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

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Outline

- 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) $\rightarrow$ 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) $\rightarrow$ 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 has goods measures of minimum wage that pick up the regional variation (Brown, et al., 1982; Card and Krueger, 1995, Lemos, 2005) $\rightarrow$ “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.
Main findings

\[ VRMW \implies \downarrow \text{Employment, Formality, Informality} \]
\[ \uparrow \text{Unemployment, Inactivity} \]
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) \( \Rightarrow \uparrow MW \rightarrow \downarrow Employment \)
- Arango and Pachón (2007) \( \Rightarrow \uparrow MW \rightarrow \downarrow Employment \), stronger effects on women, young and less skilled workers
- Mondragón et al. (2010), Ruiz (2010) \( \Rightarrow \uparrow MW \rightarrow \uparrow Informality \)
- Mora and Muro (2017) \( \Rightarrow \uparrow MW \rightarrow \uparrow Informality \)
- Arango and Flórez (2017) \( \Rightarrow \uparrow MW \rightarrow \uparrow Informality \)

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.
Data and descriptive evidence

**Impact measures**

- **Fraction affected** (Card and Krueger, 1995): it measures the costs of increasing the wages of those just above the minimum wage
  \[ FA_{cq} = 0.98 \times MW_{-1} \leq wage_{cq} \leq 1.02 \times MW \]

- **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
  \[ FA_{cq} = 0.98 \times MW \leq wage_{cq} \leq 1.02 \times MW \]

- **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
  \[ FB_{cq} = wage_{cq} \leq 1.02 \times MW \]
## Data and descriptive evidence

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

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

Note: These are averages over 23 metropolitan areas and 32 quarters. The average number of observations per area-quarter is 17,000.
Figure 1. Impact measures of the MW, 2016

Labor wages distribution

Colombia 2016

52% Fraction Below

17% Fraction at

5% Fraction Affected

MW_{t-1}

MW_t
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.

Arango(EAFIT), García(EAFIT) & Posso(Banrep)
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)

Tripartite in its integration

Government
1. Labor
2. Social Protection
3. Finance and Public Credit
4. Agriculture
5. DNP (NDP)

Employers
1. ANDI
2. SAC
3. ACOPI
4. FENALCO
5. ASOBANCARIA

Workers
1. CUT
2. CTC
3. CGT
4. CPC
5. Pensioners

Special guests
DANE
Banco de la República
Estimation procedure

Minimum wage policy in Colombia

National minimum wage negotiation
(Law 278 of 1996)

Key dates:

December 1. First meeting → Starts the debate

December 5. DANE → November Inflation
          DNP → Labor Productivity

Agree → Before December 30

December 15.

Disagree
          Explain the reasons

48 hours

No consensus
          Government decides based on

- Target inflation next year
- Labor productivity
- Wages/GDP
- GDP growth
- Evolution of the CPI

Before December 30

Decree

Presidential decree
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):

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

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

Exogenous percentage change in the minimum wage
Colombia (2009-2017)

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

Table 3. First stage
Dependent variable: Log real minimum wage

<table>
<thead>
<tr>
<th></th>
<th>(A)</th>
<th>(B)</th>
<th>(C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exogenous variation</td>
<td>0.003***</td>
<td>0.002***</td>
<td>0.002***</td>
</tr>
<tr>
<td></td>
<td>(0.0004)</td>
<td>(0.0004)</td>
<td>(0.0004)</td>
</tr>
<tr>
<td>% Less than 7 years old</td>
<td>-0.082</td>
<td>-0.074</td>
<td>-0.077</td>
</tr>
<tr>
<td></td>
<td>(0.048)</td>
<td>(0.047)</td>
<td>(0.048)</td>
</tr>
<tr>
<td>% Age over 60 years old</td>
<td>-0.252***</td>
<td>-0.140</td>
<td>-0.150*</td>
</tr>
<tr>
<td></td>
<td>(0.053)</td>
<td>(0.085)</td>
<td>(0.085)</td>
</tr>
<tr>
<td>% Women</td>
<td>0.113***</td>
<td>0.089**</td>
<td>0.095***</td>
</tr>
<tr>
<td></td>
<td>(0.034)</td>
<td>(0.033)</td>
<td>(0.033)</td>
</tr>
<tr>
<td>% Married</td>
<td>0.035</td>
<td>0.019</td>
<td>0.025</td>
</tr>
<tr>
<td></td>
<td>(0.048)</td>
<td>(0.047)</td>
<td>(0.047)</td>
</tr>
<tr>
<td>% University</td>
<td>-0.026</td>
<td>0.012</td>
<td>0.049</td>
</tr>
<tr>
<td></td>
<td>(0.028)</td>
<td>(0.027)</td>
<td>(0.033)</td>
</tr>
</tbody>
</table>

Fixed effects
- 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
## Results

### Table 4. Second stage

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Employment rate</th>
<th>Hours per week</th>
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<tbody>
<tr>
<td></td>
<td>(A)</td>
<td>(B)</td>
</tr>
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<td>Log real minimum wage</td>
<td>-1.381***</td>
<td>-1.431***</td>
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<td>(0.383)</td>
<td>(0.417)</td>
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<th>Formality</th>
<th>Informality</th>
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<td>Log real minimum wage</td>
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<td>-0.829***</td>
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<th>Inactivity</th>
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<td>(A)</td>
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</tr>
<tr>
<td>Log real minimum wage</td>
<td>0.549**</td>
<td>0.525*</td>
</tr>
<tr>
<td></td>
<td>(0.312)</td>
<td>(0.332)</td>
</tr>
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</table>

**Fixed effects**
- 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

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</table>

|                  | Unemployment    | Inactivity    |
| Log real minimum wage | 0.549**        | 0.525*        | 0.652**       | 0.832***    | 0.905***    | 0.835***    |
|                  | (0.312)         | (0.332)       | (0.322)       | (0.288)     | (0.280)     | (0.292)     |

**Fixed effects**

- City: ✓ ✓ ✓ ✓ ✓ ✓ ✓
- Quarter: X ✓ X X ✓ X X
- City*quarter: X X ✓ X X ✓ X

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

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<th>(C)</th>
<th>(A)</th>
<th>(B)</th>
<th>(C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log real minimum wage</td>
<td>-0.998***</td>
<td>-0.829***</td>
<td>-0.861***</td>
<td>-0.383***</td>
<td>-0.601***</td>
<td>-0.626***</td>
</tr>
<tr>
<td></td>
<td>(0.431)</td>
<td>(0.406)</td>
<td>(0.383)</td>
<td>(0.220)</td>
<td>(0.222)</td>
<td>(0.211)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unemployment</th>
<th>(A)</th>
<th>(B)</th>
<th>(C)</th>
<th>(A)</th>
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</tr>
<tr>
<td></td>
<td>(0.312)</td>
<td>(0.332)</td>
<td>(0.322)</td>
<td>(0.288)</td>
<td>(0.280)</td>
<td>(0.292)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inactivity</th>
<th>(A)</th>
<th>(B)</th>
<th>(C)</th>
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<tbody>
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</tbody>
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**Fixed effects**
- City ✓ ✓ ✓ ✓ ✓ ✓ ✓
- Quarter × ✓ × × ✓ ×
- City*quarter × × ✓ × × ✓

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

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- 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:

  \[
  \uparrow VRMW \implies \downarrow \text{Formality, Informality} \\
  \uparrow \text{Unemployment, Inactivity}
  \]