

OBEGEF – Observatório de Economia e Gestão de Fraude

WORKING PAPERS

#42

Persistence of informality
in a developing country



Juan Muro; Jhon James Mora



OBEGEF
Observatório de Economia
e Gestão de Fraude

>> **FICHA TÉCNICA****PERSISTENCE OF INFORMALITY IN A DEVELOPING COUNTRY**

WORKING PAPERS Nº 42 / 2015

OBEGEF – Observatório de Economia e Gestão de Fraude

Autores: Juan Muro^{1,3}; Jhon James Mora^{2,3}

Editor: Edições Húmus

1ª Edição: Fevereiro de 2015

ISBN: 978-989-755-148-2

Localização web: <http://www.gestaodefraude.eu>

Preço: gratuito na edição electrónica, acesso por download.

Solicitação ao leitor: Transmita-nos a sua opinião sobre este trabalho.

Paper in I2FC:2014 - Multiple Perspectives of the Shadow Economy

©: É permitida a cópia de partes deste documento, sem qualquer modificação, para utilização individual. A reprodução de partes do seu conteúdo é permitida exclusivamente em documentos científicos, com indicação expressa da fonte.

Não é permitida qualquer utilização comercial. Não é permitida a sua disponibilização através de rede electrónica ou qualquer forma de partilha electrónica.

Em caso de dúvida ou pedido de autorização, contactar directamente o OBEGEF (obegef@fep.up.pt).

©: Permission to copy parts of this document, without modification, for individual use. The reproduction of parts of the text only is permitted in scientific papers, with bibliographic information of the source.

No commercial use is allowed. Not allowed put it in any network or in any form of electronic sharing.

In case of doubt or request authorization, contact directly the OBEGEF (obegef@fep.up.pt).

¹ Economics Department of Alcala University (Spain); e-mail: juan.muro@uah.es

² Economics Department of Icesi University (Colombia)); e-mail: jjmora@icesi.edu.co

³ Member of Alcametrica at the University of Alcalá and of the Quantitative methods research at Icesi University

>> ÍNDICE

Introduction	5
Informality in Colombia	7
The dynamics of informality	10
Data and Results	12
Extension of the definition of informality	17
Conclusions	20
References	21

>> RESUMO

A informalidade é um fenómeno comum nos países em desenvolvimento e raro nos países industrializados. A persistência de emprego informal é indicativa da impossibilidade de sair deste estado durante um determinado período de tempo. Usando dados em painel (pseudo panel data), apresenta-se evidência mostrando que este fenómeno ocorre num país em desenvolvimento como a Colômbia, onde a educação ajuda a mitigar a ocorrência de tal persistência. Os autores também apresentam evidência de que a existência de um aumento do salário mínimo resulta não só em informalidade acrescida, mas também num aumento da persistência da informalidade. Este tipo de evidência pode ser usada para discutir a persistência da informalidade noutros países em desenvolvimento.

Palavras-chave: Informalidade dinâmica, pseudo painéis, Modelos Probit.

>> ABSTRACT

Informality is a common phenomenon in developing countries and an unusual one in industrialized countries. The persistence of informal employment is indicative of the impossibility of moving out of this status for a certain period of time. Using pseudo panel data, empirical evidence is presented to show that this phenomenon occurs in a developing country like Colombia where education helps mitigate said persistent occurrence. The authors also present evidence that a minimum salary increase does not only result in increased informality, but also increases the persistence of informality. This kind of evidence can be used for discussing the persistence of informality in other developing countries.

Key words: Dynamic Informality, Pseudo Panel, Probit Models.

JEL: C36, C51 J81, J88

>> INTRODUCTION

Informality is one of the typical characteristics of the labor market in developing countries (Meghir, Narita and Robin 2011) which has been linked with the existence of segmentation in the labor market and with the better conditions that the labor market can offer [Perry, 2007, Maloney and Núñez 2003].

Like other Latin American countries, Colombia experiences an increasingly common phenomenon with regard to informality, which is the sustained permanence in informality. While Brazil had rates close to 20% between 2002 and 2007, Argentina between 40% and 45%, and Paraguay rates from 70% to 75% between 2001 and 2006, Colombia has had an informality rate of 50% for more than two decades now [Bustamante 2011, Ruffer and Knight 2007].¹

Since there are no data panels available in Colombia, an analysis of the factors that impact this persistent informality becomes a complex matter which, to a large extent, has an influence on the labor policy measures that the Colombian government should take. Although the Colombian Department of Statistics incorporated a retrospective question (the reply to which could be used for inferring an informality condition) in the Integrated General Household Survey regarding the occupation status in the previous period, the analysis performed is limited in that informality can only be inferred from the occupation status. Additionally, if an appropriate method is not available, then the effects of individual heterogeneity could not be modeled because the population sample changes in every period.

The main contribution of this paper is that it describes the modeling of the persistence of informality as a dynamic process using pseudo panel data. The aforementioned procedure makes it possible to extend the analysis of informality over time by incorporating other definitions of informality such as, e.g., the lack of an employment contract or healthcare system coverage, and including non-observable individual heterogeneity in the analysis. By monitoring a series of cohorts of individuals and taking into account non-observable heterogeneity, we modeled the persistence of informality in Colombia and the factors that lead to a decrease or increase of informality.

The findings show that the duration of the informality status is greater than that of the formality status. They also reveal that, depending on the

¹ As properly suggested by Bernal “There is a fairly moderate fluctuation of the levels of informality in Colombia during the business cycle” (Bernal 2009, 202).

definition of informality, the persistence of informality ranges from 20% to 30%. It was also found that the persistence of informality is higher for males, household heads, and married individuals. Nevertheless, educational level or university degrees are factors that substantially reduce the persistence of informality of individuals.

From an economic policy perspective, an interesting final result is that rigid labor market factors, such as the minimum salary, have an impact not only on informality, but also on the persistence of informality in Colombia. Hence, an increase in the minimum wage results in a greater probability of continuing with situations of informality and, therefore, also increases the size of informality. This result is an extension of the standard two-sector model by Welch (1976), Gramlich (1976), and Mincer (1976) where: "Following a minimum wage increase, the principal prediction of the two sector Model is that wages in the uncovered sector fall as a result of displaced workers in the covered sector moving into uncovered sector employment. Therefore, the wage effect is expected to be positive in the covered sector and negative in the uncovered sector, while the expected employment effect is negative in the first and positive in the second" (Lemos 2010,225; Arango, Herrera and Posada 2008, 216).

This paper is divided into five different sections. The second section discusses informality in Colombia. The third presents a dynamic model of informality for pseudo panel data. The fourth presents the results of the model taking into account the definition of informality by occupation, and the last section elaborates on the concept of informality in order to consider the lack of employment contracts or healthcare system membership. The results are also presented in the last section.

>> INFORMALITY IN COLOMBIA

Providing a definition of informality is not an easy task. Informality is linked with the employment status (self-employed or independent workers), company size, and the lack of an employment contract or healthcare system coverage (healthcare and pension). According to the Colombian Department of Statistics (DANE, from its Spanish acronym), the official definition of informality states that an informal worker is an individual who works at a company of 10 or less workers (including the employer and/or partner) who are employed at all agencies of business establishments. It also includes independent domestic employees, day laborers or pawns with the exception of professional employers at companies of ten or less workers and non-compensated family workers (DANE 2007).

The works of López, Sierra and Henao (1987), Caro (1995), López (1996), Henao, Rojas and Parra (1999), Ortiz, Uribe and Correa (2006), and Flórez (2002), among others, show high informality rates in the range from 50% to 60% in the decades of the 1980s and 1990s.¹ Guataquí, García and Rodríguez (2010), on the other hand, consider two different kinds of informality. The first one is called a strong definition of informality which refers to formal workers as those who are part of a special or contributory healthcare system as contributors, not as beneficiaries. They make contributions to a pension fund or receive a pension, have an employment contract in writing, and earn more than 95% of the minimum hourly wage. There is also a second or “weak” definition which considers formal workers to be those who are affiliated to the social security system as contributors to special, subsidized or contributory systems. Based on these two definitions, informality ranged from 26% to 63% in 2010 (Guataqui et al., page 105).

In discussing the determining factors of informality, Núñez (2002) contends that the entry to the informal sector in Colombia is a voluntary and conscientious action on the part of individuals. Similarly, Ribero (2003) and Uribe, Ortiz and Correa (2006) modeled informality as the result of individual socioeconomic characteristics where education has a negative impact on the likelihood of participating [Núñez (2002), Ribero (2003) and Bernal (2009)]. Gender ranks as the third most important determining factor. The sign of

¹ In Colombia, like in many other developing countries, the definition of informality has been associated with available information for recording it, as properly pointed out by Mondragón-Vélez, Peña and Wills (2010, page 68)

the gender is a function of the incorporation of women in the labor market; Núñez (2002) and Uribe, Ortiz and Correa (2006) found a negative effect.

There are two recent works about Colombia that are worthy of note. Within the context of a static pseudo panel, Mora and Muro (2014) discuss the impact of the minimum wage on informality, which is defined as the lack of an employment contract and social security benefits (i.e. healthcare and pension). Thanks to a cohort-based analysis, the authors found that minimum wage increases generate a replacement effect among young and elderly workers who are working in the labor market on an informal basis and that there is low mobility from one sector to another. Meanwhile, Mondragón-Vélez, Peña and Wills (2010) also analyzed the effect of the minimum wage on informality. Based on the government's official definition, these authors found that a 20 percentage point increase of the minimum wage implies a 2 percentage point increase of the informality rate (page 84). In addition to these findings, the greatest contribution on the part of Mondragón-Vélez, Peña and Wills (2010) is their discussion of the transitions between the formal and informal sectors in Colombia, where information from the General Integrated Household Survey enables building matrices that represent the transition from the formal to the informal sector and vice versa based on retrospective question about the occupational status in the previous period. While it is true that the question about occupation does not address all kinds of informality, according to the official definition of informality, the number of self-employed individuals is close to 60% of the total number of informal workers (Bustamante 2011). The findings of Mondragón-Vélez, Peña and Wills (2010) show that 80% of the workers who were in the informal sector in the previous period continue to work on an informal basis in the current period, while only 20% of the workers who were in the informal sector in the previous period moved to the formal sector of the economy. Hence, "These values indicate some persistence across sectors" (Mondragón-Vélez, Peña and Wills 2010, page 86). In observing the number of data points used for estimating the probability of transitions (see Tables 4, 5, and 6), something that catches a great deal of attention is the 95.55% and 93.05% sample [size] reduction¹. Apparently, the authors only took into account individuals

¹ While the number of observations in the estimates of the informality equations is 459,105 (Tables 2 and 3), the numbers of estimations of the probability of transition towards the informal sector are 20,430 and 31,880 (Tables 4, 5, and 6).

whose employment status changed from formal to informal and vice versa¹. Therefore, analyzing only those workers whose employment status changed results in a selection bias, and disregarding the dynamic of informality excludes important aspects such as movements between the formal and informal sectors over time.

¹ As probably noted by Kugler (2010) “In this case, there would be a selected sample as only those who change jobs during the past year would be included in the analysis. This could generate positive biases if, for example, those who change jobs are more likely to be discontent with their working conditions and to move toward jobs with better conditions (page 98).”

>> THE DYNAMICS OF INFORMALITY

Although it is true that informality is a serious problem, the extent of persistence of informality is an even more serious problem. If there were no persistence, then high informality rates in the period $t-1$ would not have any consequences in the period t , and informality would be a transient, not a permanent phenomenon.

When a data panel is available, this persistence can usually be determined in the form of a discrete probit or logit model based on state dependence (Wooldridge 2002). Nevertheless, since there is no data panel in Colombia, but cross-sectional data over time (i.e. different individuals at each point in time), there is a need to propose a dynamic pseudo panel model.

Moffitt (1993), Collado (1998), Girma (2000), and Mackenzie (2004) developed these kinds of models. In particular, Moffitt (1993) posits that in light of the absence of the variable of interest at $t-1$, instead of the lagged values of the dependent variable, it is possible to use the predicted value which is obtained using least ordinary squares. Like Girma (2000) and Mackenzie (2004), Collado (1998) also uses the generalized method of moments for obtaining the lagged dependent variable. Verbeek and Vella (2004) propose that Moffitt's (1993) estimator of least ordinary squares leads to inconsistent estimators, unless the exogenous variables do not change over time or the exogeneous variables that do change over time do not have any kind of self-correlation, which is also passed on to the error term, thus giving rise to a positive correlation between the error term and the exogenous variables, which results in inconsistent estimators. Therefore, Verbeek and Vella (2004) developed an increased estimator of instrumental variables which must meet the following conditions:

1. The instruments must be exogenous.
2. Error prediction must be orthogonal to the instruments.
3. The instruments must be capable of capturing sufficient variation of the lagged dependent variable, regardless of the variation of exogenous variables.

In particular, Verbeek and Vella's procedure (2004) entails incorporating a set of additional time-invariant regressions into the main equation. This can be achieved by including cohort dummies. Although variables can be included which are not necessarily dummy variables, they must be time-invariant variables (Verbeek and Vella 14:2004).

Thus, following Verbeek and Vella (2004), we propose the following model:

$$\begin{aligned} \text{Inf}_{i(t)} = & 1[\rho \text{Inf}_{i(t),t-1} + \tau \text{Inf}_{i,t0} + \beta_1 \text{Sex}_{i(t)} + \beta_2 \text{Diplom}_{i(t)} + \beta_3 \text{HousdH}_{i(t)} + \\ & + \beta_4 \text{Married}_{i(t)} + \beta_5 \text{MinWage}_{i(t)} + \lambda Z_{i(t)} + \mu_{i(t)} > 0] \quad (1) \\ \mu_{i(t),t} = & C_{i(t)} + U_{i(t)} \end{aligned}$$

Whereas, $\text{Inf}_{i(t),t}$ in (1) is informality in period t , $\text{Inf}_{i(t),t-1}$ is informality in the previous period, “sex” is a dummy variable for sex. $\text{Diplom}_{i(t),t-1}$ is a dummy variable for the effect of diplomas in Colombia (Mora and Muro, 2008). $\text{HousdH}_{i(t),t-1}$ is a dummy variable for household head. $\text{Married}_{i(t),t-1}$ is a dummy variable when an individual is married, and $\text{MinWage}_{i(t),t-1}$ is the ratio of the minimum wage to the mean wage in each city. $Z_{i(t),t-1}$ are cohort dummies, and $\mu_{i(t),t-1}$ is the random error term.

The dependence between states is captured by ρ because when ρ is statistically different from zero, there is a relationship between informality in the period t and informality in the period $t-1$, and therefore, there is persistence of informality.

It is also worth noting that in iterating the above equation and carrying out a recurrent substitution, the problem of initial conditions arises. As it is the case with panel data, it can be assumed that either informality in the initial period is exogenous and independent from $C_{i(t)}$ or that the process is in equilibrium (it began in an infinite past). We assumed that informality in the initial period is exogenous and, as in the traditional case of panel data, it can be modeled by integrating “outside” the non-observed heterogeneity following Chamberlain (1980). In particular, this implies defining individual non-observable heterogeneity as:

$$C_{i(t)} | \text{Inf}_{i(t),0}, Z_{i(t)} \sim \text{Normal}(\alpha_0 + \alpha_1 \text{Inf}_{i(t),0} + \alpha_2 Z_{i(t)}, \sigma^2) \quad (2)$$

Lastly, the average cohort-based state dependence or estimate of persistence of informality is obtained from the distribution average taking into account individual heterogeneity, i.e.

$$NT^{-1} \sum_{i(t)=1}^{NT} \Phi(\check{\rho} \text{Inf}_{i(t),t-1} + \check{\beta} X_{i(t)}^* + \check{\alpha}_0 + \check{\alpha}_1 \text{Inf}_{i(t),0} + \check{\alpha}_2 Z_{i(t)}) (1 + \sigma^2)^{-\frac{1}{2}} \quad (3)$$

Equation (3) is evaluated at X^* which consists of covariants at values different from zero or one, in the case of discrete variables, or the mean if the variables are continuous.

>> DATA AND RESULTS

The data comes from the Great Integrated Household Survey (GEIH, from its Spanish acronym) which is conducted by the Colombian Department of Statistics (DANE, Departamento Administrativo Nacional de Estadística). In particular, information available about the first half of every year from 2007 to 2010 was used.¹ In total, 74,198 workers in the ages of 12 to 55 years were selected. This was followed by the definition of eight cohorts of individuals from the above mentioned age range as shown in the following table:

Table 1. Individuals & Cohorts

Cohort	Year of Birth	Age in 2007	Age in 2010	Average Cell Size
1	1996-2000	12	15	2,698
2	1991-1995	17	20	3,397
3	1986-1990	22	25	3,484
4	1981-1985	27	30	3,365
5	1976-1980	32	35	3,114
6	1971-1975	37	40	2,540
7	1966-1970	42	45	1,854
8	1961-1965	47	50	1,125

Source: Author's calculations

As shown in Table 1 above, the lowest number of individuals is in the last cohort (1,125), and the largest number of individuals is in the third cohort (3,365). The informality transition matrices were then calculated.

Like in Mondragón-Vélez, Peña and Wills (2010), self-employed workers were also considered to be informal. The transition matrices were built considering all self-employed workers who had previously had a self-employment job and had answered the question: "What did you do in your previous job?" to be informal. The results are listed below:

Table 2. Transition Probability Matrix by Employment Sector.

		2008	
		Formal	Informal
2007	Formal	0.6944	0.3056
	Informal	0.4744	0.5256

		2009	
		Formal	Informal
2008	Formal	0.6773	0.3227
	Informal	0.5043	0.4957
		2010	
		Formal	Informal
2009	Formal	0.6873	0.3127
	Informal	0.5224	0.4776

Source: National Household Survey. Author's calculations

As shown in Table 2 above, there was a probability of nearly 50% of staying in the informality sector in 2008, 49% in 2009, and 47% in 2010. Following Cunnigham and Bustos (2011), the transition matrices provide sufficient information for building the period of duration of a given status and the propensity to move to a different status. The results are shown in the following table:

Table 3. Period of Duration and Move out in the Formal/Informal sector.

Year/Variables	Period of Duration in Formal/ Informal sector		Propensity to Move Out formal/ informal sector	
	Formal	Informal	Formal	Informal
2007-2008	1.444	1.903	0.732	0.268
2008-2009	1.476	2.017	0.731	0.269
2009-2010	1.455	2.094	0.707	0.293

Source; National Household survey. Author's calculations

As can be seen in Table 3 above, the period of duration in the informal sector is longer than that in situations of formality. Similarly, the propensity to move out of informality is lower than propensity to move out of the formal sector.

The persistence of informality was then estimated. The results are outlined below:

Table 4. Dynamic Informality

Variables / Informality Definition	Pool-Probit Informality by Occupation	Dynamic Pseudo Panel	
		Informality by Occupation	Informality by Estimated Occupation
Informality t-1	0.4037111 (0.0120208)**	0.6798455 (0.1673007)**	0.7872379 (0.366894)**
Informality 2007	0.0698673 (0.0096904)**	0.0580487 (0.0096758)**	0.0319727 (0.0103254)**
Sex	0.1435948 (0.0107626)**	0.1655845 (0.0109304)**	0.1511652 (0.0161016)**
University Diploma	-0.2431492 (0.0161305)**	-0.2245209 (0.019238)**	-0.2202587 (0.0317243)**
Post-Diploma (Master, PhD)	-0.411741 (0.0273145)**	-0.455624 (0.0323411)**	-0.4715311 (0.0378855)**
Household Head	0.222215 (0.0104794)*	0.1364036 (0.0108656)**	0.126015 (0.0236198)**
Married	0.0498865 (0.0102322)**	0.0372382 (0.0104362)**	0.0259848 (0.0099968)**
MinWage/MedianWage	0.1874136 (0.0802224)**	0.1474542 (0.035873)**	0.255142 (0.0883981)**
Dity Effects	yes	Yes	Yes
Year Effects	Yes	Yes	Yes
Cohort Effects	No	Yes	Yes
Rank Condition		chi2(8)=313.60	chi2(8)=128.92
Log-Likelihood	-45,759.689	-81,189.902	-96,830.992
Percent Correctly Predicted	66.32%	66.24%	62.99%
ROC Area		0,5682 (0.0015)**	0,5684 (0.0018)**
Probability	0.3419	0.3418	0.3511
N	74,198	74,198	74,198

Note: ** Statistically significant at the 1 percent level. Robust Standard errors are in parentheses.

The results for a probit model for the entire period are shown in the first column in Table 4 above. The informality value in the previous period is lower than 50%, and all variables were statistically significant. The two following columns show the estimates of persistence of informality using the cohorts as instruments. The second column shows information reported by individuals about their status in t -1 using cohorts, $Z_{i(t)}$, as explanatory variables of informality in each period following Vella and Verbeek's (2004) approach.

There is not a great deal of difference between the results obtained from information about informality reported by individuals in $t-1$ and those obtained using an orthogonal projection of informality based on $Z_{i(t)}$. Not only do variables keep their expected signs, but also continue to be statistically significant. It can also be seen that the percentage of forecasts/predictions is fairly similar, and the likelihood of occurrence of the event is close to 34%.

In order to learn more about the predictions generated by both these models, the ROC curves were estimated and a contrast revealed that both areas were statistically different from each other. The results show that the predictions from both models (area under the curve) are not statistically different from one another, and the probability that they are identical to each other cannot be rejected at a significance level of 1%.

The state dependence was then estimated. The results of the estimates are presented below:

Table 5. Average Partial Effects

Average State Dependence	Observed Informal	Estimated Informal
Total	0.2272665	0.2121066
Sex	0.2928682	0.2675843
University Diploma	0.1435132	0.1416378
Household Head	0.2803951	0.2552631
Married	0.2416592	0.2208608
Wages	0.3010518	0.3375336

Source; National Household Survey. Author's calculations

The state dependence in the pool-probit without considering the covariants was 0.11. On the other hand, the state dependence in the dynamic model without considering the covariants was 0.122 in observed informality and 0.21 in the case of estimated informality. Thus, considering individual non-observable heterogeneity increases the estimate of persistence of informality almost by 50%.

The results also demonstrate that the probability of males being in an informal employment status when the individuals were in the informal sector in the previous sector is 0.26. Additionally, if an individual holds a university degree, then this probability drops down to 0.14.¹

Lastly, a minimum wage increase above the average wage in each city results in an increase of the probability of being in a situation of informality to

¹ Because of the existence of sheepskin effects in the Colombian labor market, university diplomas were used, not the years of education (Mora, 2003; Mora and Muro 2008; Hernández 2010, Muñoz and Cano 2010).

0.33. This result is consistent with Welch-Gramlich-Mincer's model in which the existence of two sectors generates labor market segmentation.^{1 2}

¹ Lemos (2009) did not find any evidence of labor market segmentation in Brazil and, therefore, he did not find any positive effects of a minimum wage increase on the size of informality.

² Galvis (2002), Ortiz, Uribe and Badillo (2008), Mesa, García and Roa (2008), Mora (2009) and Franco and Ramos (2010) found evidence of labor market segmentation in Colombia.

>> EXTENSION OF THE DEFINITION OF INFORMALITY

Making inferences about informality based on employment data provides a limited amount of information regarding the problem of persistence of informality. Therefore, the concept of informality was extended to those workers who do not have an employment contract or social security coverage (no contributions to a pension or healthcare system). This much broader definition shows that informality is nearly 45%, which is far greater than the 35% that could be obtained based on employment data.

Based on the above definition, an estimate was made of the period of duration in a given status and of the propensity to migrate out of a given status. The results obtained were as follows:

Table 6. Period of Duration and Move Out in the Formal/Informal sector.

Years / Variables	Period of Duration in Formal/Informal sector		Propensity to Move Out formal/informal sector	
	Formal	Informal	Formal	Informal
2007-2008	1.727	2.130	0.558	0.442
2008-2009	1.746	1.994	0.539	0.461
2009-2010	1.677	2.212	0.576	0.424

Source; National Household Survey. Author's calculations

As can be seen in Table 4, the period of duration in a situation of informality is close to two years, and the propensity to move out of informality still continues to be greater than the propensity to move out of formality. The results of the dynamic informality model are presented below:

Table 7. Extended Dynamic Informality.

	Informality Extended: Health, Pension, Contract
Informality t-1	0.9128039 (0.2351304)**
Informality 2007	0.0438298 (0.0106346)**
Sex	0.0579238 (0.01184405)**
University Diploma	-0.6902527 (0.032789)**

Postg-Diploma (Master, PhD)	-0.10098951 (0.0559806)**
Household Head	0.1079002 (0.0113032)**
Married	0.0463297 (0.0100166)**
MinWage/Median Wage	0.2206504 (0.0374577)**
City Effects	Yes
Year Effects	Yes
Cohort Effects	Yes
Rank Condition	chi2(8)=497.02
Log-Likelihood	-88,177.012
Percent Correctly Predicted	61,69%
ROC Area	0.6698 (0.002)**
Probability	42,52%
N	74,198

Note: ** Statistically significant at the 1 percent level. Robust Standard errors are in parentheses

The value obtained about informality in t-1 using the extended definition of informality is much higher than that obtained about informality based on employment. Like the result obtained for informality in 2007 and from other variables that account for informality, this value is approximately 43%. The results on the average partial effects are shown below:

Table 8. Average Partial Effects

Average Partial Effects	Informal by Occupation	Informal by Health, Pension, Contract
Total	0.2121066	0.3126709
Sex	0.2675843	0.3325758
University Diploma	0.1416378	0.0709085
Household Head	0.2552631	0.3495077
Married	0.2208608	0.3286144
Wages	0.3375336	0.3843345

Source; National Household Survey. Author's calculations

According to the values shown in Table 6, individuals have a 31% dependence, which means that there is a probability of 31% of staying in the informal sector. Being a male, a household head, or married or having a minimum wage increase results in an increased probability of continuing in the infor-

mal sector. Holding a university degree, on the other hand, reduce the probability of staying in a situation of informality to 7%.

>> CONCLUSIONS

Like in many other developing countries, the Colombian labor market has been experiences a serious persistent informality phenomenon during the past few decades.

An in-depth review of this phenomenon has not yet been conducted, and although there is information available from transition matrices for some periods and countries, no consideration has been given to several fundamental aspects, such as individual non-observed heterogeneity which has a substantial influence on the explanation of the cause of this phenomenon.

Depending on the definition of informality, the results discussed here demonstrate the persistence of informality in the analyzed period. Hence, the probability that those workers who were in a situation of informality in the preceding period continue to be in the informal sector ranges from 20% to 30%.

The persistence of informality increases if an individual is a male, a household head, or married. Nevertheless, informality decreases as the educational level of an individual increases. From an economic policy perspective, these results are also interesting in that the minimum wage does not only increase informality [Mondragón-Vélez, Peña and Wills (2010)], but also increases persistence of informality in Colombia.

References

- Arango, L. E; Herrera, P; Posada, C. E. (2008). "El salario mínimo: aspectos generales sobre los casos de Colombia y otros países", *Ensayos sobre Política Económica*, 26(56):204-263.
- Bustamante, J. P. (2011). "Los retos de la economía Informal en Colombia". *Notas Fiscales*, 9.
- Chamberlain, Gary (1980). Multivariate regression models for panel data. *Journal of Econometrics*, 18:5-46.
- Bernal, R. (2009). "The informal labor market in Colombia: Identification and Characterization", *Desarrollo y Sociedad*, 63:145-208. Caro, B. (1995). "Evolución del sector informal en Colombia", Plan Nacional para la Microempresa. Corporación para el Desarrollo de la Microempresa, Ministerio de Desarrollo, DNP. Bogota.
- Collado, M.D. (1998). "Estimating Binary Choice Models from Cohort Data". *Investigaciones Económicas*, 22: 259-276
- Correa, J.B., Ortiz, C. H., Uribe, J. I. (2006). "¿Cómo deciden los individuos en el mercado laboral? Modelos y estimaciones para Colombia". *Lecturas de Economía*, 64: 59-89.
- Cunningham, W., Bustos, J. 2011. "Youth employment transitions in Latin America" Policy Research Working Paper Series 5521, The World Bank.
- Franco, C y J. Ramos. (2010). "Diferenciales salariales en Colombia: Una análisis para trabajadores rurales y jóvenes, 2002-2009". *Revista de análisis económico*, 25: 91-131.
- Flórez, C. (2002). "The function of the urban informal sector in employment. Evidence from Colombia 1984-2000". *Documentos CEDE*, No. 2002-4.
- Galvis, L.A. (2002). "Integración regional de los mercados laborales en Colombia, 1984-2000", *Documentos de Trabajo sobre Economía Regional* No 27, Centro de Estudios Económicos Regionales, Banco de la República, Cartagena de Indias.
- Girma, S., 2000. "A Quasi-Differencing Approach to Dynamic Modelling from a Time Series of Independent Cross-Sections". *Journal of Econometrics*, 98: 365-383.
- Gramlich, E. 1976. Impact of minimum wages on other wages, employment, and family incomes. *Brookings Papers on Economic Activity*, 2: 409-451
- Guataquí, J.; García, A.; Rodríguez, M. (2010). "El perfil de la informalidad en Colombia". *Perfil de Coyuntura Económica*. 16: 91-115

- Henao, M, Rojas, N. y Parra, A. (1999). "El Mercado Laboral Urbano y la Informalidad en Colombia: Evolución Reciente", *Revista Planeación y Desarrollo*, 30(2).
- Hernandez, G. (2010) ¿Cuán rentable es la educación superior en Colombia?. *Lecturas de Economía*, 73: 181-214.
- Kugler, A, Kugler, M.(2008). "Labour Market Effects of Payroll Taxes in Developing Countries: Evidence from Colombia," Working Papers eg0056, Wilfred Laurier University, Department of Economics.
- Kugler, A. (2010). "Comment", *Economía*, 11:96-99.
- López, H. (1996). Empleos formales e informales, asalariados e independientes: un balance de los cambios acaecidos entre los ochenta y los noventa en Ensayos sobre Economía laboral colombiana, Bogotá: Fonade.
- López, H, Sierra, O, Henao, M. 1987. "Sector informal: entroque económico y desconexión jurídico-política con la sociedad moderna" en: J.A Ocampo, M. Ramírez (ed), *El Problema Laboral Colombiano*, tomo II.
- MacKenzie, D.J. (2004). "Asymptotic Theory for Heterogeneous Dynamic Pseudo-Panels". *Journal of Econometrics*, 120:235-262
- Maloney W. and J. Núñez. 2004. "Measuring the Impact of Minimum Wages: Evidence from Latin American". Working paper no. 9800, *NBER*.
- Megir, Costas, Narita, Renata, and Robin, Jean Marc. (2011). *Wages and Informality in Developing Countries*
- Mincer, Jacob. 1976. Unemployment effects of minimum wages. *Journal of Political Economy* 84: S87–S104.
- Moffitt, Robert. 1993. "Identification and estimation of Dynamic Models with a Time Series of Repeated Cross-Sections". *Journal of Econometrics*, 59: 99-123.
- Mora, Jhon James (2003), Sheepskin effects and screening in Colombia, *Colombian Economic Journal*, 1:95-108.
- Mora, Jhon J. (2003), "Las ganancias de tener un título: una aplicación al mercado laboral de Cali, 2000," *Lecturas de Economía*, 59: 59-72.
- Mora, Jhon J. (2009) "Labor Market Segmentation in Colombia Using Markov Chains". Universidad Icesi Department of Economics Research Paper No. 21. Available at SSRN: <http://ssrn.com/abstract=1616361>
- Mora, Jhon J and Juan Muro (2008) "Sheepskin effects by cohorts in Colombia", *International Journal of Manpower*, 29:111 – 121
- Mora, Jhon J y Juan Muro (2014). "Informality and minimum wage by cohort in Colombia", *Cuadernos de Economía*, 33(63):69-85.
- Mesa, D.; A. García y M. Roa (2008). "Estructura salarial y segmentación en el mercado laboral de Colombia: un análisis de las siete principales

- ciudades, 2001-2005”, Serie Documentos de Trabajo No 52, Facultad de Economía, Universidad del Rosario.
- Mondragón-Vélez, C., Peña, X. y D. Wills. (2010). “Labor Market Rigidities and Informality in Colombia”. *Economía*, 11:65-95.
- Muñoz, J.C., Cano, A (2010). “Análisis del mercado laboral colombiano en el período 2000-2006, desde la teoría de la señalización”. (Forthcoming in *Revista de la Educación Superior- Mexico*.)
- Núñez, J (2002). “Empleo informal y evasión fiscal en Colombia”. *Archivos de Economía DNP*, No. 210
- Ortiz, C.; J. Uribe y E. Badillo. (2008). “Segmentación Inter e Intra regional en el Mercado Laboral Urbano de Colombia, 2001-2006”, *Ensayos Sobre Política Económica*, 27:196-230.
- Perry, G. E. and others. 2007. *Informality: Exit and Exclusion*. Washington: World Bank
- Ruffer T, J. Knight (2007). “Informal Sector Labor Markets in Developing Countries”. *Oxford Policy Management*, February 2007.
- Ribero, Rocio. (2003). “Gender dimensions of non-formal employment in Colombia”. Working paper no. 2003-04. *CEDE, Bogotá*.
- Verbeek, M. and F. Vella (2004). “Estimating Dynamic Models from Repeated Cross-Sections”. *Journal of Econometrics*, 127:83-10
- Welch, F. 1976. Minimum wage legislation in the United States,q. In: Ashenfelter, O., Blum, J. (Eds.), *Evaluating the Labour Market Effects of Social Programs*. Princeton University Press.
- Wooldridge, F. (2002). “Dynamic nonlinear panel data models”. *Journal of Applied Econometrics*, 20:39-54