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Informality and minimum wage: Evidence for Colombia

Jhon James Mora R., ICESI University

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Informality and minimum wage: Evidence for Colombia

By Jhon James Mora R.

Department of Economics at ICESI University

Calle 18, No. 122-135. e-mail: jjmora@icesi.edu.co

Abstract: This paper estimates the effect of the minimum wage on the likelihood of participating in the informal sector in Colombia. Based on information from an on-going household survey by DANE in thirteen metropolitan areas in Colombia from 2001 to 2005, seven cohorts were built consisting of individuals in the age range from 18 to 56 and we estimate a pseudo panel of the likelihood of participating in the informal sector using an IV-probit. The findings show that an increase in the actual minimum wage results in a decrease in the likelihood of participating in the informal sector in the old cohorts and an increase in the likelihood of participating in the young cohorts. Therefore, an increase in the actual minimum wage leads to substitution effects into young/older workers. The findings also show that each further year of education decreases the likelihood of participating in the informal sector by 6 percentile points, while non-labor income decreases the likelihood of participating in the informal sector by 0.04 percentile points.

Key words: Employment labor participation, informal sector, minimum wages, pseudo panel

JEL: C35, J32

1.- Introduction

Although there are different explanations as to what is considered informal and formal, there seems to be a consensus with regard to the ease of entering the informal business sector because there are no entry barriers. In the formal business sector, on the contrary, labor laws, company regulations, and a fixed minimum wages, among others, have become entry barriers.

The government intervention in the economy generates incentives to either join or leave the informal business sector; for example, the minimum wage generates incentives to choose one sector in particular. In this article it is assumed that those who work in the informal sector actually choose to do so.

The minimum wage is agreed by negotiations between workers and employers in December every year. If they fail to reach an agreement, then the government establishes the minimum wage. Only in three out of the last eight years there has been an agreement between workers and employers, and the policy with respect to the minimum wage becomes particularly significant in Colombia where approximately 56 percent of all workers earn the minimum wage (Hernandez and Pinzon 2006, 12) and 73 percent of all workers affiliated to the social security system earn two or less minimum salaries (Arango, Herrera and Posada 2007, 14).

The labor market in Colombia showed an increasing rate of female labor force participation from 1981 to 2000. The female labor force participation went up from 36.46 percent in 1981 to 50.87 percent in 1998. Meanwhile, the male labor participation showed stagnation for the last decades, i.e. 74.28 percent in 1981 and 73.98 percent in 1998 (Luisa Fernanda Bernat, Rocio Ribero and Jaime Tenjo 2004:150). This means that the traditional gender gaps in labor force participation

have decreased in the last century. On the other hand, there has been an important decrease in the unemployment rate in the past few years which, according to the Colombian Department of Statistics (DANE), has dropped from 16.6 percent in 2000 to 11.4 percent in 2006.

With regard to other approaches to the problem, this paper differs in two basic aspects. Firstly, this review involves a follow-up on the informal sector from 2001 to 2005 based on building a pseudo panel. Secondly, it includes minimum wage as an opportunity cost to being a part of the informal sector. It is worth noting that the use of a pseudo panel approach allows incorporating variability, which in turn allows analyzing the effect of the minimum wage over time, which would otherwise be excluded under a cross-sectional analysis.

Seven cohorts were built based on information about the thirteen most important metropolitan areas in Colombia in the period from 2001 to 2005 from the informal business section in the National Household Survey from last June. The first cohort includes individuals who were born from 1979 to 1983, while the seventh cohort includes individuals who were born from 1949 to 1953. This selection provided a total sample size of 89,241 individuals for the period under review.

This paper is organized as follows: the second section discusses the informal sector, describes the methodology for modeling participation based on pseudo panel data, and lists the age ranges included in each cohort. The third section outlines the data and informal sector share in each metropolitan area. The fourth section presents a calculation of the estimated participation in the informal sector based on an IV-probit and a correction of the selection bias. Conclusions are presented in the last section.

2.- The informal sector in Colombia

Macnac (1991) provides the first contrast of informality in Colombia. In Macnac's (1991) bivariate probit model the informal sector is identified with self-employment (excluding employers). The results obtained reject a segmented labor market hypothesis. However, Macnac's model shows that when an individual chooses to work in the formal sector, the benefits associated with not working are indistinguishable from the benefits of working in the informal sector.

Núñez (2002) suggests that entering the informal sector in Colombia is a voluntary action of which individuals are aware. Why should one choose one sector or another? Núñez (2002) believes that there are factors that encourage participation in the informal business sector since there is a lenient environment that facilitates evasion of labor-related taxes. This refers to evasion of taxes such as tax withholding at the source and other state-imposed taxes based on a formal employment agreement. However, Núñez (2002) fails to discuss the effects of truncated sampling in his results when calculating the informal participation only of individuals who earn more than \$1,200,000 Colombian pesos.

Ribero (2003) and Uribe, and Ortiz and Correa (2006) modeled informal employment as the result of socioeconomic characteristics of an individual, where education has a negative effect on the likelihood of participating in the informal sector. Depending on the purpose of the study, other variables have been included such as age, position in the household, non-labor income, gender, and fertility. Ribero (2003) did not make a selection bias adjustment, and Uribe et-al did not include the selection correction in his calculations.

Finally, Hernández and Pinzon (2006) discussed the effect of the increase in the minimum wage on labor participation using a pseudo panel and found that there are substitution effects into workers with an increase in the minimum wage. However, Hernández and Pinzon (2006) did not consider the pseudo panel measurement error in the data about the cohorts in Colombia. ¹

Hence, let us assume that individuals are able to choose whether or not they want to join the formal or informal sector based on a set of variables. Therefore, their participation in the informal sector is estimated as follows,

$$P_{i(t),t}^* = \beta_0' S_{i(t),t} + \beta_1' NL_{i(t),t} + \beta_2' H_{male_{i(t),t}} + \beta_3' OUH_{i(t),t} + \beta_4' CMW_{i(t),t} + \eta_{i(t)} + \mu_{i(t),t} > 0$$

$$t = 1, \dots, T ; i = 1, \dots, N ; P_{i(t),t} = 1 \text{ if } P_{i(t),t}^* > 0 \quad (1)$$

In model (1), $P_{i(t),t}^*$ is a latent variable that represents earnings from working in a given sector and $P_{i(t),t}$ equals one when an individual works in the informal sector or otherwise zero. S represents years of education, which decrease the likelihood of participating in the informal sector [Macnac 1991, Núñez 2002, Ribero 2003 and Uribe, Ortiz and Correa 2006]. NL represents non-labor income, which decreases the likelihood of participating [Núñez (2002) and Ribero (2003)]. H_{male} represents a male head of a household, which increases the likelihood of participation in the informal sector [Uribe, Ortiz and Correa 2006]. OUH is a dummy variable that takes a value of either one if there is more than one individual unemployed in a household or otherwise zero. We expected this variable to have a positive sign [Arango and Posada 2006]. CMW represents the interaction between cohort variables with the minimum wage. In young individuals the opportunity cost of working in the informal sector is low and the expected sign is positive when there is an increase in the minimum wage. However, to older individuals the opportunity cost of working in the informal sector is high and a negative sign is expected.

The $\eta_{i(t)}$ variable represents the deviation of the effect of the cohort after breaking down fixed individual effects. Therefore, if there are any fixed individual effects, these will be consistent with fixed effects in the cohort. Finally the $\mu_{i(t),t}$ variable represents the idiosyncratic error.

The observations are independent cross-sectional series where N individuals are only available in each period. Since there are different individuals in each period, i ranges from 1 to N for each t . Deaton (1985) suggests using cohorts to obtain consistent estimators of β when numeric variables are used and adjusting the estimator with the measurement errors. Moffitt (1993) proposes an IV-probit estimator for pseudo panel data. Following the Moffitt's (1993) technique, we used a cohort variable dummy defined based on the year of birth of a sample of individuals from the thirteen largest cities in Colombia to instrument numeric variables such as education, non-labor income and minimum wage. Sex is a dummy variable, and dummy variables are not subject to an error correction (Angus Deaton 1985).

We began by defining our sample according to the year of birth and prepared the pseudo panel data,

[Insert table 1]

¹ There is no consensus about the effect of the minimum salary on employment in Colombia. While Maloney and Núñez (2003) found a negative relationship between the minimum salary and employment, Robbins (2003) determined that the minimum salary has not had such a negative effect.

Table 1 above shows the age range of individuals in a given cohort in a particular year. Thus, selected individuals were in the age range from 18 to 56 years in the period from 2001 to 2005.

3.- Data

In Colombia there are no panel survey statistics on household labor supply data. Our sample comes from the National Housing Survey (*NHS*) which consists of a time series of independent and representative cross-sections collected from 2001 to 2005 by the Colombian Department of Statistics (DANE). Since 2000, the DANE has collected information about the labor market through another mechanism called Continuous Housing Survey. The DANE measures engagement in the informal sector based on information about workers or employers who have less than 10 workers, independent non-professional, non-technical workers, housekeepers, and family assistants who do not earn monetary compensation. Ribero (2003) proposes four definitions and shows how the informal sector share changes substantially depending on each definition. His definitions take into account not only company size, but also membership to the social security system, an employment agreement, and medical insurance coverage.

Based on DANE's definition of informality, Castillo (2006) estimated informality to be 61 percent in 2002 and 58.8 percent in 2005. However, when the definition does not include the size of the headcount, but the kind of employment agreement or memberships, the informal sector share is approximately 30 percent, which was determined by Ribero (2003) and Hernández and Pinzon (2006) who found that the informal sector share is about 50 percent based on medical insurance coverage.

We defined "informal" to refer to anyone who is not covered by any sort of social security in health, not covered by social security in pensions and without formal labor contracts. According to this definition and based on a sample of individuals who were working in a given cohort, 89,241 individuals were selected for the period from 2001 to 2005. The means of the selected variables are listed in the table below,

[Insert table 2]

As shown in Table 2 above, the average number of years of education is close to 10. This number seems to have been stable in the past 10 years. Mora and Muro (2008) showed a similar average for the period 1995-2000 using also pseudo panel data. Labor income and non-labor income were inflation deflated for each year in each of the metropolitan areas, showing a slight improvement probably due to the improved economic growth and the inflation drop. It should also be noted that the real minimum wage has been increasing in all metropolitan areas. Other unemployment in the households, OUH, has remained stable at nearly 30% throughout the entire period under review. The percentage of male heads of households who participate in the informal sector is close to 10%.² Finally, there are no substantial differences among the number of individuals each year.

² As shown by Almanza (2006) the gap between men and women in the informal sector has been closing since last century.

Figure 1 above shows that the youngest cohort has the highest informal sector share. Medellín is the city with the lowest informal sector rates in each cohort, while Cartagena, on the other hand, has the lowest informal sector rate in the seventh cohort throughout the period under review.

4.- Results

The estimates by Núñez (2002), Ribero (2003) and Uribe, Ortiz and Correa (2006) of participation in the informal employment sector were determined only for working individuals. Ribero (2003) justifies this selection because there are other models, such as those by Ribero and Meza (1997), which specifically represent labor participation in Colombia. Uribe, Ortiz and Correa (2006) did not raise any special considerations with regard to this. The results of the model of participation in the informal sector are discussed below,

[Insert table 3]

The first column in Table 3 shows a pool-probit, which is determined based on the model (1) for the entire sample without considering the existence of measurement error because of the nature of the pseudo panel. The sign of the years of education is negative and statistically significant. The effect of the minimum wage on each cohort shows positive and statistically significant effects on the probability of participation in the informal sector. Only the last cohort shows negative effects over the participation. The signs of non-labor income are not as expected and Hmale was found to be not significant.

The third and fourth columns in Table 3, i.e. IV-probit, shown the estimated probability of participation in the informal sector with instrument variables.³ These estimations also discuss the existence of selection biases. As indicated by Ribero (2003) and Uribe, Ortiz and Castro (2006), estimates of a model of sector participation for the entire sample of workers led to the occurrence of selection biases because the unemployment choice was not considered.⁴ The existence of such selection biases was corrected by estimating and incorporating the Mills inverse ratio in model (1). In this way, we estimated the likelihood of participating from the number of working individuals in the cohort following the work of Gronau (1974) and Lewis (1974). Mora and Muro (2007) showed that it was possible to correct the existence of selection biases based on a semi-parametric contrast, which consists of incorporating Mills inverse ratio. This Mills inverse ratio is calculated from the proportion of the labor participating individuals in each cohort with respect to the total number of individuals in the cohort (See the appendix).⁵

The results show that all coefficients are statistically significant and the years of education and non-labor income has negative effects over informal participation. Hmale and OUN variables have positive sign and the percentage of successes of the model is approx 59 and 69 percent respectively.

The final column shows a complete model for the minimum wage. In particular, dummy interactions between the cohorts and the minimum wage were incorporated. The results show

³ The variance-covariance matrix of the IV-probit estimator was corrected using the method proposed by Amemiya (1978).

⁴ Although Ribero (2003) and Uribe, Ortiz and Castro (2006) are aware of the problem, Ribero (2003) does not consider it. Uribe, Ortiz and Castro (2003), on the other hand, try to avoid it by proposing a multinomial model which not only fails to correct the selection bias, but also raises a discussion about the independence of irrelevant alternatives.

⁵ We have 274,162 individuals in all seven cohorts.

that a increase in the minimum wage results in an increase in the labor participation in the informality in young cohorts, but also decreases the probability of participation in older cohorts. These results show an interesting issue: an increase in the minimum wage produce substitution effects between young and older individuals in the informal labor market.

5.- Conclusions

The engagement of informal workers in the labor market is a subject that has been recently discussed in Colombia in this millennium. Concerning the determining factors of participation in the informal sector, there is only a consensus in that the higher the educational level the higher the incentives to engage in the informal sector, and non-labor income has negative effects. The estimates discussed in this paper corroborate this negative effect of both education and non-labor income on the participation in the informal sector.

Besides having an impact on the distribution of salaries among formal and informal workers [Arango and Pachón (2004), and Maloney and Núñez (2003)] ⁶, the minimum wage also generates incentives to join one or the other sector. Therefore, the estimates provided herein show that there are substitution effects over the labor market.

This is the reason that the political discussion around the elimination of the minimum wage in Colombia needs to incorporate an analysis of the current encouraging factors that have had an impact on labor participation in the Colombian labor market. It is also necessary to conduct a more in-depth discussion of advisable policies with respect to the reduction or elimination of the minimum wage in Colombia.

Appendix 1. Selection bias in Pseudo Panel Data

In the pseudo panel case with selectivity bias, the cohort expression will be as follows:

$$\begin{aligned}
 &E(Y_{i(t),t} | X_{i(t),t}, S_{i(t),t}=1, g_{i(t)} \in I_c) = \\
 &E(X'_{i(t),t} \beta + \tau_{i(t)} + \mu_{i(t),t} | X_{i(t),t}, S_{i(t),t}=1, g_{i(t)} \in I_c) = \\
 &E(X'_{i(t),t} \beta | X_{i(t),t}, S_{i(t),t}=1, g_{i(t)} \in I_c) + E(\tau_{i(t)} | X_{i(t),t}, S_{i(t),t}=1, g_{i(t)} \in I_c) + E(\mu_{i(t),t} | X_{i(t),t}, S_{i(t),t}=1, g_{i(t)} \in I_c) \quad (2)
 \end{aligned}$$

Where $Y_{i(t),t}$ as an interest variable in repeated cross section model with measurement error.⁷ On other hand, $Y_{i(t),t}$ is only observed when $S_{i(t),t}=1$. $X_{i(t),t}$ are covariates; $\tau_{i(t)}$ are individual effects in t ; $\mu_{i(t),t}$ are idiosyncratic errors; i run for individuals. Our data consist of a time series of independent cross-sections so we can only observe the same individual in one period of time. In equation (2) $g_{i(t),t} \in I_c$ shows that observation $i(t)$ in the appropriate cross section belongs to a specific cohort in t time. The solutions for pseudo panel data show that the direct procedure for the first term in equation (2) implies the use of the sample mean of the variables in the respective cohorts. By Mora and Muro (2006, 2007) the second term becomes zero while the deviation of the cohort is independent from the selection process. There is, however, no guarantee that the last term equals zero, which shows that the estimator is inconsistent when there is a potential selection bias. Because the selection process does not affect the presence or absence of a cohort in a

⁶ Arango and Pachón (2004), and Maloney and Núñez (2003) did not estimate the effect of minimum salary on the informal employment share directly.

⁷ That is, over all individuals in a specific cohort.

specific cross section, cohorts will comprise a set of different individuals in each repeated cross section, and the presence of different individuals in each cross-section is independent from the incidental truncation process. Therefore, a random selection of representative samples of each sub-population of cohorts will contain different individuals in each cross section. This makes it necessary to find an expression that allows inferring the behaviour of a cohort based on the behaviour of different individuals in the cohort. Thus, the last expression in equation (2) is,

$$E(\mu_{i(t),t} | X_{i(t),t}, S_{i(t),t}=1, g_{i(t),t} \in I_c) = E(R_{i(t),t} | g_{i(t),t} \in I_c) \quad (3)$$

In equation (3) above, $R_{i(t),t}$ is Mills inverse ratio, which shows the transformation of individual results into cohort results. It is worth noting that if the nature of the selection process is known, then it is possible to use individual parameters (estimated for the selection process) and apply them to the means of the cohort to obtain a selection indicator for each cohort. To evaluate the expression in (3) Mora and Muro (2007) proposed, instead of integrating out the individual Mills inverse ratio for all the observed individuals in each cohort, calculate Mills inverse ratio for the normit of a consistent estimation of the observed proportion of individuals in each cohort. In particular, to this cases,

$$E(R_{i(t),t} | g_{i(t),t} \in I_c) \propto \phi(P_{c,t}) / \Phi(P_{c,t}) \quad (4)$$

Whereas, $P_{c,t}$ is the proportion of individuals selected from cohort c in t time. Finally this expansion of the original specification with a selectivity bias correction term implies,

$$Y_{i(t),t} = X'_{i(t),t} \beta + \tau_{i(t),t} + R'_{i(t),t} \rho + \psi_{i(t),t}; E(\psi_{i(t),t} | \tau_{i(t),t}, X_{i(t),t} + S_{i(t),t}) = 0 \quad (5)$$

Then a contrast about the existence of selection biases involve contrasting the hypothesis of a lack of significance of ρ in (5), that is a contrast implies the use of a Wald test of $H_0: \rho=0$ as a test of the null hypothesis of absence of sample selection bias.

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TABLES

Table 1. Definition of cohorts

Cohort / Year	Date of birth	2001	2002	2003	2004	2005
Cohort 1	1979-1983	18-22	19-23	20-24	21-25	22-26
Cohort 2	1974-1978	23-27	24-28	25-29	26-30	27-31
Cohort 3	1969-1973	28-32	29-33	30-34	31-35	32-36
Cohort 4	1964-1968	33-37	34-38	35-39	36-40	37-41
Cohort 5	1959-1963	38-42	39-43	40-44	41-46	42-46
Cohort 6	1954-1958	43-47	44-48	45-49	46-50	47-51
Cohort 7	1949-1953	48-52	49-53	50-54	51-55	52-56

Source.- Author's calculations.

Table 2. Means of the variables

Variable/Year	2001	2002	2003	2004	2005	2001-2005
Years of education	9.85	9.99	10.17	10.32	10.43	10.15
Non-labor income	60.3	78.05	88.66	98.1	112.65	87.76
Inflation (13 metropolitan areas)	8.35%	6.32%	7.78%	5.99%	5.03%	6.44%
Minimum wage (thousand)	286	309	332	358	381.5	333.75
Real minimum wage (thousand)	262.11	289.46	306.16	336.52	362.3	311.79
Others unemployment at home	36.07%	34.67%	31.61%	29.41%	27.63%	31.84%
Male head of family	9.84%	9.73%	10.90%	11.13%	11.93%	10.72%
Informality	44.51%	44.60%	44.74%	43.65%	43.71%	44.26%
Number of individuals	18,136	17,348	17,415	17,444	18,898	89,241

Source.- Author's calculations using The National Housing Survey (DANE-ECH).

Table 3. Marginal effects for Informal participation

Variable / Model	Pool-Probit	IV-Probit	IV-Probit
Education	-0.0641845 (0.00049) **	-0.0322842 (-0.0002752)**	-0.0679544 (0.004143) **
Non-labor income	0.0000162 (0.000003)**	-0.0002752 (-14.99)**	-0.0004799 (0.000062)**
Hmale	0.0025179 (0.00621)	0.0650612 (0.0225352) **	0.1824889 (0.0220179) **
OUN	0.0534534 (0.00399) **	0.0812005 (0.0045363)**	0.0369982 (0.0047308)**
C1*MWR	0.0008334 (0.00003)**		0.0011671 (0.0000304)**
C2*MWR	0.0005139 (0.00003)**		0.0004916 (0.0000327)**

C3*MWR	0.0002682 (0.00003)**		0.0000816 (0.0000319)**
C4*MWR	0.0001266 (0.00003)**		-0.0001284 (0.0000318)**
C5*MWR	0.0000634 (0.00003)**		-0.0002017 (0.0000324)**
C6*MWR	-0.0001509 (0.00003)**		-0.0002936 (0.0000334)**
Mills		-1.443092 (0.09062)**	-4.800297 (0.1145766)**
χ^2	(10) =22643.98	(5) =1042.01	(11) =5130.71
% forecast	70.78%	58.86%	68.47%
N	89,241	89,241	89,241

Source.- Author's calculations using The National Housing Survey (DANE-ECH).

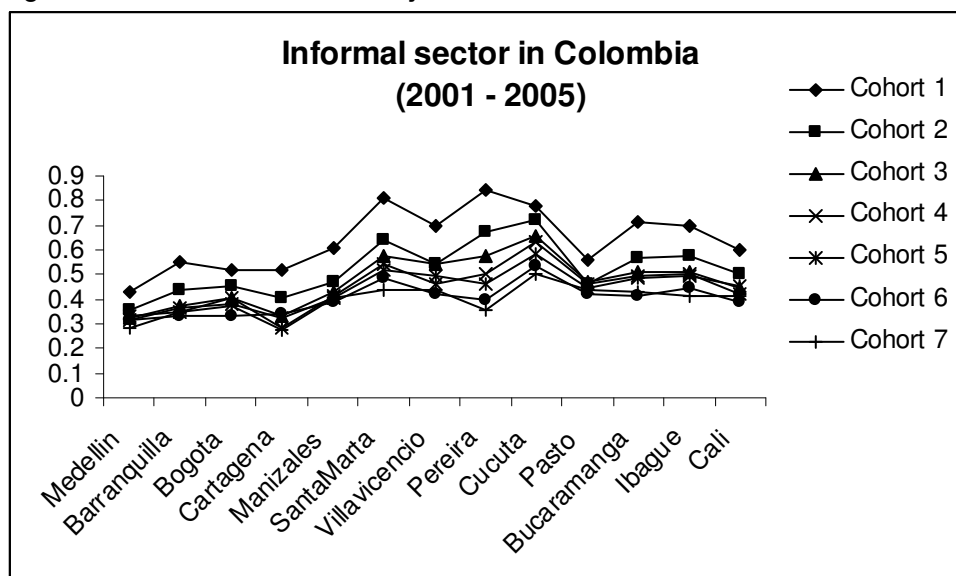
Note.- Dummy variables for cities are included in all regressions.

* p< .05.

** p< .01.

FIGURES

Figure 1. Informal sector share by cohorts



Source.- Author's calculations using The National Housing Survey (DANE-ECH).