

# Solving the Puzzle between the Minimum Wage and (In)formal Employment: An Analysis for a Developing Economy

**Salomé Arango**

Department of Economics  
Universidad EAFIT

**Gustavo A. García**

Research in Spatial Economics (RiSE-group)  
Department of Economics  
Universidad EAFIT

**Christian Posso**

Banco de la República - Colombia

**The Economics of Informality Conference 2018**

Universidad del Rosario  
Bogotá - Colombia  
28 - 29 May 2018

- Motivation
- Contribution
- Main findings
- Relevant literature
- Data and descriptive evidence
- Estimation procedure
- Results
- Conclusions

# Motivation

There is a sharp dichotomy in the literature on apparent consensus of negative effect on the employment of an increase in the minimum wage. This ambiguity may arise from the fact that:

- employment effects of minimum wages may have **different impacts and consequences** across different **segments of the population and different economic circumstances and contexts** (Neumark and Wascher, 2007)  $\implies$  **regional heterogeneity in the minimum wage effects**
- a regression of minimum wage on labor market outcomes is endogenous because **minimum wage and employment are simultaneously determined** (Ham, 2018)  $\implies$  **it requires finding excluded exogenous instruments**
- to identify the effect of the minimum wage separately of effect of other variables on employment when there is **a national policy of minimum wage**, it is necessary to have **goods measures of minimum wage that pick up the regional variation** (Brown, et al., 1982; Card and Krueger, 1995, Lemos, 2005)  $\implies$  **“fraction affected”, “fraction at”, and “fraction below” the minimum wage**

# Contribution

- This study contributes to the understanding of **the effect and magnitude of minimum wage on the labor market in developing economies**, studying the Colombian case
- We provide descriptive evidence of the **relevance of the minimum wage across the wage distribution** in each of the cities of Colombia
- We use **an exogenous policy instrument** to measure the net effect of the minimum wage in the employment

$VRMW \implies \downarrow$  Employment, Formality, Informality  
 $\uparrow$  Unemployment, Inactivity

Several recent studies of the effects of the minimum wage increases in employment have been carried out in developing countries. [These studies agree that increases in the minimum wage have adverse employment effects](#)

- Brazil (Foguel et al., 2001; Neri et al., 2001; Lemos, 2004; Neumark et al., 2006; and Jales, 2017), Costa Rica (Hamidi and Terell, 2002; Gindling and Terell, 2007), Nicaragua (Alaniz et al., 2011), and Honduras (Ham, 2018)
- Indonesia (Rama, et al., 2001, and Alatas and Cameron, 2003)
- Hungary (Kertesi and Kollo, 2003).

For the Colombian case, there are the following studies:

- Maloney and Núñez (2004)  $\implies \uparrow \text{MW} \rightarrow \downarrow \text{Employment}$
- Arango and Pachón (2007)  $\implies \uparrow \text{MW} \rightarrow \downarrow \text{Employment}$ , stronger effects on women, young and less skilled workers
- Mondragón et al. (2010), Ruiz (2010)  $\implies \uparrow \text{MW} \rightarrow \uparrow \text{Informality}$
- Mora and Muro (2017)  $\implies \uparrow \text{MW} \rightarrow \uparrow \text{Informality}$
- Arango and Flórez (2017)  $\implies \uparrow \text{MW} \rightarrow \uparrow \text{Informality}$

**However, these studies do not take into account the simultaneous determination of the MW and employment, which would generate biased estimates of the effect between these two variables**

# Data and descriptive evidence

- The data used in this paper came from [the Great Integrated Household Survey \(GIHS\) for the period 2009-2016 \(quarterly\)](#). This cross-section survey contains individual-level information on the labor force of **23** metropolitan areas in Colombia
- We focus on information at urban level for the population between 18 and 60 years old, excluding the employees of the mining and agricultural sectors
- **Informality (DANE-ILO)**: private employees in establishments with up to 5 employees, unpaid family workers, self-employees...
- To deflate the wages, quarterly data from the Consumer Price Index (CPI) were used, base 2008, for each city
- For the econometric analysis, a panel with a sample of **736 observations** (23 cities  $\times$  32 quarters) was obtained

# Data and descriptive evidence

In Colombia, increases in the minimum wage are given only once in January and at the national level

Minimum wage variables with regional variation:

- Relative measures

- ▶ Real minimum wage

$$RMW_{cq} = MW/CPI_{cq}$$

- ▶ Kaitz Index (Kaitz, 1970)

$$Kaitz_{cq} = MW/aw_{cq}$$

Where  $MW$  is the annual nominal minimum wage,  $aw_{cq}$  is the average wage by city ( $c$ ) and quarter ( $q$ ) and  $CPI_{cq}$  is the consumer price index also by city and quarter

- Impact measures

- ▶ **Fraction affected** (Card and Krueger, 1995): it measures the costs of increasing the wages of those just **above** the minimum wage

$$FAF_{cq} = 0.98 * MW_{-1} \leq wage_{cq} \leq 1.02 * MW$$

- ▶ **Fraction at** (Lemos, 2004; Dolado et al. 1996): it is a **measure of erosion of the MW** in relation to other wages and it is also a measure of those worker whose wages went up and thus a **measure of employment extra costs**

$$FA_{cq} = 0.98 * MW \leq wage_{cq} \leq 1.02 * MW$$

- ▶ **Fraction below** (Dolado et al. 1996; Neumark et al, 2006): it measures the costs of increasing the wages of those just **below** the minimum wage

$$FB_{cq} = wage_{cq} \leq 1.02 * MW$$

# Data and descriptive evidence

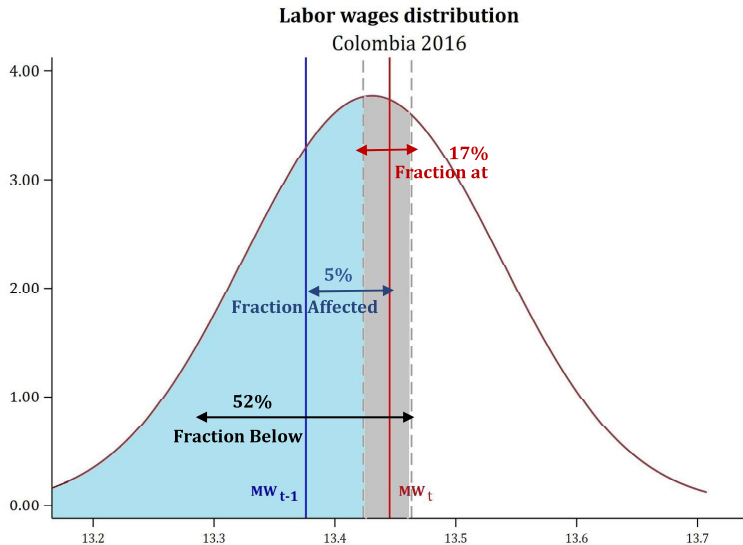
**Table 1. Descriptive statistics, 2009-2016**

Variables	Mean	SD	Min	Max
<i>Labor market outcomes</i>				
Employment	0.646	0.067	0.245	0.783
Hours per week	30.159	3.432	11.576	37.766
Unemployment	0.112	0.028	0.060	0.240
Formality	0.327	0.065	0.103	0.505
Informality	0.319	0.052	0.140	0.433
Inactivity	0.242	0.057	0.130	0.526
<i>MW measures</i>				
Log Real minimum wage	13.143	0.036	13.066	13.232
Kaitz Index	0.732	0.077	0.559	0.926
Fraction Affected	0.047	0.085	0.000	0.310
Fraction At	0.125	0.051	0.035	0.279
Fraction Below	0.511	0.085	0.284	0.707
Log Real MW exogenous variation	8.526	0.561	7.583	9.284
<i>Percentage of total population</i>				
Less than 7 years old	0.250	0.068	0.129	0.605
Age over 60 years old	0.194	0.039	0.094	0.327
Women	0.964	0.073	0.847	1.422
Married	0.619	0.040	0.470	0.703
University	0.385	0.082	0.196	0.619
Obs	736	736	736	736

Note: These are averages over 23 metropolitan areas and 32 quarters. The average number of observations per area-quarter is 17,000.

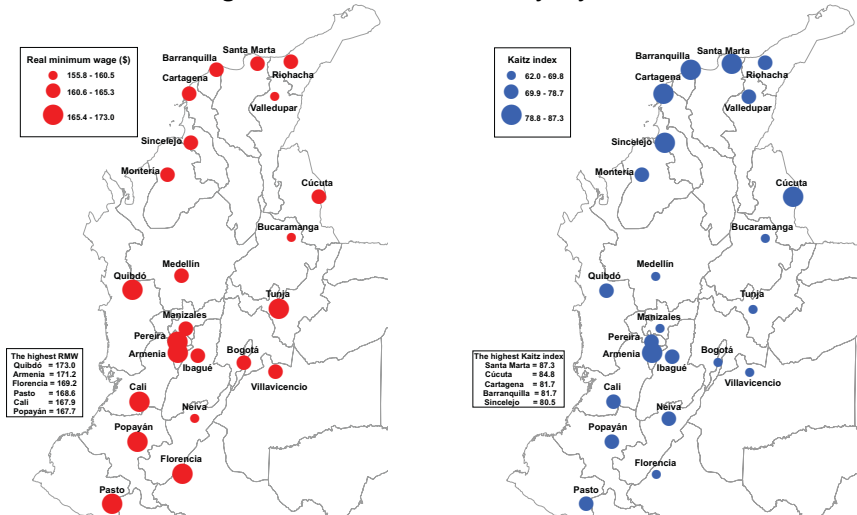
# Data and descriptive evidence

Figure 1. Impact measures of the MW, 2016



# Data and descriptive evidence

Figure 2. RMW and Kaitz index by city, 2016

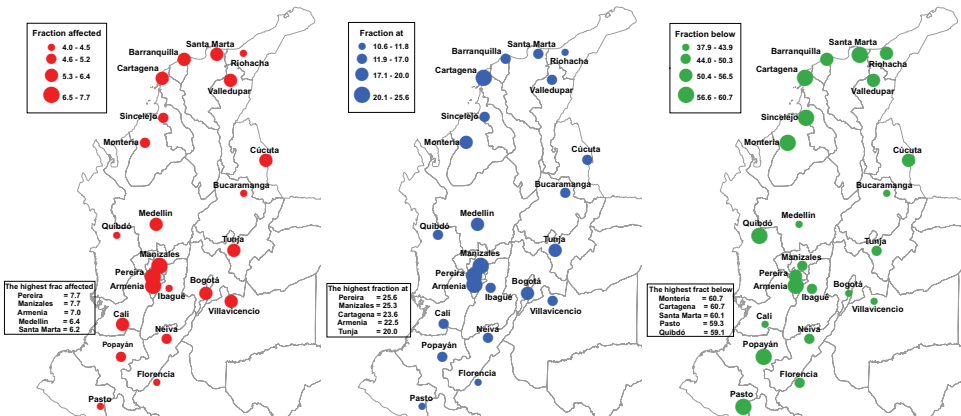


The highest real minimum wages are reported in Quibdó, Armenia, Pasto, Florencia and Popayán, cities located in the periphery of the country

The highest Kaitz indexes are found in the cities of the Caribbean coast, with values higher than 80%, this means very low wages in these cities

# Data and descriptive evidence

Figure 3. Fraction affected, fraction at and fraction below by city, 2016



The coffee region or *eje cafetero* concentrates the highest proportion of workers who are affected by changes in the minimum wage and who earn the minimum wage

In Montería, Cartagena and Santa Marta around 60 % of workers earn wages at or below the minimum wage

## Estimation procedure

$$N_{cq}/pop_{cq} = \alpha + \beta \Delta \log RMW_{cq} + \lambda X_{cq} + f_c + f_q + \varepsilon_{cq}$$

- $N_{cq}/pop_{cq}$  is the employment rate for each city  $c$  and quarter  $q$
- $RMW_{cq}$  is the real minimum wage
- $X_{cq}$  are the proportion on the population in age of work who are: younger than 7 years old, older than 60 years of age, women, married and with university or more education (including technician and technologist, university and postgraduate)
- $f_c$  and  $f_q$  represent fixed effects of city and quarter

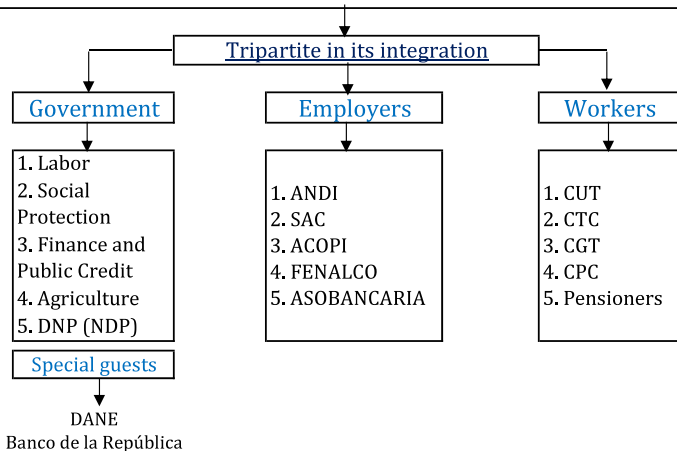
# Estimation procedure

- One aspect to be considered in the estimation is the **endogeneity bias caused by the simultaneity between the minimum wage and the employment**
- In order to avoid the endogeneity bias, the literature has proposed the use of IV techniques as a possible strategy to address the concern. In particular, it has been suggested the following set of instruments:
  - ▶ regional average of log real minimum wage, with the exception of the region in question (Neumark and Wascher, 1992)
  - ▶ political majorities indicators for each region in each year (Lemos 2005; Green and Harrison, 2010; Sen et al., 2011; Rybczynski and Sen, 2018)
  - ▶ time lags of the minimum wage (Ham, 2018)
- We use policy circumstances in the setting of the minimum wage in Colombia and propose that there is a part of the annual variation of the minimum wage that is an exogenous shock, which we use as an instrument variable

# Estimation procedure

## Minimum wage policy in Colombia

"Permanent Commission of Agreement of Wage and Labor Policies"  
(Law 278 of 1996)

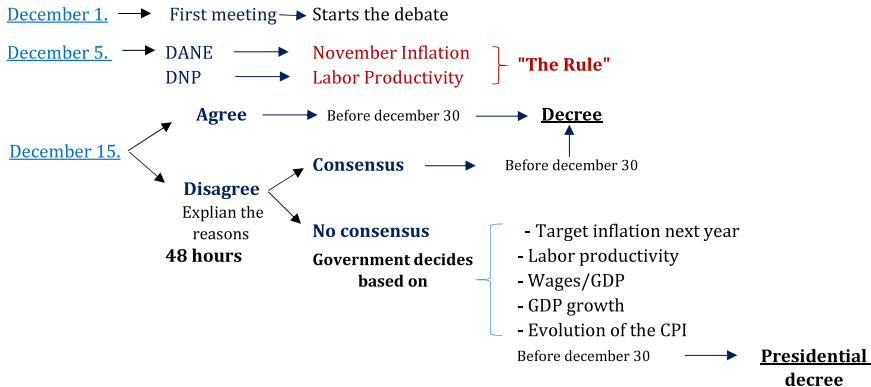


# Estimation procedure

## Minimum wage policy in Colombia

### National minimum wage negotiation (Law 278 of 1996)

#### Key dates:



## Identifying the minimum wage exogenous variation in Colombia

The Rule:

$$\bar{V} = \max(\text{Inflation}_{nov} \pm \text{Lab.Productivity}; \text{Inflation}_{nov})$$

Exogenous variation ( $EV$ ):

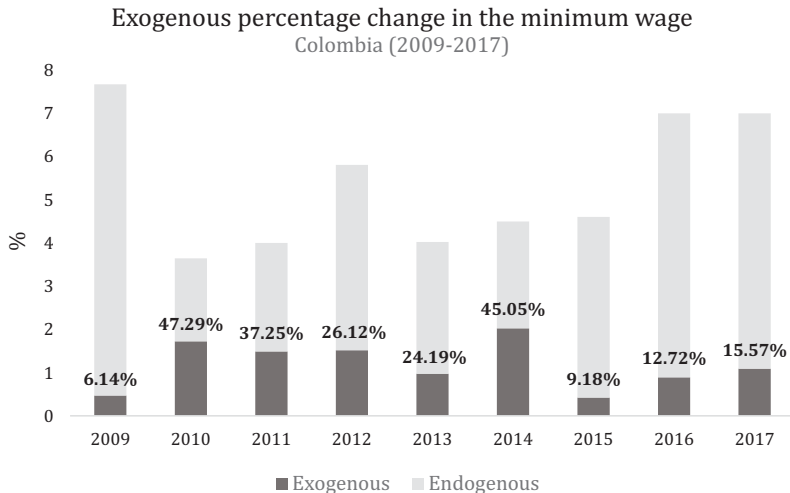
$$EV = EFV - \bar{V}$$

Minimum wage differential (in real terms):

$$REV_{cq} = \frac{MW_{-1} * EV}{CPI_{cq}}$$

Where  $MW_{-1}$  is the nominal minimum wage in the previous year and  $EFV$  is the effective increase in the minimum wage

# Estimation procedure



Source: DANE, Annual Decree of minimum wage. Own calculations.

### Table 3. First stage

Dependent variable: Log real minimum wage

	(A)	(B)	(C)
Exogenous variation	0.003*** (0.0004)	0.002*** (0.0004)	0.002*** (0.0004)
% Less than 7 years old	-0.082 (0.048)	-0.074 (0.047)	-0.077 (0.048)
% Age over 60 years old	-0.252*** (0.053)	-0.140 (0.085)	-0.150* (0.085)
% Women	0.113*** (0.034)	0.089** (0.033)	0.095*** (0.033)
% Married	0.035 (0.048)	0.019 (0.047)	0.025 (0.047)
% University	-0.026 (0.028)	0.012 (0.027)	0.049 (0.033)
<i>Fixed effects</i>			
City	✓	✓	✓
Quarter	✗	✓	✗
City*quarter	✗	✗	✓

Robust standard errors clustered at the area level in parentheses

\*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$

Source: DANE - GIHS. Own calculations

- Results indicate that changes in the annual exogenous variation in the minimum wage, have positive and significant effects on changes in the real minimum wages
- The instrument is strong, and its effect is robust over fixed effects changes

**Table 4. Second stage**

	Dependent variable					
	Employment rate			Hours per week		
	(A)	(B)	(C)	(A)	(B)	(C)
Log real minimum wage	-1.381*** (0.383)	-1.431*** (0.417)	-1.486*** (0.404)	-58.593*** (20.185)	-66.689*** (21.215)	-67.508*** (19.667)
	Formality			Informality		
	(A)	(B)	(C)	(A)	(B)	(C)
Log real minimum wage	-0.998*** (0.431)	-0.829*** (0.406)	-0.861*** (0.383)	-0.383*** (0.220)	-0.601*** (0.222)	-0.626*** (0.211)
	Unemployment			Inactivity		
	(A)	(B)	(C)	(A)	(B)	(C)
Log real minimum wage	0.549** (0.312)	0.525* (0.332)	0.652** (0.322)	0.832*** (0.288)	0.905*** (0.280)	0.835*** (0.292)
<i>Fixed effects</i>						
City	✓	✓	✓	✓	✓	✓
Quarter	✗	✓	✗	✗	✓	✗
City*quarter	✗	✗	✓	✗	✗	✓

Robust standard errors clustered at the area level in parentheses \*\*\*p<0.01, \*\*p<0.05, \*p<0.1

Notes: All models include proportion of younger than 7 years old, older than 60 years of age, women, married and with university

- The results show a negative causal relationship between the minimum wage and employment, in both extensive (employment) and intensive (hours worked) order
- We can also note that changes in the minimum wage also have a negative effect on formality and informality, and a positive effect on unemployment and inactivity

# Results

**Table 4. Second stage**

	Dependent variable					
	Employment rate			Hours per week		
	(A)	(B)	(C)	(A)	(B)	(C)
Log real minimum wage	-1.381*** (0.383)	-1.431*** (0.417)	-1.486*** (0.404)	-58.593*** (20.185)	-66.689*** (21.215)	-67.508*** (19.667)
	Formality			Informality		
	(A)	(B)	(C)	(A)	(B)	(C)
Log real minimum wage	-0.998*** (0.431)	-0.829*** (0.406)	-0.861*** (0.383)	-0.383*** (0.220)	-0.601*** (0.222)	-0.626*** (0.211)
	Unemployment			Inactivity		
	(A)	(B)	(C)	(A)	(B)	(C)
Log real minimum wage	0.549** (0.312)	0.525* (0.332)	0.652** (0.322)	0.832*** (0.288)	0.905*** (0.280)	0.835*** (0.292)
<i>Fixed effects</i>						
City	✓	✓	✓	✓	✓	✓
Quarter	✗	✓	✗	✗	✓	✗
City*quarter	✗	✗	✓	✗	✗	✓

Robust standard errors clustered at the area level in parentheses \*\*\*p<0.01, \*\*p<0.05, \*p<0.1

Notes: All models include proportion of younger than 7 years old, older than 60 years of age, women, married and with university

- The results show a negative causal relationship between the minimum wage and employment, in both extensive (employment) and intensive (hours worked) order
- We can also note that changes in the minimum wage also have a negative effect on formality and informality, and a positive effect on unemployment and inactivity

**Table 4. Second stage**

	Dependent variable					
	Employment rate			Hours per week		
	(A)	(B)	(C)	(A)	(B)	(C)
Log real minimum wage	-1.381*** (0.383)	-1.431*** (0.417)	-1.486*** (0.404)	-58.593*** (20.185)	-66.689*** (21.215)	-67.508*** (19.667)
	Formality			Informality		
	(A)	(B)	(C)	(A)	(B)	(C)
Log real minimum wage	-0.998*** (0.431)	-0.829*** (0.406)	-0.861*** (0.383)	-0.383*** (0.220)	-0.601*** (0.222)	-0.626*** (0.211)
	Unemployment			Inactivity		
	(A)	(B)	(C)	(A)	(B)	(C)
Log real minimum wage	0.549** (0.312)	0.525* (0.332)	0.652** (0.322)	0.832*** (0.288)	0.905*** (0.280)	0.835*** (0.292)
<i>Fixed effects</i>						
City	✓	✓	✓	✓	✓	✓
Quarter	✗	✓	✗	✗	✓	✗
City*quarter	✗	✗	✓	✗	✗	✓

Robust standard errors clustered at the area level in parentheses \*\*\*p<0.01, \*\*p<0.05, \*p<0.1

Notes: All models include proportion of younger than 7 years old, older than 60 years of age, women, married and with university

- The results show a negative causal relationship between the minimum wage and employment, in both extensive (employment) and intensive (hours worked) order
- We can also note that changes in the minimum wage also have a negative effect on formality and informality, and a positive effect on unemployment and inactivity

# Conclusions

- This paper presents evidence of the negative relationship between the minimum wage and the employment in Colombia
- We use a novel strategy to identify the effect of the minimum wage. This strategy consists in using the exogenous variation associate to the annual variation of the minimum wage as an instrument variable
- The results suggest that a 10 % increase in the real minimum wage variation, reduces the employment rate in 1.5 pp
- We also find that changes in the minimum wages have effects on other labor market outputs, such as (in)formality, unemployment and inactivity:

$\uparrow VRMW \implies \downarrow$  Formality, Informality  
 $\uparrow$  Unemployment, Inactivity