Sánchez Torres, Roberto Mauricio

Article

Poverty and labor informality in Colombia

IZA Journal of Labor Policy

Provided in Cooperation with:
IZA – Institute of Labor Economics

Suggested Citation: Sánchez Torres, Roberto Mauricio (2020) : Poverty and labor informality in Colombia, IZA Journal of Labor Policy, ISSN 2193-9004, Sciendo, Warsaw, Vol. 10, Iss. 1, pp. 1-20, https://doi.org/10.2478/izajolp-2020-0006

This Version is available at:
https://hdl.handle.net/10419/298749

Roberto Mauricio Sánchez Torres[1,2,*]

Poverty and labor informality in Colombia

Abstract

Labor informality and poverty are at high levels in Latin America. In developing countries, poverty and the labor market are related not through unemployment but through employment. The purpose of this paper is to analyze the link between labor informality and poverty in Colombia. To do so, earnings gaps associated with labor informality are estimated; then, the effect of formalization on poverty is calculated, as the influence of changes in labor informality on Colombia's poverty reduction from 2002 to 2013. The findings show that the earnings gap between formal and informal workers is 37–44%, and if informality were eliminated, poverty would decrease by approximately 40%. However, even though informality has great potential to reduce poverty, its actual effect on Colombia's poverty reduction in the years analyzed was low.

Current version: June 11, 2020
Keywords: poverty; Colombia; labor informality; earnings gaps; selection bias
JEL codes: I32, J31, J46
Corresponding author: Roberto Mauricio Sánchez Torres
rmsanchezt@gmail.com

[1] Department of Economics, National University of Colombia, Bogotá, Colombia
[2] Faculty of Economic and Social Sciences, La Salle University, Bogotá, Colombia

Cite as: Sánchez Torres. *IZA Journal of Labor Policy* (2020) 10:6.
https://doi.org/10.2478/izajolp-2020-0006

List of abbreviations

ECLAC, Economic Commission for Latin America and the Caribbean
EIS, Employment in the Informal Sector
FGT, Foster-Greer-Thorbecke
HIPC, Household Income Per Capita
ICLS, International Conference of Labour Statisticians
IE, Informal Employment
NADS, National Administrative Department of Statistics

1 Introduction

One of the remarkable features in Latin American labor markets is the high labor informality rate. Labor informality is characterized by a broad role of self-employment and labor in small enterprises with low earnings as well as by poor job quality, marked by instability, insecurity, and lack of protection. Informality is the historical consequence of the economic structure; it is an alternative for people who are unemployed and are living in countries without enough unemployment protection. They need to work to have incomes in order to survive, so they do not have a trade-off between work and leisure.

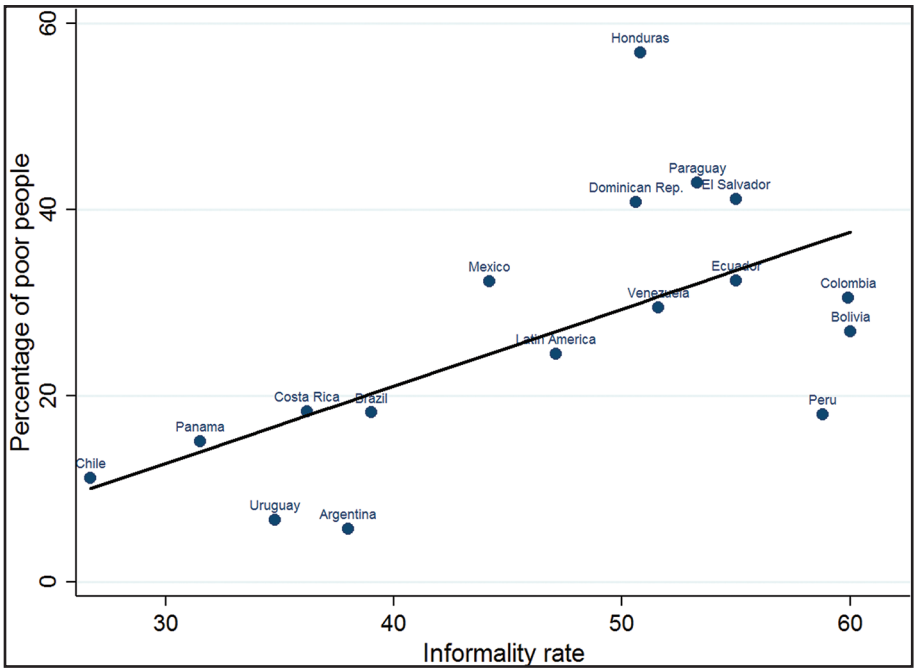
Therefore, in developing countries, poverty and the labor market are linked through employment types and the different ways in which people work but not through unemployment. In contrast to unemployed people in industrialized countries, most unemployed people in developing countries do not belong to poor households because they do not depend on labor income. As a result, in those countries, there is "luxury unemployment," where individuals who can be unemployed for a considerable amount of time have the luxury of not working out of necessity (Fields, 2012; Banerjee and Duflo, 2012).

The aim of this paper is to analyze the link between labor informality and poverty in Colombia. Quantitative evidence is revealed through two empirical exercises: first, the potential effect of a labor-formalizing policy on poverty indicators through changes in labor earnings is analyzed; second, the effect of the recent changes in labor informality on the extent of poverty in Colombia from 2002 to 2013 is examined. The article is organized into five sections. The first section presents an outline of the topics analyzed in this article. The next section illustrates the measurement of poverty and informality and the recent trends in Colombia. Then, the earnings gaps associated with informality are shown; they are the main input to develop the empirical exercises, which are presented in the fourth section. Finally, the conclusions are presented at the end of the article.

2 Poverty and informality: an outline

Latin American countries have high levels of poverty and labor informality. Based on the data from the Economic Commission for Latin America and the Caribbean (ECLAC), the poverty headcount ratio in 2013 was 28% overall (approximately 165 million people) and 23% in urban areas (ECLAC, 2014a) in Latin American countries. Additionally, 46.7% of Latin American workers worked in the informal sector in 2013. Figure 1 shows the level of poverty and the rate

Figure 1 Poverty and informality in Latin American countries.



Source: Data from the Economic Commission for Latin America and the Caribbean (2014b).
Notes: 1. The *y*-axis is analyzed based on monetary poverty in urban areas. 2. The informality rate is the percentage of workers who are working in the informal sector.

of labor informality. According to the figure, on average, the more informal workers a country has, the higher the percentage of poverty in that country. There are heterogeneities between countries: Chile has the lowest level of informality, and in Uruguay and Argentina, less than 15% of the population is below the poverty line. However, some Central American countries have the highest levels of poverty, and more than 60% of Bolivian and Colombian workers work in the informal sector.

Most poor people are working and at the same time are poor because of the nature of work that they have, not because they are unemployed. Many occupations provide low incomes to a large number of workers. Therefore, understanding job characteristics is the key to understanding poverty in Latin American countries. Several factors, such as the social security system and the labor structure, have been exposed as sources of low incomes and poverty.

Majid (2001) explains that the relationship between the labor market and poverty depends on the existence and quality of social protection. This is because developing countries do not have unemployment insurance or strong social protection, and so poor people need to work even in jobs with unsafe labor conditions and low earnings. However, Fields (2012) says that the labor structure explains the low labor incomes of the working poor. The labor structure is characterized by a high percentage of people working in agriculture, a few people working for large companies, many self-employed workers, many individuals engaged in nonsalary activities, and family entrepreneurs. This provides evidence of the importance of informality in developing countries.

Studies analyze the link between labor informality and poverty through the wage gap between formal and informal workers. There should be a wage gap that is unfavorable to informal workers if the labor market is segmented. As a result, on average, informal workers should

have lower incomes than that of formal workers. This influences the level of household income because poor people cannot obtain enough income from their informal jobs.

The segmented labor market does not explain low income itself. People who are working informally tend to have characteristics, such as low experience, low education, and low skills, that lead to low wages. Additionally, one of the most important aspects is labor discrimination by gender, race, ethnicity, and nationality. All of these factors are related to labor informality, but they do not explain the reason for the wage gap linked with labor informality. When the gap is explained by labor informality, low incomes are found to be the result of the type, quality, and condition of jobs.

The decline in poverty is the result of several trends inside and outside of the labor market. During the first decade of the twenty-first century in Latin American countries, there was a constant reduction in poverty, which was explained by economic growth (Medina and Galván, 2014), the labor market and its institutions (Azevedo et al., 2013; Sánchez, 2015), and the expansion of cash transfers (Cruces and Gasparini, 2013), among other factors. Maurizio (2015) analyses four Latin American countries and concludes that labor informality is a key factor of poverty reduction. Although there are differences between countries, if workers had formal work, poverty would decline remarkably in all of the countries. Based on that background, this paper estimates the specific relation between poverty and informality in Colombia between 2002 and 2013.

3 Measurement of informality and poverty

3.1 Measurement of informality

There is much discussion about the measurement of informality. Different approaches adopt distinct criteria to identify which people work in the informal sector or have an informal job. Some of the most common perspectives used to study informality are the legal records or tax payments of businesses, the number of workers hired by an establishment, different job features (occupational position, nature of labor relations, levels of productivity), and compliance with labor laws and regulations.

In 2003, the International Conference of Labour Statisticians (ICLS) proposed a specific way to measure informality that involved two different approaches: measuring employment in the informal sector and measuring informal employment (ICLS, 2003; Hussmanns, 2005). This is the perspective adopted in this article based on the microdata of the National Continuous Survey and the Integrated Household Survey.[1]

On the one hand, wage-earning workers in a small establishment (five or fewer employees), domestic workers, unpaid workers, non-professional own-account workers, and non-professional employers of a small establishment comprise *employment in the informal sector* (EIS). Professional self-employed individuals who have more than 15 years of education are excluded because they tend to engage in the formal economy if they want to work.

On the other hand, all wage earners and unpaid workers whose employer does not obey the labor laws comprise *informal employment* (IE). These workers do not have access to labor

1 The National Continuous Survey was conducted from 2002 to 2005 and the Integrated Household Survey from 2008 to 2013. The two surveys have different formats, methodologies, and populations of reference. Therefore, throughout the article, the examined period is divided into two (2002–2005 and 2008–2013) based on the survey used.

rights. In this article, as in the majority of related studies, the proxy variable for identifying informal employment is the receipt of payment (or not) from the pension social system.[2] In the case of self-employed people, the criterion is the same as in *employment in the informal sector,* because they do not depend on an employer. This means that basically the difference between the two measures is the treatment of wage-earning workers. This article considers the two alternative definitions of informality (EIS and IE) in every estimation to check that the link between poverty and labor informality does not depend on the definition used.

This perspective was developed by ICLS (2003) and explained by Hussmanns (2005). The figures for Colombia in 2013 are shown in Table 1, which shows that 57.5% of urban Colombian workers were working in the informal sector and 59.6% had informal employment. Self-employed accounted for more than 60% of informality, and 30.8% of workers worked in the formal sector with formal jobs. As found in other studies, the extent of informal employment was higher than the extent of labor in the informal sector in most Latin American countries (Maurizio, 2015). This means that if only one perspective of measurement is taken into account, the level of informality could be over- or under-estimated. This article adopts both perspectives (EIS and IE) to carefully calculate the different effects of changes in the two types of employment on the reduction in monetary poverty.

3.2 **Measurement of poverty**

There exists a debate about how poverty can be accurately measured. A simple way of identifying poverty is to check whether a household does not have enough income to stay above a

Table 1 Informal employment and employment in the informal sector in Colombia, 2013

Employment in the informal Sector: 57.5 Informal employment: 59.6			Occupational position					
			Own-account workers	Employers	Unpaid workers		Wage-earning workers	
					Formal	Informal	Formal	Informal
			1	2	3	4	5	6
Economic Establishment	Formal sector (establishment with more than 5 employees)	A	4.4 (719640)	1.5 (243867)		0.2 (28405)	30.8 (5015828)	5.4 (891832)
	Informal sector (establishment with 5 or fewer employees)	B	36.3 (5913077)	3.2 (524612)	0.5 (78009)	2.7 (448819)	2.1 (348184)	8.1 (1327603)
	Households hiring domestic workers	C					0.9 (155388)	3.7 (602247)

Source: Integrated Household Survey. National Administrative Department of Statistics (NADS, 2014).
Notes: 1. The figures are the percentages of the total urban workers. In brackets are the absolute numbers. 2. Weights are considered in the estimations. 3. Employment in the informal sector: B1+B2+B3+B4+B5+B6+C5+C6; informal employment: A4+A6+B1+B2+B4+B6+C6.

2 Specifically, the following question is considered: "*Are you currently paying into the pension system?*" If the answer is "no," that wage earner worker has informal employment.

certain threshold. This methodology considers "unidimensional" indicators, using only one variable to classify people as poor or not poor. Other recent approaches take into account several variables to identify poverty. However, given the aim of this article, monetary poverty is chosen as the measurement of poverty. In this paper, a household is considered poor if its household income per capita (HIPC) is lower than the poverty threshold estimated by the National Administrative Department of Statistics of Colombia[3] (NADS).

This study estimates the most common poverty indicators, that is, the Foster-Greer-Thorbecke (FGT) (1984) indicators. These indicators are calculated using the poverty threshold, the level of HIPC, and the different levels of poverty aversion:

$$FGT(\propto)=\frac{1}{N}\sum_{i=1}^{N}k_i\left(1-\frac{x_i}{z_i}\right)^{\propto};\quad \begin{matrix} k_i=1\,if\ x_i<z_i \\ k_i=0\,if\ x_i\geq z_i \end{matrix},\ \propto\geq 0 \tag{1}$$

where N is the total population, x_i is the HIPC for i, z_i is the poverty threshold corresponding to i,[4] k_i is the indicator function such that $k_i = 1$ if the person belongs to a poor household and $k_i = 0$ otherwise, and $\propto$ is the poverty aversion coefficient. Based on the value of $\propto$, the poverty indicator changes. When it is zero ($\alpha = 0$), the indicator is the headcount ratio; if it is one ($\alpha = 1$), the FGT indicator shows the average relative distance between the incomes of poor people and their threshold (poverty gap index); and when alpha is two ($\alpha = 2$), the indicator has higher relevance for the poorest people (severity of poverty).

3.3 **Trends of poverty and informality in Colombia**

Poverty decreased in Colombia during the first decade of the twenty-first century. The poverty headcount ratio was reduced from 46.3% in 2003 to 27.2% in 2013. This trend is similar to that of Latin American countries, whose poverty levels were reduced by approximately 40% in the same period (ECLAC, 2014a). Some countries were more successful than others in the fight against monetary poverty: Argentina, Peru, and Uruguay reduced their poverty by more than 60% . In Colombia, the level of informality decreased slightly, but as shown in Figure 2, it increased in some years of the period analyzed.[5]

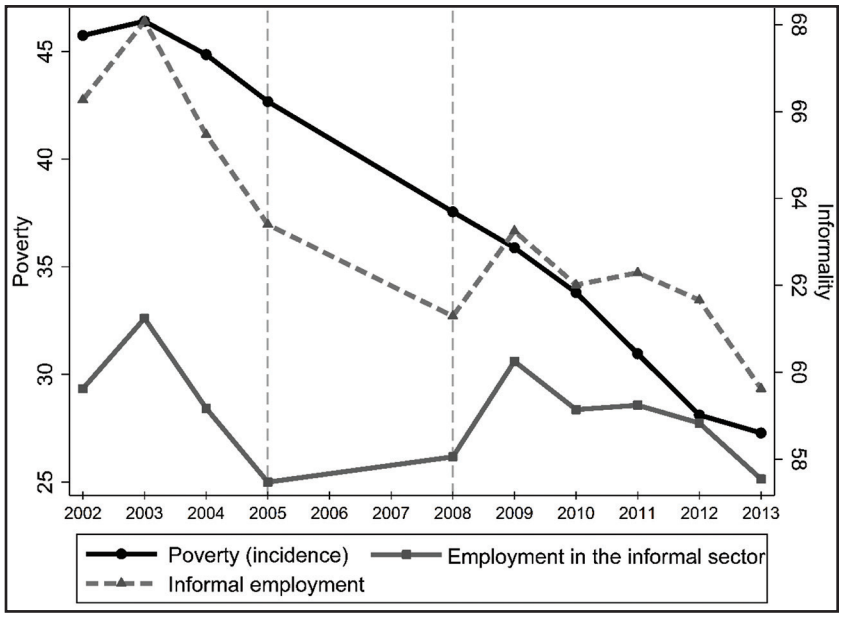
Therefore, poverty and informality did not change to the same extent, and that could be the result of different links between low income and the labor market. Figure 3 shows changes in poverty and informality. Poverty decreased more than 40% when every indicator is considered, and the decrease in poverty severity is even higher than the decrease in the percentage of the poor population. However, throughout the period analyzed, the informal urban sector represented a labor problem that did not change noticeably. The reduction in informal sector employment was 5%, whereas the reduction in informal employment was 11%. This suggests a certain lack of connection between the improvements in the quality of living and the persistence of labor market problems, such as informality.

3 Importantly, no data are available for 2006 and 2007 because in those years, a change in the survey was made. A commission of several institutions merged data from different years.

4 There are several poverty thresholds (z_i) depending on the region and geographical references.

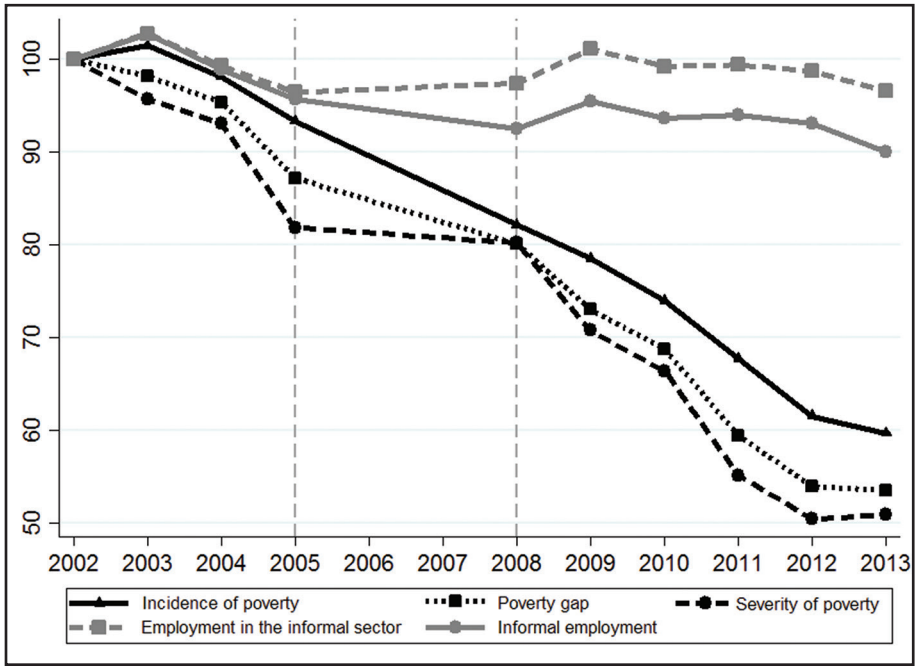
5 Between 2005 and 2008, there is a different trend in the level of informality that may be the result of the change in the survey in those years.

Figure 2 Poverty and informality in Colombia during the period 2002–2013.



Source: Integrated Household Survey (NADS, 2014).

Figure 3 Changes in poverty indicators and informality rate in Colombia during 2002–2013.



Source: Integrated Household Survey (NADS, 2014).
Notes: Index for every indicator. 2002=100.

4 Formal–informal labor earnings gap in Colombia

This section shows the formal–informal labor earnings gap in Colombia based on observed and estimated differences. First, monthly and hourly earnings gaps are considered for both definitions of informality: formal–informal sector (EIS) and formal–informal employment (IE). In addition, the figures are shown for workers depending on their occupational position and the kind of informality. Second, individual formal–informal earnings gaps are estimated using

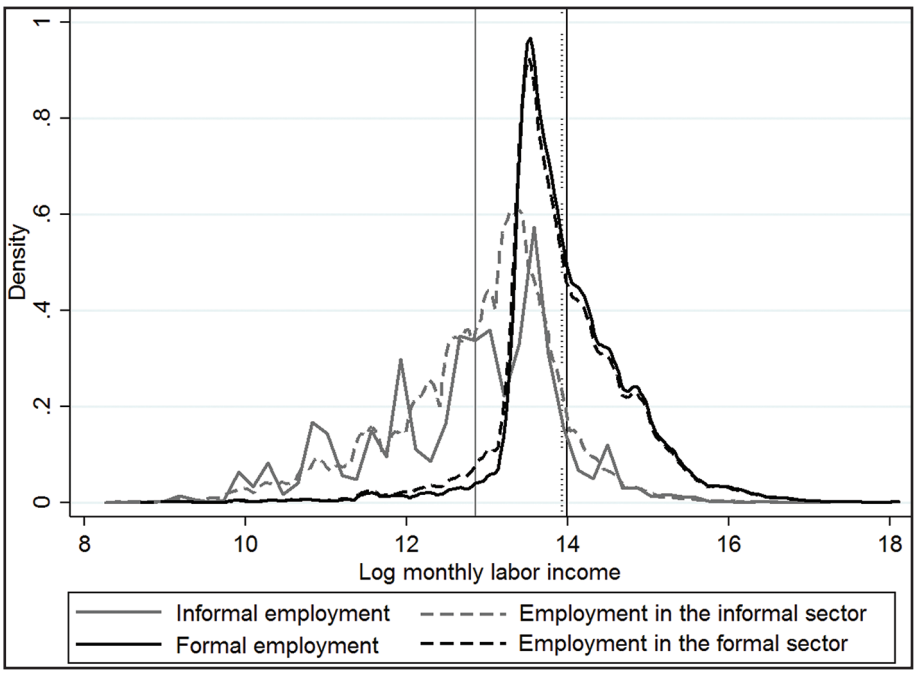
the Jenkins methodology (Jenkins, 1994) and the two definitions of informality (EIS and IE), enabling a counterfactual analysis based on an econometric estimation of Mincer's earnings functions corrected for sample selection bias through Heckman's method (Heckman, 1979; Pradhan and van Soest, 1995).

4.1 Observed earning differentials by informality

Figures 4 and 5 show the earning differentials between formal and informal workers (EIS/IE). Kernel-based nonparametric estimation methods are used to determine the monthly and hourly earnings of formal and informal workers. There is a close relationship between the two informality approaches: the mean income is similar. The same situation occurs with formal workers (EFS/FE); their mean labor income is similar in both definitions of formality but higher for workers with formal employment. In addition, there is a bunching around the minimum wage for formal workers. Both Figures 4 and 5 illustrate that there is a critical gap between formal and informal workers, and the latter have higher dispersion. This dispersion is seen in monthly and hourly earnings, but it is greater for monthly earnings because of the dispersion of the number of hours in the jobs of informal workers.

A primary conclusion from the figures is that most workers with the lowest income have informal employment or are working in the informal sector. However, this is not evidence of segmentation, nor does it mean that the difference is explained by informality. It could be the consequence of low skills or personal characteristics related to low productivity. If this were true, the gap between formal and informal workers could partially be explained by segmentation, as will be shown in the next section of the article.

Figure 4 Distribution of log monthly labor income by informality.

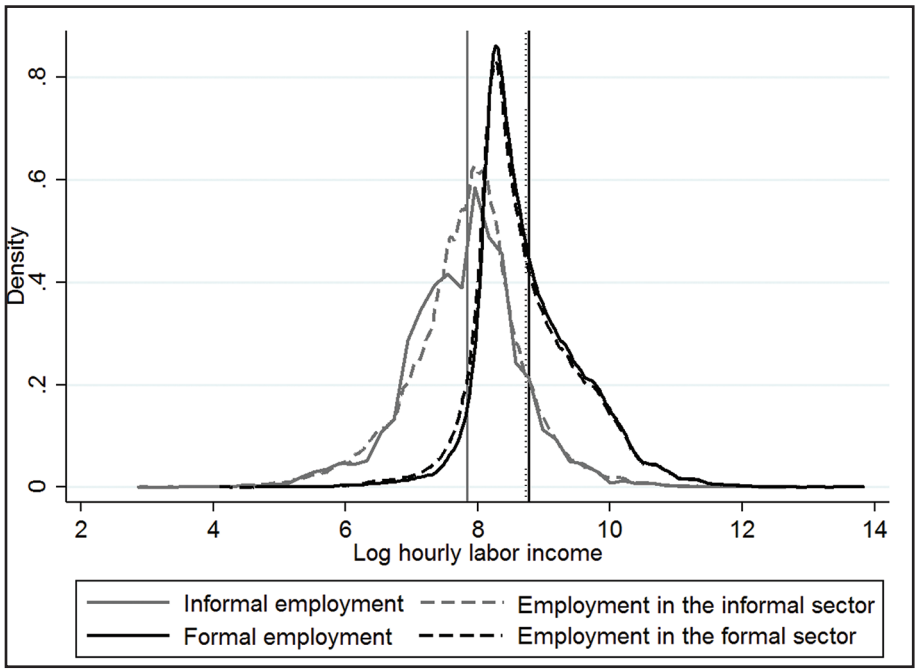


Source: Integrated Household Survey (NADS, 2014).

Notes: 1. The graphs illustrate density functions estimated by kernel methodology. 2. The estimated kernel is the Epanechnikov kernel with optimal bandwidth.

The gap between formal and informal workers depends on, among other factors, the kind of informality and occupational position. Table 2 shows that workers with the lowest average income are informal self-employed and informal wage earners who are working in the informal

Figure 5 Distribution of log hourly labor income by informality.



Source: Integrated Household Survey. (NADS, 2014).

Notes: 1. The graphs illustrate density functions estimated by kernel methodology. 2. The estimated kernel is the Epanechnikov kernel with optimal bandwidth.

Table 2 Average earnings by occupational position and informality

Category	Average monthly labor income[1]	% total average	Average hourly labor income	% total average
Own-account workers in the informal sector	508,250	54	3,450	61
Own-account workers in the formal sector	1,834,812	194	12,427	221
Employers in the informal sector	1,355,576	143	7,109	126
Employers in the formal sector	3,492,591	369	20,162	358
Formal employees in the formal sector	1,638,424	173	9,020	160
Informal employees in the formal sector	691,276	73	4,098	73
Formal employees in the informal sector	909,387	96	4,677	83
Informal employees in the informal sector	507,253	54	3,269	58
Total average	947,549	100	5,633	100

Source: Integrated Household Survey (NADS, 2014).

Notes: 1. The figures are in Colombian pesos in 2013. 2. Weights are considered in the calculation.

sector; both groups have mean incomes equivalent to 54% of the mean income of total workers. Despite the low average incomes of informal workers, the figures demonstrate that there are large differences within informality. Even in the formal sector, there are many employees with low incomes, and the main references are those who are working in that sector but lack coverage by labor law, whose incomes are 27% lower than the average. Overall, it is possible to conclude that even though there are heterogeneities by occupational position, informal sector employment and informal employment are sources of low earnings.

4.2 **Estimated formal–informal earnings gaps**

This section presents the estimation of individual earnings gaps, which are measured based on Jenkins' methodology (1994). This methodology consists of a counterfactual analysis that estimates what the earnings of informal workers would be if they were working in the formal sector or had formal employment. This methodological approach goes further than traditional estimations of Mincer's functions because after the econometric predictions for formal and informal workers are performed, a detailed set of individual gaps is calculated for every individual. This means that workers with different personal characteristics would have different gaps (Beccaria and Groisman, 2008; Jenkins, 1994).

The first step is to estimate earnings functions (monthly and hourly), such as those presented in equation (2). They are estimated separately for formal (F) and informal (I) workers (J = I,F). The same estimations are carried out for the two types of informality (EIS and IE) to compare the gaps when different definitions of informality are considered.

$$\ln w_{i,J} = x'_{i,J}\beta_J + e_{i,J} \tag{2}$$

The $x'_{i,J}$ vectors comprise the personal characteristics of workers that influence their level of earnings, such as age (experience), education (non-lineal relation), gender and relationship to the head of household, and sector of the job and geographical control variables. Each equation estimates a vector of coefficients. If there is any difference between the two vectors, it could be quantitative evidence of labor segmentation because one group (formal–informal) does not have the same treatment as the other.

Those estimations assume a conditional mean of zero ($E[e_{i,J}|x_J] = 0$), but this is not plausible due to the sample selection bias. Because the most important result is the coefficient vector, unbiased parameters need to be warranted. To correct the potential sample selection bias in equation (2), Heckman's methodology (1979) is included in the estimations. In this application, the sample selection bias correction is different from the traditional methodology for two reasons: first, because, when Mincer's function is estimated for formal (informal) workers, there are two groups that are excluded from the estimations: people who are working in the informal (formal) sector and people who are not working; second, because, differently from the case in which the estimations are performed by gender, there is a probability that informal/formal workers could change sector and potential for self-selection in the decision to work in the informal/formal sector.

Consequently, there are three labor market statuses: working in the informal sector (EIS and IE) ($y_{1i} = 1$), working in the formal sector ($y_{2i} = 1$), and out of the labor force ($y_{3i} = 1$). The first step of the Heckman methodology is a multinomial logit selection model (3); the s_i vector includes

variables that affect the likelihood of being in each of the mentioned labor market statuses (y_{ji}), which are the same personal characteristics used in equation (2), plus a dummy variable indicating whether the household has children and the marital status. This has been proposed by several studies as an alternative when the selection bias is not bivariate (Bourguignon et al., 2007; Dahl, 2002; Lee, 1983) and it was applied by Pradhan and van Soest (1995) to estimate the formal and informal labor earnings of Bolivia.

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

Based on the results of equation (3), Lee (1983) proposed to calculate the Mills ratio with the cumulative distribution function and the standard normal density. The second step is shown in equation (4), which contains $\hat{\lambda}_{i,J}$, the inverse Mills ratio, the coefficient (ψ_J) of which establishes the direction and significance of the selection bias.

$$\ln w_{i,J}=x_{i,J}'\beta_J+\hat{\lambda}_{i,J}\,\psi_J+e_{i,J} \tag{4}$$

Then, there are two incomes available for every informal worker: first, the predicted earnings and, second, the simulated earnings, which are equal to the earnings of an informal worker if he/she were paid as a formal worker. Equation (5) illustrates the individual gap for each informal (I) worker *i*:

$$b_{i,I}=\frac{\hat{r}_{i,I}-\hat{w}_{i,I}}{\hat{r}_{i,I}} \tag{5}$$

The estimated labor income for each informal worker ($\hat{w}_{i,I}$) is the result of estimating the income function (4), whose sample selection bias is corrected by the Heckman two-step methodology. The counterfactual income for each informal worker ($\hat{r}_{i,I}$) is calculated considering personal and occupational characteristics and also considering the earning structure of formal workers (β_F). It is important to examine how the inverse Mills ratio is calculated. Because some of the individual gaps for informal workers could be the result of differences in the selection process, they are supposed to have formal workers' sample selection when the counterfactual income for informal workers is analyzed:

$$\ln\left(\hat{r}_{i,I}\right)=x_{i,I}'\,\hat{\beta}_F+\hat{\lambda}_{i,I}\,\hat{\psi}_F \tag{6}$$

Equation (6) shows how the counterfactual income for each informal worker *i* is calculated. The personal gap is the result of comparing the estimated and the counterfactual income. Consequently, there is a vector with the distribution of the gap. It is important to have complete information for every worker, instead of an average gap, to perform an analysis of different populations and occupational groups. Based on that estimation, in the next section, quantitative evidence of the relation between poverty and informality is shown through microsimulations of incomes for informal workers and changing rates of informality.

Table 3 shows the average individual earnings gaps associated with informality considering both approaches to informality, IE and EIS, and hourly and monthly earnings for the period from 2002 to 2013. The gap is higher when monthly earnings and the IE approach are considered. On average, the monthly individual gap for informal employment is 43.6%,

Table 3 Average individual earnings gaps by informality type in Colombia, 2002–2013

Informality	Labor income	2002	2005	2008	2013
Informal sector	Monthly income	35.7	32.8	40.5	42.3
	Hourly income	30.4	28.6	36.6	37.6
Informal employment	Monthly income	40.9	38.9	44.0	43.6
	Hourly income	36.2	34.2	39.8	39.1

Source: Integrated Household Survey (NADS, 2014).
Notes: 1. The figures show the average increase in informal workers' earnings if they were paid as formal workers, taking the average income of the latter as the reference. 2. The number is the result of the logarithmic transformations in the income equations.

whereas the gap for the informal sector is 42.3%. This means that the same informal worker would noticeably increase his/her labor earnings if he/she were employed in the formal sector or had informal employment, or at least if the structure of earnings were the same as that of better jobs. The figures illustrate a trend of a reduction in the gap between 2002 and 2005 and a steady leveling of the average gap from 2008 to 2013.

These gaps are, partially, empirical evidence of segmentation by informality type in the Colombian labor market. The gaps are not the result of personal productivity but are the consequence of sectoral differences and the type of employment. Many other studies have found the same result using different methodological approaches and examining several countries (Appleton et al., 2005; Beccaria and Groisman, 2008; Charmes, 2009; Maurizio, 2013). Therefore, informality, which includes several types of workers, such as those working in small establishments, those with nonregulated labor relations, or those with family occupations, is a source of low incomes that cannot provide resources to overcome monetary poverty.

5 Relationship between labor informality and poverty in Colombia, 2002–2013

Workers who belong to poor households have high levels of informality and face high unemployment rates. Table 4 shows the percentage of workers by informality and poverty (if they belong to a household whose income is below the poverty threshold). The poverty headcount ratio is 18.3% for workers, 9 points lower than that for the total population, which is explained by the lower labor participation of poor households (households that have more children and more women who are not working). The figures of poverty and informality indicate that more

Table 4 Workers by informality type and poverty

Type of informality	Formal/informal	Poor	Not poor	Total
Informal sector	Employment in the informal sector	15.8	41.7	57.5
	Employment in the formal sector	2.5	40.0	42.5
	Total	18.3	81.7	100.0
Informal employment	Informal employment	16.5	43.1	59.6
	Formal employment	1.8	38.6	40.4
	Total	18.3	81.7	100.0

Source: Integrated Household Survey (NADS, 2014).
Notes: The figures are the percentage of total workers.

than 40% of workers are informal workers, but they are not poor. However, there is a strong (preliminary and hypothetical) relation between labor informality and poverty: 90% of the working poor have informal employment, and 86% are working in the informal sector.

Based on the preliminary relationship between poverty and informality, the paper will continue analyzing the research question through two quantitative exercises: first, the potential effect of excluding informality will be estimated; second, the actual effect of changes in informality between 2002 and 2013 will be shown. As above, monthly and hourly earnings and both approaches to informality will be considered. In addition, conventional FGT indicators will be taken as the measurement of poverty (equation (1)).

5.1 **Formalization effect on poverty indicators**

In this approach, the methodology is static, which means that the analysis considers only the last year in the study period (2013). This estimation tries to quantify the potential effect of formalization. Nevertheless, it is not a real scenario if informality does not exist, but this simulation should be interpreted as an analytical exercise with the intention of analyzing the quantitative importance of the relationship between poverty and labor informality (Beccaria and Groisman, 2008; Maurizio, 2015).

The estimation takes into account the individual gaps associated with informality, as shown in the previous section of the paper. Based on those results, the exercise is to calculate the simulation of household income per capita (HIPC) if informal workers were paid as if they were formal workers. The estimated ($HIPC^h_{Est}$,) and the simulated ($HIPC^h_{Sim}$) HIPC for household h are given by

$$HIPC^h_{Est} = \left[\left[\sum_{i=1}^{F} \hat{w}_i^h\right] + \left[\sum_{j=1}^{I} \hat{w}_j^h\right] + \left[\sum_{k=1}^{M} NL_k^h\right]\right] / M^h \tag{7}$$

$$HIPC^h_{Sim} = \left[\left[\sum_{i=1}^{F} \hat{w}_i^h\right] + \left[\sum_{j=1}^{I} \hat{r}_j^h\right] + \left[\sum_{k=1}^{M} NL_k^h\right]\right] / M^h \tag{8}$$

where $\hat{w}_i^h$ is the estimated labor income for formal worker i from household h; $\hat{w}_j^h$ is the estimated labor income for informal worker j from household h; NL_k^h is the nonlabor income for member k from household h; F and I are the number of formal and informal workers in each household h; M^h is the number of members in household h; and $\hat{r}_j^h$ (6) is the simulated income for informal worker j from household h.

The formalization effect (exclusion of individual earnings gaps by informality) on poverty indicators is equivalent to the difference between the indicator calculated with $HIPC^h_{Sim}$ and $HIPC^h_{Est}$, keeping the same threshold of poverty z_i:

$$\text{Formalization effect} = \text{FGT}\left(HIPC^h_{Sim}, z_i, \propto\right) - \text{FGT}\left(HIPC^h_{Est}, z_i, \propto\right) \tag{9}$$

The earnings gaps between formal and informal workers are related to the low incomes of poor households. Table 5 shows that if workers with informal employment were paid as if they were formal workers, keeping the same personal and productivity characteristics, the extent of poverty would decrease by 44.5% when monthly labor income is considered. A higher

formalization effect is found when gap and severity poverty indicators are analyzed; those indicators would be reduced by 51%.

The higher effect on the gap and severity of poverty is the evidence that workers who belong to poor households have informal employment, and they are people whose households have the greatest vulnerability and the lowest income. Therefore, improving labor market conditions (formalization process) would be a key factor in decreasing the level of poverty in the country. The estimated effects are consistent with the average gaps associated with informality, which are shown in Table 3; this means that the higher the gaps are, the larger the formalization effect is.

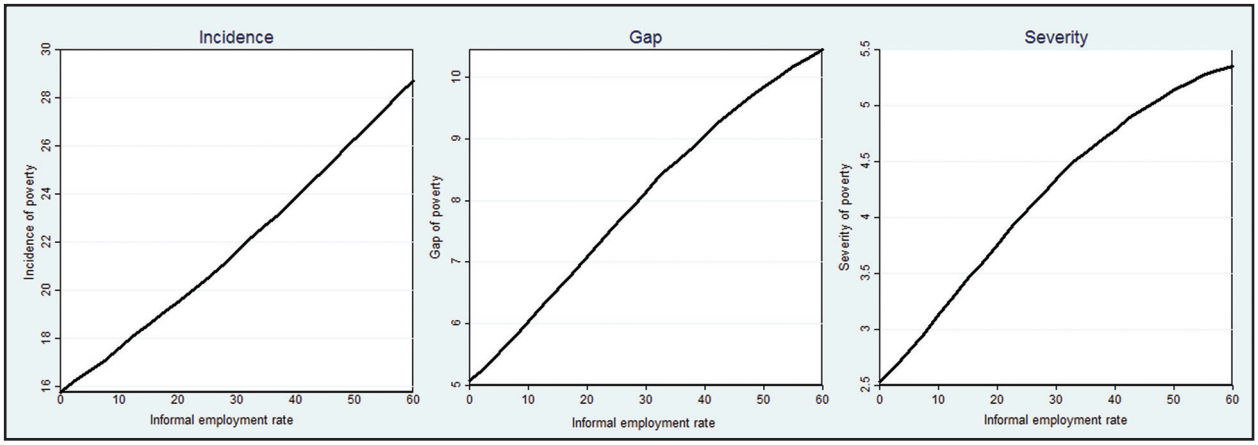
Figure 6 shows the formalization effect in a situation where continuous change in informality is simulated. The initial situation is characterized by the actual informality rate (59.6%) and poverty indicator in 2013 (28.4 headcount ratio, 10.5 poverty gap, and 5.5 severity); it is shown at the top of the figure. When informality is eliminated, the *x*-axis is zero and the effects on poverty indicators are changed, as shown in Table 5. In the middle, there is also a continuous change in poverty indicators when informality changes. As expected, the greater the reduction in informality, the higher the effect on the reduction in poverty. The order of formalization depends on the likelihood of a person being an informal worker: the beginning of the effect is calculated based on people who have a higher possibility of being formal workers. Once

Table 5 Formalization effect on poverty indicators in Colombia, 2013

Informality	Income	Change in indicators	Head count ratio	Gap	Severity
Informal sector	Monthly income	Change in indicator	−11.2	−4.8	−2.6
		Change in percentage	−40.0%	−47.1%	−49.0%
	Hourly income	Change in indicator	−10.1	−4.4	−2.4
		Change in percentage	−33.7%	−37.0%	−35.2%
Informal employment	Monthly income	Change in indicator	−12.7	−5.3	−2.8
		Change in percentage	−44.5%	−51.0%	−52.3%
	Hourly income	Change in indicator	−11.6	−4.6	−2.4
		Change in percentage	−41.3%	−45.9%	−46.4%

Source: Integrated Household Survey (NADS, 2014).

Figure 6 Continuous formalization and poverty indicators in Colombia.



Source: Integrated Household Survey. (NADS, 2014).
Note: Data were estimated considering monthly income and informal employment.

the order of formalization is organized (based on a probit model), the formalization effect is the elimination of the individual earnings gap; then, the new income is estimated for every worker, and the HIPC is simulated for each household. Based on that income, the new poverty indicators are calculated.

Initially, the reduction in informality is more effective in reducing the headcount ratio than in reducing the gap and severity. This is because workers who have a lower likelihood of being informal workers also have a smaller individual earnings gap associated with informality.[6] The primary result of this simulation is that the effect of the reduction in informality on poverty indicators is systematic and essential to increase the incomes and to improve the quality of life of people who belong to poor households.

Notably, this approach is a partial equilibrium estimation (ceteris paribus), and there are several aspects that could affect the figures shown in this exercise but are not included in this methodology.[7] Several studies have examined labor informality from this methodological perspective, and they have recognized that policies reducing informality would produce other economic and labor market effects, which are not analyzed in this method (Albrecht et al., 2009; Beccaria and Groisman, 2008; Gasparini and Tornarolli, 2009). In particular, as Maurizio (2015) stated, these microsimulations do not account for the possibility that the labor-formalization policy would imply effects on the unemployment rate and average earnings. However, this does not mean that formalization would be ineffective; rather, it could mean that formalization would not be as easy as is explained in this hypothetical scenario.

Boeri and Garibaldi (2007) consider that stronger control over informality does not necessarily reduce it; on the contrary, such a policy could boost the unemployment rate. Based on their general equilibrium model, the authors conclude that the potential effect of formalization is restricted by the macroeconomic environment and changes in productivity (Boeri and Garibaldi, 2007). In addition, informality would not be reduced automatically even if there were economic growth; rather, it should be promoted with labor and redistribution policy.

The results analyzed in this section show the potential impact of reductions in informality and in the earnings gaps associated with informality on poverty indicators. However, poverty and low incomes depend on many other factors, such as quality of employment, education, economic structure, and the health system. This indicates that even if there were no informal workers, poverty would be persistently high, with a headcount ratio of 15.8% and a poverty gap of 5.1.

5.2 **Changes in informality and its effect on poverty**

This section presents the actual effect of changes in informality (rate and gaps) on poverty through microsimulations. The starting point is the change in the rates of informality and poverty (Figure 2) and in the earnings gaps by informality type (Table 3). The estimates are performed considering two periods, 2002–2005 (National Continuous Survey) and 2008–2013 (Integrated Household Survey). Poverty indicators are estimated taking into account three types

6 This methodology implies that the beginning of the process is more costly because workers who have a lower likelihood of being informal have higher labor incomes even though they have a smaller gap.

7 A helpful comment from an anonymous referee suggested the importance of explaining in greater depth this limitation of the empirical exercise that is developed in the article, which similar studies have had to face and recognize.

of household incomes[8]: household income calculated considering the estimated labor incomes of formal and informal workers; household income calculated considering the estimated labor income of formal workers and the estimated income of informal workers, taking into account the gap from the initial year; and household income calculated as the labor income of formal and informal workers considering the gap from the initial year but also simulating the proportion of informal workers in the total to be the same as that in the initial year. Household income simulated to calculate the influence of informality on poverty reduction is

$$HIPC^{h}_{Sim,t} = \left[\left[\sum_{i=1}^{F} \hat{w}^{h}_{i,t}\right] + \left[\sum_{j=1}^{I} \hat{w}^{h}_{j,\pi_{t-1}}\right] + \left[\sum_{k=1}^{M} NL^{h}_{k,t}\right]\right] / M^{h} \tag{10}$$

In this equation (10), there is a temporal component (t) because the aim is to compare the rate and the gap associated with informality between two moments in time (t and t–1). The main difference between the definition of HIPC in equations (7) and (10) is that the estimation of labor earnings ($\hat{w}^{h}_{j,\pi_{t-1}}$) for each informal worker j of household h is performed with the penalty of informality in the initial year (π_{t-1}).

To estimate the effect of changes in the informality rate on the extent of poverty through the increase in labor incomes, the HIPC is calculated as in equation (10) for the year t but simulating the degree of informality from the initial year (t–1). Informal workers are classified by estimating a probit model that estimates the likelihood of a person being an informal worker. Based on the results of the estimated probability, workers are organized depending on whether they were informal in 2005 and 2013 (final years). Because Colombia's informality rate declined between the periods analyzed, the classification is from formal to informal workers until the informality rate of the initial year of comparison is achieved (t–1).[9] The simulation of the effect of changes in informality on poverty indicators is the result of estimated and simulated earnings and changes in informality rate δ:

Effect of change in informality gap on FGT

$$= \mathrm{FGT}\left(HIPC^{h}_{Est}, z_i, \delta_t, \alpha\right) - \mathrm{FGT}\left(HIPC^{h}_{Sim,t}, z_i, \delta_t, \alpha\right) \tag{11}$$

Effect of change in informality rate on FGT

$$= \mathrm{FGT}\left(HIPC^{h}_{Sim,t}, z_i, \delta_t, \alpha\right) - \mathrm{FGT}\left(HIPC^{h}_{Sim,t}, z_i, \delta_{t-1}, \alpha\right) \tag{12}$$

The total effect of changes in informality on poverty is the sum of two variations: the gap associated with informality (11) and the informality rate (12). This approach aims to measure how informality affects the extent of poverty; however, this is just a partial perspective, and several essential changes in the labor market, such as labor participation, unemployment rate, average change in labor incomes, returns of education and experience, or nonlabor incomes, have not been analyzed. As a consequence, a large change in poverty is not explained by informality but is the result of factors that are not considered in these estimates.

Table 6 shows the results of microsimulations that measure the actual effect of changes in informality on poverty indicators in Colombia from 2002 to 2013, considering two different

8 Nonlabor incomes are not changed.

9 If the informality rate had increased, the simulation would have changed the classification of workers from informal to formal.

Table 6 Effects of changes in informality on poverty indicators in Colombia, 2002–2013. Monthly labor income

Period	Informality	Kind of effect		Headcount ratio		Gap		Severity	
				Change in indicator	% total change	Change in indicator	% total change	Change in indicator	% total change
2002–2005	**Informal sector**	**Change explained by informality**	**Earnings gap**	**−0.5**	**10.8**	**−0.3**	**9.9**	**−0.2**	**8.7**
			Informality rate	**−0.5**	**12.0**	**−0.3**	**9.9**	**−0.2**	**9.2**
		Change not explained by informality		−3.3	77.2	−2.3	80.1	−1.7	82.1
		Total change		−4.3	100.0	−2.8	100.0	−2.1	100.0
	Informal employment	**Change explained by informality**	**Earnings gap**	**−0.5**	**11.5**	**−0.2**	**8.5**	**−0.2**	**7.8**
			Informality rate	**−0.8**	**17.9**	**−0.4**	**14.9**	**−0.2**	**11.7**
		Change not explained by informality		−3.3	70.6	−2.2	76.6	−1.7	80.6
		Total change		−4.7	100.0	−2.8	100.0	−2.1	100.0
2008–2013	**Informal Sector**	**Change explained by informality**	**Earnings gap**	**0.4**	**−4.0**	**0.2**	**−3.9**	**0.1**	**−3.7**
			Informality rate	**−0.1**	**1.0**	**−0.1**	**1.1**	**0.0**	**1.2**
		Change not explained by informality		−10.6	103.0	−5.5	102.8	−3.3	102.5
		Total change		−10.3	100.0	−5.3	100.0	−3.2	100.0
	Informal employment	**Change explained by informality**	**Earnings gap**	**0.3**	**−2.6**	**0.1**	**−2.1**	**0.1**	**−1.8**
			Informality rate	**−0.3**	**2.5**	**−0.1**	**2.2**	**−0.1**	**2.1**
		Change not explained by informality		−10.1	100.1	−5.3	99.8	−3.3	99.7
		Total change		−10.1	100.0	−5.3	100.0	−3.3	100.0

Source: Integrated Household Survey (NADS, 2014).

Note: Bold entries specify the effect of changes in informality on poverty indicators.

periods (2002–2005, 2008–2013).[10] Table 6 only shows the results considering monthly labor income, though estimates were also made considering hourly income with similar results. As shown above, there is divergence between the changes in informality and the changes in poverty indicators, which is verified in the results of this simulation: informality has had little influence on poverty indicator changes. Although informality has great potential to reduce poverty (as shown through the formalization effect), the actual effect has been very limited. This is more evident in the recent period (2008–2013), when the informality rate declined very little and the earnings gap by informality type increased. This result indicates that in the period when poverty was greatly reduced, the situation in the labor market associated with informality did not contribute to the change.

Between 2002 and 2005, when poverty reduced annually much less than in the next period (2008–2013), the role of informality in the reduction was more important; however, the stronger role was partially a consequence of the small decrease in poverty indicators. In that period, the informality rate decreased between 3% and 4%, whereas the informality earnings gap in monthly income reduced by 3%; these changes affected the poverty indicator to some extent. Specifically, the effect was 22.8% for the headcount ratio and was less notable for the other indicators, with 19.8% for the poverty gap and 17.9% for poverty severity.

Although the gap and severity of poverty were the poverty indicators with higher reductions, the influence of informality was smaller for these indicators. Changes in informality more strongly affected the labor incomes of workers whose household income was not far from the threshold of poverty; that is why informality was more important for the reduction in the headcount ratio than for the reduction in poverty severity.

The persistence of labor informality in a context of poverty reduction and acceptable economic growth indicates that improvements in the quality of life of people whose incomes are low have been the consequence of different factors, but the problem remains that their labor conditions have not improved. In addition, the trend shows the difficulties of achieving better labor conditions through formalization. This does not mean that the earnings of informal workers have not increased, but they could have increased as a result of several factors, such as changes in personal characteristics and remuneration. It is important to emphasize that even though thousands of informal workers have overcome monetary poverty, they still have a large earnings gap in comparison with formal workers, and for the majority of them, their labor conditions have not changed.

6 Conclusion

The relationship between poverty and the labor market in developing countries is closer when the low labor incomes and quality of employment are analyzed than when the lack of income due to unemployment is considered. In Latin American countries, on average, the greater the extent of poverty, the larger the extent of informal sector and informal employment.

The formalization effect (drop in earnings gaps associated with informality) indicates a large effect of labor-formalizing policy on labor income improvement; as a consequence, such a policy would have a large impact on the reduction in poverty. Specifically, the formalization of

10 The long period is divided into shorter years because two household surveys are considered.

workers would decrease the number of poor people by approximately 40%, with larger effects on the gap and severity of poverty. Consequently, the improvement in labor market conditions (in terms of a reduction in informality) would have a significant effect on the reduction in poverty, but it would also contribute to income redistribution. However, this is a hypothetical situation, and there are not-included highly probable effects on unemployment rate and average earnings; depending on the macroeconomic environment, such improvements would have a limited effect on poverty reduction for some kinds of households and would imply a large cost of approximately 22% of the total labor income.

Although formalization would have a large effect on the reduction in poverty indicators, the recent trend in Colombia has shown that the persistence of informality has not contributed to poverty reduction. Other factors have been more important for the effect (between 40% and 50% reduction) in Colombia from 2002 to 2013. This result has two implications: one in terms of labor policy and the other concerning the research agenda. The latter is related to the importance of analyzing and trying to identify which labor changes have influenced poverty reduction since the beginning of the twenty-first century. On the other hand, formalization is a key element of labor policy, and it would have a huge effect on other dimensions of well-being, such as poverty and inequality. Therefore, focusing on informality and improving the quality of jobs (among them, labor laws and a minimum wage) could improve the welfare of workers and reduce the high vulnerability of households with low incomes.

Declarations

Availability of data and material

The datasets used and analyzed in the current study are available from the corresponding author on reasonable request.

Competing interest

The author declares that he has no competing interest.

Funding

La Salle University, Colombia, provided funding for the research "Poverty and labor discrimination in Colombia." This article was partially written based on that research and was improved during the time the project was conducted.

Author contributions

RMST performed all analyses and wrote the manuscript.

Acknowledgments

Not applicable.

References

Albrecht, James; Lucas Navarro; Susan Vroman (2009): The Effects of Labour Market Policies in an Economy with an Informal Sector. The Economic Journal 119(539), 1105-1129. doi:10.1111/j.1468-0297.2009.02268.x

Appleton, Simon; Lina Song; Qingjie Xia (2005): Has China Crossed the River? The Evolution of Wage Structure in Urban China during Reform and Retrenchment. Journal of Comparative Economics 33(4), 644-663. doi:10.1016/j.jce.2005.08.005

Azevedo, Joao; Gabriela Inchauste; Sergio Olivieri; Jaime Saavedra; Hernan Winkler (2013): Is Labor Income Responsible for Poverty Reduction? A Decomposition Approach. The World Bank Policy Research Working Paper No. 6414.

Banerjee, Abhijit; Esther Duflo (2012): Poor Economics. A Radical Rethinking of the Way to Fight Global Poverty. New York.

Beccaria, Luis; Fernando Groisman (2008): Argentina Desigual. Buenos Aires.

Boeri, Tito; Pietro Garibaldi (2007): Shadow Sorting, in: Frankel, Jeffrey; Christopher Pissarides (eds.), NBER International Seminar on Macroeconomics 2005. National Bureau of Economic Research, 125-163.

Bourguignon, François; Martin Fornier; Marc Gurgand (2007): Selection Bias Corrections Based on the Multinomial Logit Model: Monte Carlo Comparisons. Journal of Economic Surveys 21(1), 174-205. doi:10.1111/j.1467-6419.2007.00503.x

Charmes, Jacques (2009): Concepts Measurement and Trends, in: Jütting, Johannes; Juan de Laiglesia (eds.), Is Informal Normal? Towards More and Better Jobs in Developing Countries. Paris, 27-62.

Cruces, Guillermo; Leonardo Gasparini (2013): Políticas sociales para la reducción de la desigualdad y la pobreza en América Latina y el Caribe. Diagnóstico, propuesta y proyecciones en base a la experiencia reciente. CEDLAS Documento de trabajo No. 142.

Dahl, Gordon (2002): Mobility and the Returns to Education: Testing a Roy Model with Multiple Markets. Econometrica 70(6), 2367-2420. doi:10.1111/1468-0262.00379

Economic Commission for Latin America and the Caribbean (2014a): Social Panorama of Latin America. 2014, in: Economic Commission for Latin America and the Caribbean. https://repositorio.cepal.org/bitstream/handle/11362/37627/4/S1420728_en.pdf. Accessed 22 November 2018.

Economic Commission for Latin America and the Caribbean (2014b): Databases and Statistical Publications. CEPALSTAT. http://estadisticas.cepal.org/cepalstat/WEB_CEPALSTAT/estadisticasIndicadores.asp?idioma=i. Accessed October 2018.

Fields, Gary (2012): Working Hard, Working Poor. A Global Journey. New York.

Foster, James; Joel Greer; Erik Thorbecke (1984): A Class of Decomposable Poverty Measures. Econometrica 52(3), 761-766. doi:10.2307/1913475

Gasparini, Leonardo; Leopoldo Tornarolli (2009): Labor Informality in Latin America and the Caribbean: Patterns and Trends from Household Survey Microdata. Revista desarrollo y sociedad 63, 13-80. doi:10.13043/dys.63.1

Heckman, James (1979): Sample Selection Bias as a Specification Error. Econometrica 47(1), 153-161. doi:10.2307/1912352

Hussmanns, Ralf (2005): Measuring the Informal Economy: From Employment in the Informal Sector to Informal Employment. International Labour Office Bureau of Statistics. Working Paper No. 53.

International Conference of Labour Statisticians (2003): Final Report of the 17th International Conference of Labour Statisticians, in: International Labour Office https://www.ilo.org/wcmsp5/groups/public/---dgreports/---stat/documents/meetingdocument/wcms_087568.pdf. Accessed July 2018.

Jenkins, Stephen (1994): Earnings Discrimination Measurement: A Distributional Approach. Journal of Econometrics 61, 81-102. doi:10.1016/0304-4076(94)90078-7

Lee, Lung-Fei (1983): Generalized Econometric Models with Selectivity. Econometrica 51(2), 507-512. doi:10.2307/1912003

Majid, Nomaan (2001): The Working Poor in Developing Countries. International Labour Review 140(3), 271-291. doi:10.1111/j.1564-913X.2001.tb00533.x

Maurizio, Roxana (2013): Informalidad laboral y brechas salariales en América Latina, in: Luciana Gandini; Mauricio Padrón (eds.), Población y trabajo en América Latina: abordajes teórico-metodológicos y tendencias empíricas recientes. Mexico, 197-222.

Maurizio, Roxana (2015): Labor Informality and Poverty in Latin America: The Case of Argentina, Brazil, Chile and Peru, in: Cling, Jean-Pierre; Stéphane Lagrée; Mireille Razafindrakoto; François Roubaud (eds.), The Informal Economy in Developing Countries. New York. 21-49.

Medina, Fernando; Marco Galván (2014): Crecimiento económico, pobreza y distribución del ingreso. Fundamentos teóricos y evidencia empírica para América Latina, 1997-2007. Comisión Económica para América Latina y el Caribe. Serie estudios estadísticos No.82.

National Administrative Department of Statistics (2014): Microdatos anonimizados. Gran Encuesta Integrada de Hogares, in: National Administrative Department of Statistics. https://sitios.dane.gov.co/anda-index/. Accessed June, July and August 2018.

Pradhan, Menno; Arthur van Soest (1995): Formal and Informal Sector Employment in Urban Areas of Bolivia. Labour Economics 2, 275-297. doi:10.1016/0927-5371(95)80032-S

Sánchez, Roberto (2015): Descomposiciones de los cambios en la pobreza en Colombia 2002-2012. Revista desarrollo y sociedad 75, 349-398. doi:10.13043/dys.75.9