "Formalization Gap Effect." This scenario is presented in equation [9], which simulates the effect of closing the informality gap and the effect on the measurement of multidimensional poverty.

$$\begin{aligned} \text{Formalization Gap } E. &= \text{ByCH}_\alpha^\theta(\alpha, \theta, J, INF_{obs}, BR_{sim}) \\ &- \text{ByCH}_\alpha^\theta(\alpha, \theta, J, INF_{obs}, BR_{est}) \end{aligned} \quad (9)$$

The third simulation is based on the first two; the "Aggregate Formalization Effect" makes simultaneous modifications to variables 1 and 2 of the work dimension. Thus, the effects of equations [8] and [9] are added together.

Table 8 shows how the multidimensional poverty indicators would change with the formalization of the entire population and the consequent increase in labor income (aggregate effect). These results demonstrate a reduction in the three indicators of multidimensional poverty ($\alpha = 0, 1, \text{ and } 2$) for all areas of Bogotá and the MA, with more significant decreases in the peripheral localities, as well as in the gap and severity indicators when there is perfect substitution between dimensions. Thus, potential formalization (elimination of incidence and gaps in remuneration) would undoubtedly improve the welfare of the population, even when there are households that continue to be poor due to their deprivations in other dimensions, in which even the deficits in the variables are more acute than in work, which is why the effect is smaller when the degree of substitution decreases.

Table 8. Multidimensional poverty indicators with the aggregate effect for Bogotá and MA

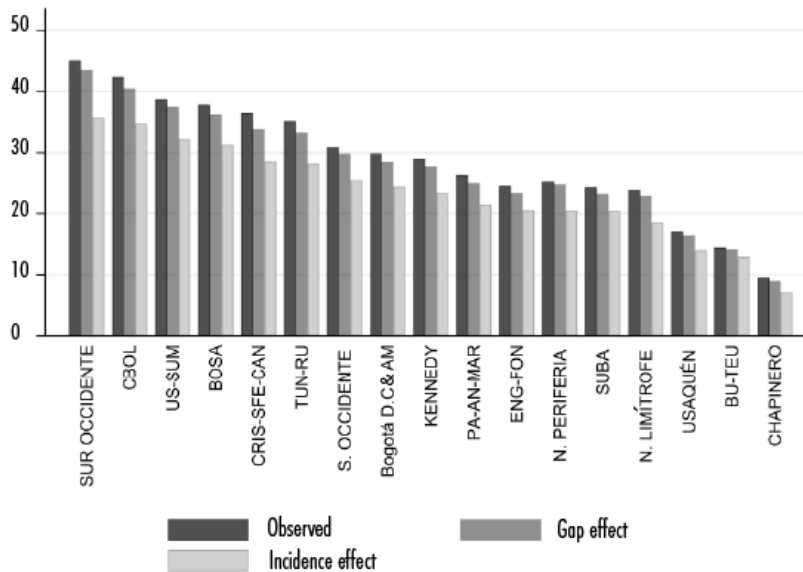
| Localities and grouped zones | Change | Incidence ($\alpha = 0$) | | Gap ($\alpha = 1$) | | | Severity ($\alpha = 2$) | | |
|------------------------------|-----------|----------------------------|----------------------------|-------------------------------------|-------|-------|---------------------------|-------|-------|
| | | Work dimension incidence | Multidimensional incidence | Grades of substitution (θ) | | | | | |
| | | | | 1 | 2 | 5 | 1 | 2 | 5 |
| US-SUM | Indicator | -11.9 | -6.7 | -0.7 | -1.2 | -1.7 | -0.1 | -0.3 | -0.5 |
| | Change % | -77.7 | -17.3 | -18.8 | -16.8 | -15.5 | -24.0 | -15.3 | -12.8 |
| CBOL | Indicator | -14.4 | -8.0 | -0.9 | -1.5 | -2.1 | -0.2 | -0.4 | -0.7 |
| | Change % | -78.8 | -18.9 | -21.9 | -19.0 | -17.8 | -25.8 | -18.6 | -15.8 |
| TUN-RU | Indicator | -11.4 | -7.4 | -0.7 | -1.2 | -1.7 | -0.1 | -0.2 | -0.5 |
| | Change % | -80.3 | -20.9 | -21.4 | -19.2 | -18.3 | -22.0 | -16.7 | -14.7 |
| BOSA | Indicator | -12.9 | -6.7 | -0.8 | -1.2 | -1.7 | -0.1 | -0.3 | -0.5 |
| | Change % | -79.7 | -17.7 | -21.8 | -18.5 | -16.9 | -27.1 | -18.7 | -14.9 |
| KENNEDY | Indicator | -9.0 | -5.7 | -0.5 | -0.9 | -1.3 | -25.8 | -17.3 | -14.5 |
| | Change % | -81.4 | -19.6 | -21.5 | -18.8 | -17.7 | -0.1 | -0.2 | -0.4 |
| PA-AN-MAR | Indicator | -7.7 | -5.0 | -0.4 | -0.8 | -1.1 | -0.1 | -0.1 | -0.3 |
| | Change % | -88.9 | -19.1 | -20.0 | -17.7 | -16.8 | -20.8 | -15.3 | -13.4 |
| CRIS-SFE-CAN | Indicator | -12.8 | -8.2 | -0.8 | -1.4 | -2.0 | -0.1 | -0.3 | -0.6 |
| | Change % | -82.5 | -22.5 | -22.9 | -20.6 | -19.8 | -24.5 | -18.1 | -15.8 |
| ENG-FON | Indicator | -6.9 | -4.2 | -0.4 | -0.7 | -1.0 | -0.1 | -0.2 | -0.3 |
| | Change % | -82.8 | -17.0 | -20.3 | -17.0 | -15.7 | -26.9 | -17.2 | -13.5 |
| BU-TEU | Indicator | -3.0 | -1.6 | -0.2 | -0.3 | -0.4 | 0.0 | -0.1 | -0.1 |
| | Change % | -84.8 | -11.0 | -14.4 | -11.6 | -10.4 | -18.8 | -12.1 | -8.8 |
| CHAPINERO | Indicator | -3.2 | -2.4 | -0.2 | -0.3 | -0.5 | 0.0 | -0.1 | -0.1 |
| | Change % | -90.3 | -25.3 | -24.3 | -21.2 | -20.6 | -25.0 | -16.1 | -14.7 |
| USAQUÉN | Indicator | -4.6 | -3.1 | -0.3 | -0.5 | -0.8 | 0.0 | -0.1 | -0.2 |
| | Change % | -74.5 | -17.8 | -18.8 | -17.1 | -16.3 | -20.0 | -16.4 | -13.7 |
| SUBA | Indicator | -7.2 | -4.1 | -0.4 | -0.7 | -1.0 | -0.1 | -0.1 | -0.3 |
| | Change % | -80.3 | -16.7 | -19.4 | -16.6 | -15.3 | -22.2 | -15.6 | -12.7 |
| SUR OCCIDENTE | Indicator | -16.2 | -9.7 | -0.9 | -1.5 | -2.2 | -0.1 | -0.3 | -0.6 |
| | Change % | -88.4 | -21.6 | -19.5 | -17.8 | -17.1 | -17.7 | -13.4 | -11.7 |
| S. OCCIDENTE | Indicator | -8.5 | -5.4 | -0.5 | -0.8 | -1.2 | -0.1 | -0.2 | -0.3 |
| | Change % | -86.6 | -17.5 | -16.8 | -15.2 | -14.1 | -19.4 | -12.4 | -10.0 |
| N. LIMÍTROFE | Indicator | -7.9 | -5.5 | -0.5 | -0.9 | -1.3 | -0.1 | -0.2 | -0.3 |
| | Change % | -87.6 | -23.2 | -24.0 | -21.9 | -20.9 | -27.3 | -18.8 | -17.1 |
| N. PERIFERIA | Indicator | -7.2 | -4.7 | -0.4 | -0.7 | -1.0 | -0.1 | -0.1 | -0.3 |
| | Change % | -82.7 | -18.6 | -19.2 | -17.2 | -16.0 | -20.0 | -14.8 | -12.6 |
| Bogotá D.C & AM | Indicator | -9.4 | -5.6 | -0.6 | -0.9 | -1.4 | -0.1 | -0.2 | -0.4 |
| | Change % | -81.8 | -18.8 | -20.4 | -18.0 | -16.9 | -24.3 | -16.9 | -13.8 |

Source: Compiled by the authors based on EM17 (DANE, 2020).

Figure 8 illustrates the impact of each of the effects of formalization (incidence and gap), as well as the joint effect on the potential reduction of the multidimensional poverty incidence indicator in Bogotá and its MA. The Incidence Effect clearly reduces poverty more significantly, however; despite the

lesser impact of the Gap Effect, the levels of income inequality in Bogotá stand out, since, despite the elimination of the gaps in remuneration, the peripheral localities and geographic domains continue to lag behind localities such as Chapinero, Barrios Unidos-Teusaquillo, or Usaquén. On the other hand, there is little distinction between the multidimensional poverty indicators, which would indicate that the improvement of the working conditions of the population from the elimination of the gap would not have a great impact on the reduction of poverty in the domains with greater vulnerability.

Figure 8. Changes in the incidence of multidimensional poverty due to formalization and closing of gaps in informality in areas of Bogotá and MA



Source: Compiled by the authors based on EM17 (DANE, 2020).

6. CONCLUSIONS

Development policies can only be successful if they are designed informed by an understanding of deficits in the population's levels. This article analyzed how informal labor status affects poverty from a monetary and multidimensional approach for the case of Bogotá and its MA. The results indicate that the reduction of informality would have a positive impact on poverty. The impact would be more significant on the incidence of monetary and multidimensional poverty when perfect substitution between dimensions is assumed. Formalization would only have a limited impact on the gaps and severity of severity, indicating that other factors in low family income have a more decisive impact on the poverty levels. These include low household income factors (labor discrimination, economic dependence, low levels of productivity and human capital, etc.), as well as factors related to living conditions (the health dimension, in particular, stands out, with several areas of Bogotá and the MA having deprivation rates above 20% for this dimension).

It is important to emphasize that the microsimulation exercise is intended to produce a quantitative diagnosis, without necessarily interpreting it as a definitive scenario or causal of a strict formalization policy. These estimates are developed in a partial equilibrium model, so they do not consider potential effects on unemployment, changes in remunerations, or the structure of labor demand (Maurizio, 2015). The approach used in this research demonstrates that, although labor informality is conceived as a barrier to higher income, it is also true that this sector has provided income generation options to a part of the population whose situation would be worse if they did not have this option.

Thus, it should be understood that, although informality produces low income, it also represents a livelihood alternative in the context of low employment opportunities. It is therefore also important to see the potential for articulation, resisting the temptation to attack the effects (forms of informal employment that exist) rather than causes (inequality, as evidenced by problems of excess supply and limited demand of labor, combined with the lack of social protection).

BIBLIOGRAPHY

- Alkire, S. and Foster, J. (2011). Counting and multidimensional poverty measurement. *Journal of Public Economics*, 95(7-8). <https://doi.org/10.1016/j.jpubeco.2010.11.006>
- Beccaria, L. and Groisman, F. (2008). *Argentina desigual*. Universidad Nacional de General Sarmiento.
- Bourguignon, F. and Chakravarty, S. (2003). The measurement of multi-dimensional poverty. *Journal of Economic Inequality*, 1. <https://doi.org/10.1023/A:1023913831342>

- Departamento Administrativo Nacional de Estadística (DANE) (2019). Boletín Técnico Pobreza Monetaria en Colombia-2018. https://www.dane.gov.co/les/investigaciones/condiciones_vida/pobreza/2018/bt_pobreza_mo-netaria_18.pdf
- _____ (2020). Encuesta Multipropósito-2017. <https://www.dane.gov.co/index.php/estadisticas-por-tema/pobreza-y-condiciones-de-vida/encuesta-multiproposito/encuesta-multiproposito-2017>.
- _____ (2021). Microdatos anonimizados. Censo Nacional de Población y Vivienda-CNPV-2018. <http://microdatos.dane.gov.co/index.php/catalog/643>
- Economic Commission for Latin America and the Caribbean (ECLAC) (2019). *Income poverty measurement: updated methodology and results*. ECLAC Methodologies, 2.
- Fields, G. (2011). *Working hard, working poor. A global journey*. Oxford University Press.
- Foster, J., Greer, J. and Thorbecke, E. (1984). A class of decomposable poverty measures. *Econometrica*, 52(3). <https://doi.org/10.2307/1913475>
- Heckman, J. (1979). Sample selection bias as a specification error. *Econometrica*. 47(1). <https://doi.org/10.2307/1912352>
- Jenkins, S. (1994). Earnings discrimination measurement: a distributional approach. *Journal of econometrics*, 61(1). [https://doi.org/10.1016/0304-4076\(94\)90078-7](https://doi.org/10.1016/0304-4076(94)90078-7)
- Lee, Lung-Fei (1983). Generalized econometric models with selectivity. *Econometrica*, 51(2). <https://doi.org/10.2307/1912003>
- Maurizio, R. (2015). Labor informality and poverty in Latin America: The case of Argentina, Brazil, Chile and Peru. In J. Cling, S. Lagrée, M. Razafindrakoto and F. Roubaud (eds.). *The informal economy in developing countries* (pp. 21-49). Routledge.
- Mincer, J. (1974). *Schooling, experience and earnings*. National Bureau of Economic Research.
- Organización Internacional del Trabajo (OIT) (2003). Report of the 17th International Conference of Labor Statisticians. <https://www.ilo.org/public/spanish/bureau/stat/download/17thicls/nal.pdf>.
- Pradhan, M. and Van Soest, A. (1995). Formal and informal sector employment in urban areas of Bolivia. *Labour Economics*, 2(3). [https://doi.org/10.1016/0927-5371\(95\)80032-S](https://doi.org/10.1016/0927-5371(95)80032-S)
- Sánchez, R. (2020). Poverty and labor informality in Colombia. *IZA Journal of Labor Policy*, 10:6. <https://doi.org/10.2478/izajolp-2020-0006>
- Sánchez, R., Maturana, L. and Manzano, L. (2020). Estimación alternativa de la pobreza multidimensional en Colombia. *Revista de Economía Institucional*, 22(43). <https://doi.org/10.18601/01245996.v22n43.07>
- Torres, A., Méndez, S., López, L., Galarza, S. and Oviedo, N. (2013). Calidad de vida y ciudad: análisis del nivel de desarrollo en Bogotá a través del método de necesidades básicas insatisfechas. *Estudios gerenciales*, 29(127). <https://doi.org/10.1016/j.estger.2013.05.011>
- Vinuesa, J. (1975). Sobre el concepto de área metropolitana. *Estudios geográficos*, 36(140). <https://repositorio.uam.es/handle/10486/668499>

¹In Colombia, socioeconomic stratification is a mechanism for identifying users' ability to pay of users for residential public utilities (water, sewerage, sanitation, electricity, gas, telephone, internet). Each household is classified into a low (0, 1, and 2), medium (3 and 4) or high (5 and 6) strata, depending on the area where it is located. In this way, different rates are created according to the stratum of the home, thus generating cross-subsidies.