

Informality and Mobility in the Labor Market: A pseudo-panel's approach

Informalidad y movilidad en el mercado laboral: una aproximación de pseudo-panel

*Gustavo Canavire-Bacarreza**

*Joaquin A. Urrego***

*Fabiola Saavedra****

Abstract

One of the main limitations of labor market analysis in developing countries is the lack of appropriate panel data information. This paper extends the methodology of Dang *et al.* (2014) to examine labor market mobility between the formal and informal sectors in Bolivia and Colombia building consistent pseudo panels from repeated cross-sectional survey data. After testing the robustness of the methodology, we identified confidence intervals for mobility's group in Bolivia and Colombia (formal to formal, informal to informal, formal to informal and informal to formal). The results provide evidence that in Bolivia and Colombia mobility between labor sectors is relatively low, which can explain the low variability of the informality rate in those countries. Results suggest that the number of people who move to the informal sector tends to be larger than those who scape from the informal market to the formal, or at least there is more variability across years for the first ones. This implies that public policies focused on labor market in Latin America would not lead to significant improvements if mobility patterns do not change.

Keywords: Mobility, Informality, Pseudo-panel, Labor, Bolivia, Colombia.

* Universidad EAFIT, Medellín, Colombia and IZA, Bonn, Germany.
Contact: gcanavir@eafit.edu.co

** The World Bank, Washington DC, USA.
Contact: jurrego@worldbank.org

*** Universidad EAFIT, Medellín, Colombia.
Contact: fsaaved1@eafit.edu.co

Resumen

Una de las principales limitaciones del análisis del mercado laboral en los países en desarrollo es la falta de información apropiada de datos de panel. Este documento extiende la metodología de Dang *et al.*, (2014) para examinar la movilidad en el mercado laboral entre los sectores formal e informal en Bolivia y Colombia, construyendo un pseudo-panel consistente a partir de datos de encuestas de corte transversal repetidas. Después de poner a prueba la robustez de la metodología, identificamos los intervalos de confianza de los grupos de movilidad en Bolivia y Colombia (formal a formal, informal a informal, formal a informal e informal a formal). Los resultados proveen evidencia de que en Colombia y Bolivia la movilidad entre los sectores laborales es relativamente baja, lo cual explica la baja variabilidad de la tasa de informalidad en estos países. Los resultados sugieren que el número de personas que se mueven al sector informal tiende a ser más grande que la cantidad de trabajadores que escapan del mercado informal hacia el formal, o por lo menos existe más variabilidad entre años para los primeros. Esto implica que las políticas públicas enfocadas en el mercado laboral en América Latina no llevarían a mejoras significativas si los patrones de movilidad no cambian.

Palabras clave: Movilidad, informalidad, pseudo-panel, trabajo, Bolivia, Colombia.

Classification/Clasificación JEL: J6, J46, C83, C52

1. Introduction

In a simple theoretical labor market, participants face a dichotomous labor force decision, namely, to either work or remain unemployed. In real-life economies, however, especially in developing countries, labor force participation is less straightforward due to the existence of both informal and formal labor markets, with the main difference among countries being the degree of this segregation (Meghir *et al.*, 2011). In Latin American, the informal sector typically holds greater importance because the majority of the population holds informal jobs. In Colombia, almost 56% of the active population is employed in the informal sector (Galvis, 2012), while in Bolivia, this figure is over 60% (Evia & Pacheco, 2010). This bias towards the informal sector not only affects social cohesion; regulations are also more difficult to formulate and implement and government budgets are directly affected (Gómez & Morán, 2012).

In this context, movements to and from the informal sector are of extreme importance to understanding labor markets in developing countries and, more specifically, in Latin America.

It is not usually possible to measure this movement, however, mainly due to the lack of data following individuals' behavior over time, especially in developing countries. Therefore, the objective of this paper is to overcome this limitation by expanding Dang *et al.* (2014) methodology and by using cross sectional data to estimate movements in and out of the informal labor market. To test this method, we use an employment panel household survey for Bolivia and apply it to the Colombian case (where the panel structure is unavailable).

The principal results of this analysis show that labor market mobility is reduced in both countries. People who remain in the informal sector represent over 36% and 54% of the working population in Colombia and Bolivia, respectively. However, what is most important is the proportion of the population that escapes the informal sector (in Colombia, between 0.28% and 8.6%; in Bolivia, approximately 7%) compared to the proportion that enters it; the last figure can be larger than first one.

The remainder of this paper is organized in six sections. In the next section, we briefly review the literature on informality in Latin America and the suitable methodologies to analyze it. The third section explains the methodology used, while sections four and five present the dataset and main results. Robustness checks are described in section six, and the conclusions of the research are drawn in section seven.

2. A brief literature review

Informality in labor markets is characteristic of both developed and developing economies and, therefore, generates significant social costs in all nations. Schneider (2004 and 2007), for example, showed that the informal sector represents between 8% and 23% of GDP in developed countries compared with 23% and 60% in developing nations. Other authors (Bourguignon, 1979; Galvis, 2012) have found that informal workers tend to generate a lower proportion of physical capital and earn lower average wages than formal workers. Furthermore, because the formal sector usually contracts the most qualified workers, it is characterized by an excess labor supply that it cannot employ. Therefore, the informal sector must employ these residual workers (Rauch, 1991; Maloney, 2004).

Education is considered one of the principal barriers to mobility between the formal and informal sectors. Uribe *et al.* (2007) showed that if access to education were equal for all population groups, all individuals could access better job opportunities in the formal sector.

Maloney (2004) used longitudinal data for Argentina, Brazil and especially Mexico to estimate individual optimal choice in selecting a market in which to work, subject to the level of human capital attained and average productivity in the formal and informal sectors. The economic cycle and minimum wage are also related to the optimization of labor market mobility. In recessions, the proportion of the active economic population typically increases, but the minimum wage is a barrier for the formal sector, and after the formal sector has absorbed as many workers as it can, people generally turn to the informal market.

Bosh & Maloney (2010) used similar data to Maloney (2004) but with the objective of examining mobility between markets; their study characterized people who chose the informal sector as their best option. Bosh & Maloney (2010) showed that mobility is more volatile in the informal sector; the jobs of salaried informal workers typically last for approximately one year, while the jobs of formal workers last approximately 4.5 years. In addition, the flow of workers between markets is almost asymmetrical; the proportion of people who move from the informal to the formal market is larger than the flow in the opposite direction. However, Bosh & Maloney (2010) did identify an additional sector in the labor market: self-employment. Their conclusions show that people move from the informal and formal sectors to self-employment. This third option behaves similar to a “workers’ bag,” where the other two-segmented markets can take their employees.

Gagnon (2009) defined four categories of employment: inactive, bad jobs in the informal sector, good jobs in the informal sector and employment in the formal sector. The author identified a principal incentive for movements between sectors. People who work in the informal sector only prefer to move if the increase in earnings will compensate the increased cost of working in the formal sector; in contrast, those who work in the formal sector would earn more money if they moved to the informal sector. These findings are strictly related to poverty and individual conditions. Gagnon (2009) showed that mobility depends on education, networks and a healthy economic, institutional and social environment. Moreover, the author proved that greater mobility is a mechanism to improve the living conditions of the poor who work in the informal sector.

Gagnon (2009) found similar results to those of Bosch & Maloney (2010) in research on Mexico. The proportion of the population who moved from the informal sector to the formal sector over the course of that study was 19.7%. Nevertheless, approximately 18.2% of the subjects entered the informal sector over the same period. The proportion of those who

remained in the informal sector in Mexico in 2005 was 42.1%, although the level of informality in Mexico was 18.8%.

Bosch, Goni & Maloney (2007) developed another case study using Brazilian data. One conclusion of this work is based on job to job transitions, and they find that mobility between the formal and informal sectors behaves similar to the United States' scenario, where the proportion of people who escape from the informal sector is similar to the proportion who enter it.

Slonimczyk & Gimpelson (2015) investigated informality mobility in Russia, where longitudinal data surveys are available. Their research shows that approximately 50% of people remain in the informal sector, while approximately 26% escape it; however, the proportion of people who worked in the formal sector in 2002 and moved to the informal sector by 2011 are different across gender, 7% for males and only 4% for females.

It is not always possible to study these dynamics with the available data; most household surveys are cross sectional and do not follow individuals across time.

This is probably the reason why papers about labor mobility in Colombia and Bolivia are still scarce. In Bolivia, Villarroel *et al.* (2011) study mobility patterns in labor market. However, their focus is on entrepreneurship, self-employment, and employer. They found that self-employment behaves more like a "casual job" than a form of entrepreneurship (it supports our definition used for informality in the next section). Therefore, we propose a simple method following Dang *et al.* (2014) approach to poverty analysis to characterize movements in and out of informal labor markets.

3. Methodology

Dang *et al.* (2014) method can be used to estimate the probability of remaining, escaping, or entering into any socio-economic phenomenon. Since this method is based in household survey, its applications are not limited to some specific topics. As an example, Cruces *et al.* (2013) noted its failure to predict income mobility in relation to poverty in Chile. These authors reviewed the construction of pseudo-panels and found that Dang *et al.* (2014) approach provides biased results related to the proportion of the population considered to be below the poverty line.

Although these results have been found in the study of poverty in Chile that not implies that it has the same bias when we study other countries or other types of situations, specifically given than the poverty line is exogenous and this reduces the flexibility of the methodology to move the threshold. However, this paper aims to give us information about the study of labor mobility. Applying this method to labor outcomes has its own structural differences respect to poverty analysis, one particularly relevant is the definition of the threshold which determines if someone works in the informal market, over the cutoff, or in the formal one, below the threshold.

For the initial analysis in this study, a cross-sectional estimation was carried out using the Colombian household survey (GEIH, its acronym in Spanish) for 2008 and 2011 ($t = 1; 2$) and the Bolivian employment panel survey (ETE, its acronym in Spanish) for the first quarter of 2010 and second quarter of 2011. The Colombian household survey is representative for the main metropolitan areas of the city, including their rural and urban areas. It surveys about 200,000 and 300,000 households across the country. The GEIH is annual and its main focus is socio-economic variables. For Bolivia, we used the employment survey. Although, the ETE is not a household survey, it indeed provides the relevant information we need to study labor market. The Bolivian survey focuses in the urban area of the country, particularly La Paz, Cochabamba and Santa Cruz.

To begin, we define that someone is informal when the person work in a firm with less than 10 employees and she/he has less than complete secondary education. Furthermore, we defined a probability cutoff (c) that categorized under what conditions each individual could be informal, which remained the same for each survey and individual. The cutoff is a probability level that is applied after the primary estimation of the probability to be informal. This first stage is applied to transform the bivariate dependent variable into a continuous variable, which provides the probability of being informal for each observation. A higher cutoff is the threshold that determines under what point individuals are informal. The cutoff can be thought of as exogenous, but its empirical distinction will be shown later in the text.

Consistent with the approach of Dang *et al.* (2014), we define the following four groups. The first is given by:

$$\Pr(\hat{\rho}_{i2} > c \quad \text{and} \quad \hat{\rho}_{i1} > c) \quad (1)$$

Where $\hat{\rho}_{it}$ represents the individual and i 's probability to be informal during the period t . This group includes the people who remained in the informal sector in both surveys. The next group is:

$$\Pr(\hat{\rho}_{i2} < c \text{ and } \hat{\rho}_{i1} < c) \quad (2)$$

This group is comprised of workers who remained in the formal sector in both surveys. The third group includes individuals who entered into the informal sector. This measure indicates that they were in the formal sector in the first survey, but in the informal sector in the second survey. This group can be written as:

$$\Pr(\hat{\rho}_{i2} > c \text{ and } \hat{\rho}_{i1} < c) \quad (3)$$

The last group is defined as:

$$\Pr(\hat{\rho}_{i2} < c \text{ and } \hat{\rho}_{i1} > c) \quad (4)$$

This group is the opposite of the third group, namely, those people who moved from the informal sector to the formal sector between surveys.

In the next step, we estimate a linear probability model (LPM), where the informality condition is the dependent variable and the exogenous variables are defined by characteristics considered to be invariant in the short run:

$$\hat{\rho}_{it} = \beta_{1it}X_{1it} + \beta_{2it}X_{2it} + \varepsilon_{it} \quad t = 1, 2 \quad (5)$$

Where:

X_{1it} is a matrix of individual characteristics, such as education, gender, experience, and employment, and X_{2it} is a matrix of household characteristics, such as household head gender, poverty, location, and overcrowding.

Because this equation is estimated using an LPM, the predicted values can be larger than 1 or even negative. Therefore, we use different cutoff values to find the most appropriate form for the data generation process. In this regard, the first approach is given by the level at which the methodology can replicate the real data, as follows:

$$k_1 < \Pr(\hat{\rho}_{i2} > c \text{ and } \hat{\rho}_{i1} > c) < k_2 \quad k \in [k_1, k_2] \quad (6)$$

$$m_1 < \Pr(\hat{\rho}_{i2} < c \text{ and } \hat{\rho}_{i1} < c) < m_2 \quad m \in [m_1, m_2] \quad (7)$$

$$g_1 < \Pr(\hat{\rho}_{i2} < c \text{ and } \hat{\rho}_{i1} > c) < g_2 \quad g \in [g_1, g_2] \quad (8)$$

$$n_1 < \Pr(\hat{\rho}_{i2} > c \text{ and } \hat{\rho}_{i1} < c) < n_2 \quad n \in [n_1, n_2] \quad (9)$$

where k , m , g and n are the real proportions of each of the four groups defined earlier. Empirically, we find a particular frequency that the cutoff satisfies:

$$F(c) = \Pr(\hat{\rho}_i < c) = \textit{Real Informality Rate} \quad (10)$$

In other words, the proportion of people below the cutoff level in the two surveys is approximately equal to the average real informality rate in recent years. By using this definition, we thus calculated the cutoff for each country.

Then, because we know that both household surveys are applied to different individuals, we use the coefficients obtained in the LPM regression to predict the probability of being informal in the first survey for individuals in the second survey. We build an estimated vector of informal probability by using the first survey coefficient and the invariant characteristics in the second survey. Further, we define how to trade the residuals. Dang *et al.* (2014) found a non-negative relationship between the residuals of each survey, suggesting that the bound that can be obtained for the model depends on the assumptions of that correlation.

The first assumption is necessary to estimate the upper bound of the four groups. We assume that the correlation between each error term is equal to zero. Thus, to estimate the probability of working in the informal sector in the second survey, we generate random residuals by using the distribution of the residuals in the first survey. We can thus write equation 11 as follows:

$$\hat{\rho}_{it}^{2u} = \hat{\beta}_{1i1} X_{1i1}^2 + \hat{\beta}_{2i1} X_{2i1}^2 + \tilde{\varepsilon}_{i1} \quad t = 1, 2 \quad (11)$$

where

$\hat{\rho}_{it}^{2u}$ is the estimated probability of working in the informal sector in the first survey (upper bound) for individuals in the second survey, X_{1i1}^2 and X_{2i1}^2 are individual and household characteristics in the second survey, respectively, which we use as retrospective variables, $\tilde{\varepsilon}_{i1}$ is the residual error term for individuals in the second survey that is generated by using the distribution of the error term in the first survey.

The lower bound is estimated under the assumption of perfect autocorrelation between the residuals in both surveys. Hence, we use the predicted values for the second survey derived from equation (5) to estimate the residuals. Then, we use these residuals without changing any elements, such as the approach for calculating the error term in the first survey for individuals in the second survey.

Formally:

$$\hat{\rho}_{it}^{2L} = \hat{\beta}_{1i1} X_{1i1}^2 + \hat{\beta}_{2i1} X_{2i1}^2 + \bar{\varepsilon}_{i2} \quad t = 1, 2 \quad (12)$$

where

$\bar{\varepsilon}_{i2}$ is the error term obtained in the estimation of equation (5) for the second survey.

Thus, we can rewrite the four groups for the estimation as follows:

$$\Pr(\hat{\rho}_{i2}^2 > c \quad \text{and} \quad \hat{\rho}_{i1}^{2v} > c) \quad (13)$$

$$\Pr(\hat{\rho}_{i2}^2 < c \quad \text{and} \quad \hat{\rho}_{i1}^{2v} < c) \quad (14)$$

$$\Pr(\hat{\rho}_{i2}^2 > c \quad \text{and} \quad \hat{\rho}_{i1}^{2v} < c) \quad (15)$$

$$\Pr(\hat{\rho}_{i2}^2 < c \quad \text{and} \quad \hat{\rho}_{i1}^{2v} > c) \quad (16)$$

where \mathbf{v} is composed by $\{U, L\}$, where U refers to the upper bound and L to the lower bound.

Finally, we define the number of repetitions necessary to calculate the upper bound. Given that the upper bound is built as a function of the random residuals and that only the final one depends on the distribution of the estimated error term in the first survey, the process should be repeated n times to provide real significance to the model (for main estimation $n = 10$). This process is not applied to the lower bound, which assumes the same error term in both surveys for all individuals.

4. Dataset

As discussed above, we use ETE data (Bolivia) for 2010 and 2011 and GEIH data (Colombia) for 2008 and 2011 to estimate the mobility bounds of informality. Cruces *et al.* (2011) found that the methodology of Dang *et al.* (2014) did not change significantly depending on the time gap between surveys, implying that the mobility bounds do not change regardless of whether short-run or long-run data are used. In our case, three years is useful to identify movement into or out of the informal sector.

First, we apply the methodology presented in section three to our Bolivian employment survey data (ETE). The most important advantage of this survey is that it makes at least two observations for the same individual, thus providing us with insightful job mobility information.

In terms of our individual and household variables, their principal characteristics should be invariant, which is essential in the short run (*i.e.*, fewer than five years). These variables included education level, gender, experience, age, location, whether the house (apartment) was in the city or near towns, labor characteristics, and second sources of income. The other regression variable is poverty condition (*i.e.*, position with respect to the poverty line).

From the Colombian dataset, we sampled 327,669 individuals in the first survey (2008) and 357,901 in the second (2011). The percentage of informal workers was similar in both surveys (55.52% and 55.69%, respectively). The situation in Bolivia was comparable. In the first quarter of 2010, 63.4% of the sample was working in the informal sector, compared with 63.6% in the second quarter of 2011. The Bolivian data sampled 21,504 individuals for the first quarter of 2010 and 8,262 for second quarter of 2011.

In terms of the gender divide, no difference was notable in Colombia: 56.4% of men were informal workers versus 54.3% of women in 2008. For 2011, the respective percentages were 56.6% for men and 54.6% for women. However, we found a real relationship between informality and poverty. Altogether, 80.3% of people living below the poverty line in 2008 were informal workers, while 54.8% of people considered to be non-poor were formal workers. This situation did not change in 2011.

With respect to the number of children under the age of six in a household, 55.2% of households with one child under six years old were employed in the informal sector in 2008 compared with 72.5% for households with three children under six. This proportion grew to 87.9% for households with six children, implying that the propensity to work in the informal sector increases with household size. The conclusion is the same when using data from the second survey.

Another important factor to analyze is the relationship between informality and part-time work (defined as working fewer than 40 hours per week). As expected, 68.3% of part-time workers were employed in the informal sector, while 47.8% of full-time workers were employed in the formal sector.

5. Main Results

From the Bolivian household data, we used equation (1) to estimate the number of observations ($m = 1816$). If we know the real distribution of the population between the different groups, we can then replicate the real data using Dang *et al.* (2014) methodology. From that estimation, we found that the probability distribution for working in the informal sector was biased to the left, as there were many values above 0.5, including those above 1. This was one reason for using different cutoff levels. Finally, we found that a cutoff level equal to 0.9 allows that percentage of people behind it is equal to informality rate and that cutoff better replicated the real mobility bounds in Bolivia. Table 1 shows the results of the principal estimation of the mobility bounds. The real data are included in the estimated bounds for each group.

These results suggest a significant incidence of informality in Bolivia; indeed the majority of the population was working in the informal sector in both surveys. Further, we found that more people enter the informal sector than escape from it, implying a positive variation in the

informal population, but the bounds show that the variation in people who escape from the informal sector is greater.

We found that the population beneath the cutoff level of 0.9 was approximately 61%, close to the average informality rate over recent years in Bolivia. The relationship between the cutoff level and average rate of informality is an important basis on which to choose the cutoff for Colombia, where we found that the probability distribution was biased to the right, including some values less than 0. Based on a cutoff level of 0.6, the population below this threshold was approximately 55% (*i.e.*, the average informality rate over recent years). In the next section, these bounds are estimated by using other cutoff values.

These results are shown in the lower half of Table 1. In contrast to Bolivia, the proportion of people who remain in the informal sector is lower than that for people who retain their formal employment. The bounds for mobility between sectors are thus similar, which explains the low degree of variation in informality in Colombia. In addition, the rank of the bounds is similar in the both groups (formal to informal and informal to formal).

The mobility bounds for Colombia are similar to those for Bolivia, but the difference in the average informality rate is also significant. The problem is the same; mobility within the labor market is low, and it is more likely that an informal worker remains and new formal ones enter to informal sector than an informal worker will leave the informal sector.

Table 1
Real Mobility vs. Estimated Mobility

	Real	Lower-Bound	Upper-Bound
Panel Bolivia: 2010q1 and 2011q2			
Formal-Formal	28.38	35.60	23.37
Formal-Informal	6.57	1.98	10.02
Informal-Formal	6.88	0.21	12.44
Informal-Informal	55.18	62.21	54.77
Panel Colombia: 2008 and 2012			
Formal-Formal	-	55.16	46.85
Formal-Informal	-	0.15	7.97
Informal-Formal	-	0.28	8.59
Informal-Informal	-	44.40	36.59

The first part of the table corresponds to the estimations for Bolivia. The bottom part of the table is for Colombia's dataset. Column Real is only available for Bolivia, given the structure of the dataset the Real mobility values can be calculated just for Bolivia.

6. Robustness Check

Three variations of the model are presented in this section to verify that the main results do not change. Similar to Cruces *et al.* (2011) performed important checks of the methodology employed in our study using data from Latin American countries. For our robustness check, we made changes to the cutoff level, panel length, and the number of iterations for the upper bound, as described in the upcoming subsections.

A. Cutoff level

By using Bolivian data, we found that the cutoff represented the threshold beneath which lies the same percentage of informal workers in the sample and the proportion according to the official rate. However, to prove that this approach provides a good approximation, we estimated different bounds using two other cutoff levels, namely, five percentage points above and below the original cutoff.

Table 2 displays the results. The upper half shows results for Bolivia and the lower half for Colombia. Columns identified with [1] present the results for a cutoff level of 0.85 for Bolivia and 0.55 for Colombia, columns [2] are the main estimation, and columns [3] present the results for a cutoff level of 0.95 (Bolivia) and 0.65 (Colombia). These results suggest that the bounds change little when using a lower cutoff and move closer to the actual values when using a higher cutoff. That is most apparent when we look mobility groups that what happen with remain groups (formal to formal and informal to informal).

Furthermore, while the bounds of the formal-formal group move to the left as the cutoff level increases, the proportion of this population that remains in the formal sector decreases as the cutoff increases. Likewise, the proportion of workers that remains in the informal group in the second survey increases when the cutoff rises.

In relation to bounds that represent mobility between the two sectors, the changes are not significant and are similar to the principal estimation, namely, different cutoff levels present similar bounds for people who escape from and enter the informal sector.

Table 2
Sensibility to Cut-off

	[3] LB (+0.05)	[2] LB (0)	[1] LB (-0.05)	[1] UB (-0.05)	[2] UB (0)	[3] UB (+0.05)
Panel Bolivia						
Formal-Formal	28.99	35.60	43.75	34.13	23.37	14.39
Formal-Informal	2.31	1.98	1.69	9.26	10.02	8.28
Informal-Formal	0.10	0.21	0.15	9.77	12.44	14.70
Informal-Informal	62.63	62.21	54.40	46.83	54.17	68.61
Panel Colombia						
Formal-Formal	52.72	55.16	57.45	51.65	46.85	42.03
Formal-Informal	0.46	0.15	0.20	8.44	7.97	6.73
Informal-Formal	0.32	0.28	0.50	6.34	8.59	11.00
Informal-Informal	46.50	44.40	41.85	33.61	36.59	40.24

The columns [2] show the main estimation. Columns [1] employ principal cut-off minus a factor of 0.05; that means, for Bolivia the cut-off is 0.85 and for Colombia is 0.55. Likewise, columns [3] show the estimation with a principal cut-off plus 0.05. So for Bolivia is 0.95 and for Colombia is 0.65.

B. Panel length

In a second robustness check, we used different panel lengths. For Bolivia, we examined the differences brought about by having a longer gap between surveys using the surveys from the second quarter of 2009 and the second quarter of 2011. This difference in length compared with the principal estimation is sufficient to assess changes in bounds when the gap between surveys increases.

We found that the changes in the bounds for Bolivia were small (Table 3). Similar to the changes in the cutoff level discussed in subsection 6.1. However, while the estimate of people who escape from or enter the informal sector does not change significantly, the variation is less than one percentage point. For Colombia, we used the surveys from 2006 and 2011 and found similar results to those for Bolivia. The changes were not significant, especially the mobility bounds, confirming Cruces *et al.* (2011) findings that panel length does not change the principal results when using the presented methodology.

Table 3
Sensibility to Panel Length

	[2] LB	[1] LB	[1] UB	[2] UB
Panel Bolivia				
Formal-Formal	38.91	35.60	23.37	24.13
Formal-Informal	0.63	1.68	10.02	10.13
Informal-Formal	1.10	0.21	12.44	15.88
Informal-Informal	59.36	62.21	54.17	49.86
Panel Colombia				
Formal-Formal	48.62	55.16	46.85	43.19
Formal-Informal	0.43	0.15	7.97	11.77
Informal-Formal	1.11	0.28	8.59	6.54
Informal-Informal	49.84	44.40	36.59	38.49

The columns [1] contain the results of the principal panel and the columns [2] display the results of alternative length panel. For Bolivia we used data of 2009q2 and 2011q2; and for Colombia, 2006 and 2008.

C. Number of iterations for upper bound

As noted earlier, the calculation of the upper bound assumes that there is no correlation between the error terms of the first and second surveys, but we can use the distribution of the residuals in the former to generate estimated residuals for the individuals in the latter. For this check, however, it is crucial to repeat this exercise many times to observe the strength of this assumption.

Table 4 displays the changes in the upper bound for the four groups in Bolivia and Colombia. The principal estimation is given by 10 repetitions and since this number seems low, we repeat the process with 100 and 200 repetitions. We found that the differences are minimal, but greater in the Bolivian data than in the Colombian one. Additionally, when using 100 or 200 iterations, the upper bound values in Colombia are equal. Thus, the main conclusion is the theoretical assumption that the zero correlation between error terms in each survey are robust; the principal conclusion concerning the methodology is not affected by the number of iterations of the upper bound.

Table 4
Sensibility to Number of Repetitions

	LB	UB	UB-100	UB-200
Panel Bolivia: 2010q1 and 2011q2				
Formal-Formal	35.60	23.37	23.62	23.60
Formal-Informal	1.68	10.02	10.14	10.08
Informal-Formal	0.21	12.44	12.19	12.20
Informal-Informal	62.21	54.17	54.05	54.11
Panel Colombia: 2008 and 2011				
Formal-Formal	55.15	46.85	46.87	46.87
Formal-Informal	0.15	7.97	7.94	7.95
Informal-Formal	0.28	8.59	8.57	8.58
Informal-Informal	44.40	36.59	36.61	36.61

The column UB-100 represents the estimation of upper bounds using 100 repetitions of the exercise and the column UB-200 is using 200 repetitions.

7. Conclusions

In this study, we used the methodology of Dang *et al.* (2014), which is suitable for explaining job mobility, to describe recent trends in the informal sector in Colombia, particularly with regard to the number of people who move into or out of the informal sector. We found that the proportion of people who remain in the informal sector was high, implying that it is difficult for an informal worker to alter his or her labor situation. Additionally, the mobility bounds show low intersectoral mobility over time. This finding indicates that although some people are able to leave the informal sector, the proportion of people who escape is similar to the proportion of those who enter, meaning that the informality rate does not change over time.

The overall suitability of Dang *et al.* (2014) approach is important for conducting research in countries, such as those in Latin America, where data are not always readily available. This methodology allows researchers to investigate people mobility and characterizes the driving forces that affect the lack of advances in any phenomenon. Performing a synthetic panel would also be a good option for improving the research output in these countries.

This paper shows one of the most relevant characteristic of any socio-economic phenomenon: persistence. Identifying and monitoring the level of persistence in informality over time will be helpful for public policy design. Making the labor market more dynamic

will improve the informal rate in Colombia and Bolivia, though the more significant improvements are likely to happen in the long-run than in the short-run.

In conclusion, the findings of this study suggest that policymakers need to focus on the mobility capabilities of the market at the time they implement interventions. Then, they can use the persistence characteristic of the market to switch labor outcomes—moving from high rates of informality to larger rates of formality—, making those who are in the formal sector remaining over time and bringing more informal workers to the formal sector. It is extremely important to ensure that the proportion of people who escape informality overcome the proportion of people who enter it, before focusing on reducing the proportion of people who remain in the informal sector. This will lead to reduce informality over time.

Fecha de recepción: 2 de febrero de 2017

Fecha de aceptación: 26 de abril de 2017

Manejado por la A.B.C.E.

References

1. Bosch, M., E. Goni and W. Maloney. 2007. "The determinants of rising informality in Brazil: Evidence of gross worker flows". Technical Report 2970, Institute for the Study of Labor (IZA).
2. Bosch, M. and W. F. Maloney. 2010. "Comparative analysis of labor market dynamics using markov processes: An application to informality". *Labour Economics*, 17(4):621 - 631.
3. Bourguignon, F. 1979. "Pobreza y dualismo en el sector urbano de las economías en desarrollo: El caso de Colombia". *Desarrollo y Sociedad*, 1:39-72.
4. Cruces, G., G. Fields and M. Viollaz. 2013. "Can the limitations of panel datasets be overcome by using pseudo-panels to estimate income mobility?" Technical report, Institute for the Study of Labor (IZA).
5. Dang, H.A., P. Lanjouw, J. Luoto and D. McKenzie. 2014. "Using repeated cross-sections to explore movements into and out of poverty". *Journal of Development Economics*, 107:112 - 128.
6. Evia, J. L. and N. Pacheco. 2010. "Una perspectiva económica sobre la informalidad en Bolivia". Technical report, The Konrad-Adenauer-Stiftung (KAS).
7. Gagnon, J. 2009. "Moving out of bad: jobs more mobility, more opportunity". In: Jutting, J. and de LaiglesiaJan, J., (editors), *Is informal normal? Towards more and better jobs in developing countries*, 115-142. The Organization for Economic Co-operation and Development (OECD).
8. Galvis, L. A. 2012. "Informalidad laboral en las áreas urbanas de Colombia". Technical Report 164, Documentos de trabajo sobre economía regional, Banco de la Republica.
9. Gómez, J. C. and D. Morán. 2012. "Informalidad y tributación en América Latina: explorando los nexos para mejorar la equidad". Technical Report 124, Serie Macroeconomía del Desarrollo.
10. Maloney, W.F. 2004. "Informality revisited". *World Development*, 32(7):1159 -1178.
11. Meghir, C. & L. Pistaferri. 2011. "Earnings, consumption and life cycle choices". *Handbook of Labor Economics*, 4, 773-854.
12. Rauch, J. E. 1991. "Modelling the informal sector formally". *Journal of Development Economics*, 35(1):33 - 47.

13. Schneider, F. 2004. "The size of the shadow economies of 145 countries all over the world: First results over the period 1999 to 2003". Technical Report 1431, Institute for the Study of Labor (IZA).
14. ----- 2007. "The shadow economies in middle and south America and their influence on the oficial economy: what do we know?". Technical Report, Johannes Kepler University.
15. Slonimczyk, F. and V. Gimpelson. 2015. "Informality and mobility". *Economics of Transition*, 23(2):299-341.
16. Uribe, J. I., C. H. Ortiz and G. A. García. 2007. "La segmentación del mercado laboral colombiano en la década de los noventa". *Economía Institucional*, 9(16):189-221.
17. Villarroel, P., W. Hernani-Limarino and A. Eid. 2011. "Entrepreneurship and economic mobility: A case study of Bolivia". *Working Paper*, Fundación ARU.

