This paper analyzes the effects of minimum wages on employment and the wage distribution in Colombia from 2006 to 2010. Specifically, it uses multinomial logistic regressions to explore the effects of the minimum wage on the probability of being unemployed, employed or inactive and on the odds of being a formal worker, an informal employee or self-employed. Unconditional quantile regressions are employed to observe the effect of the minimum wage on the gender differentiated wage distribution. The study uses data from the new National Household Survey (Gran Encuesta Integrada de Hogares, GEIH) which contains significant changes relative to the previous Survey and has not been used for analytic purposes yet. Results show that increases in the minimum wage raise both the probabilities of being employed and unemployed relative to inactive, but the effect on unemployment is larger. Informal workers are more affected by increases in the minimum wage, although the odds of having either a formal or an informal job relative to being an independent worker decline with a raise in the wage. In terms of wages, for male and female workers, increases in the minimum wage tend to reduce the reported wages at the tails of the distribution, while increasing the salaries of those in the middle, creating a compression effect. In addition a simple simulation showed that increasing the minimum wage results in reductions in wage inequality at the right tail of the distribution but not at the left tail, which has important inequality consequences for poor and low-skilled workers.
### Table of Contents

1. Introduction .......................... 1

2. Minimum wages in Colombia and macroeconomic context .................. 5

3. Related literature ....................... 8

4. Data and descriptive statistics .......... 16

5. Model ................................ 23

6. Econometric estimation results ........ 26
   6.1. Replication of results from previous papers .... 26
   6.2. Effects on employment and unemployment .... 28
   6.3. Effects on the wage distribution ....... 34

7. Conclusions and policy implications .. 40

8. Bibliography ............................ 43
MINIMUM WAGES AND LABOR MARKETS IN COLOMBIA: 2006-2010

1. Introduction

Unemployment in Colombia has always been a problem for the government. It tends to be high (the average rate between 2006 and 2010 was the third highest in Latin America, according to the World Bank), and does not seem to respond easily to economic shocks. Even though unemployment levels tend to increase when the country is going through an economic crisis, in periods of economic booms it does not go down as much as would be expected. In fact, in 1999, when the country was experiencing its most severe economic slowdown, with its GDP decreasing at -4.2%, the unemployment rate rose to 20.1% of the total labor force. But in 2007, when the country was growing at almost 7%, unemployed workers were 10.3% of the working population. This behavior indicates that there must be other factors influencing unemployment in the country, fostering the apparent inertia of the unemployment rate and impeding the adjustment of the labor market to new economic conditions.

One of the factors blamed for driving the inflexibility in the Colombian labor market is the minimum wage. It was established in 1945 in order to ensure a minimum standard of living to all workers in the country and to protect their families from exploitation and poverty. At first, the country had a system of multiple minimum wages which were different by regions, by industries and by firm sizes. In 1983, these were unified, and with
the 1991 Constitution, the minimum wage was enacted as an economic and social right of the Colombian population. Nevertheless, there is still not definitive evidence that the minimum wage has served its purpose during the years.

It is expected that the existence of a minimum wage will have positive effects on reducing poverty and inequality and also on increasing the well-being of the population. However, worldwide evidence on that matter is mixed as it is on its effects on labor market outcomes. In terms of the effect that minimum wages have on employment levels, the literature goes in two different directions. On one hand, the introduction (or increase) of the minimum wage can have positive effects on employment, as shown by Card and Krueger (1994) for the state of New Jersey, Katz and Krueger (1992) for Texas or Card (1992) for California. These authors explained their findings by proposing the existence of monopsony power in low-skilled employment in those states at the time of the change in policy. This would imply that the minimum wage is fixed above the monopsony equilibrium wage but below the perfect competition one, which implies that increases in the minimum wage will induce firms to hire more workers and so the overall level of low-skilled employment increases. This will occur up to the point where the increase in the minimum wage reaches the perfect competition equilibrium, and beyond this point, any further rise starts to reduce employment. Nevertheless, the evidence supporting this theory of monopsonic labor markets has been heavily criticized both on their choice of control groups and survey methods (Newmark and Wascher, 2008). New analyses of these case studies show negative or negligible effects of minimum wages on the employment level.
On the other hand, and based on a neoclassical competitive labor market model, the theory indicates that the introduction of a minimum wage will generate unemployment. Since the minimum wage is a price floor, it creates excess supply of labor. Workers want to supply work at that elevated wage, but employers are not demanding workers at that price and prefer to substitute capital for labor. Thus, minimum wage creates involuntary unemployment by introducing rigidities to the market. There is also a negative effect of total output, as setting a minimum wage above the equilibrium raises the marginal cost of production for firms and so the price of output rises and its demand falls, generating a decline in production. Evidence for this negative effect of minimum wages on employment is found both in cross-country and individual country studies, especially in Latin America, where the effect seems to be large (see Maloney and Núñez, 2004).

As Maloney and Núñez (2004) showed, the median minimum wage in Colombia is high relative to other Latin American countries, and the proportion of individuals (formal workers) in the country earning below the minimum wage is small, so the minimum wage is high and binding. In addition, in 1999 the Constitutional Court ruled that the minimum wage has to increase every year, indexed to the previous year’s inflation in order to preserve workers’ purchasing power. These two issues have increased the pressure on firms, which face higher labor costs and are restricted from balancing these through prices. This would imply that in the Colombian case, the existence of the minimum wage seems to generate negative effects on employment, since employers cannot reduce salaries and so have to adjust by reducing the number of employees.
This paper wants to contribute to the literature regarding the effects of minimum wages on employment and the wage distribution. Specifically, it wants to analyze the effects of the minimum wage on the probability of being unemployed, employed or inactive in the Colombian labor market between 2006 and 2010. It also wants to explore the effects of the minimum wage on the wage distribution in the country, in order to see in which way the minimum wage is affecting the incomes of the population. The results will be useful in ascertaining whether during those years the observed raises in the minimum wage contributed or not to the reported increase in unemployment. This analysis would be useful for policy makers in deciding whether the benefits of minimum wage policy in terms of higher incomes for those covered are worth when compared to the effects in terms of employment.

One of the big contributions of this paper is that it uses data from the new National Household Survey (Gran Encuesta Integrada de Hogares, GEIH) which, as section 4 will explain, contains significant changes relative to the previous Survey and makes this new one even more representative of the overall Colombian population. It is important to highlight that this is the first paper to use these new data, which could be useful for understanding the behavior of the Colombian labor market in recent years.

Another important contribution this paper makes to the literature on the subject is that it includes not only the effect of minimum wages on employment and unemployment, but also on the probability of becoming inactive. The analysis also separates the effects that the minimum wage has on informal workers depending if they are employees or self-employed. This is important because on the one hand, individuals can exit the labor market and on the
other hand, the effects of the minimum wage could be different depending on the working status of the individual.

The paper is organized in the following way. The first section was this introduction, the second part is a brief explanation of the history of the minimum wage in Colombia and the macroeconomic situation of the country during the period of analysis. The third section deals with the related literature on the subject, the fourth describes the data used in the analysis and the fifth section presents the model. The sixth section includes the statistical and econometrical analysis and the seventh and final section concludes and elaborates on policy implications.

2. Minimum wages in Colombia and macroeconomic context

As was stated before, the minimum wage in Colombia was enacted by law in 1945 although it was not formally established until 1949, when it was determined by decree to be of COP$2 a day\(^1\) (Arango, Herrera & Posada, 2008). The idea was to ensure the right that all workers have to cover for their own and their family’s “material, moral and cultural”\(^2\) needs.

At first, there were multiple different minimum wages by region, economic sector and firm size, which were unified in 1983 to avoid what labor unions referred to as “unjust

\(^{1}\) Around US$1 in 1949  
\(^{2}\) Chapter II, Section 145 of the Labor Code
discrimination towards rural workers.” Adjustments to the minimum wage were not necessarily done at the beginning of every year, sometimes changes were established for several years and in other cases, more than one adjustment was done in a year. The reason behind this behavior was to accommodate for the inflationary processes the country was going through and in that sense, the changes were done to maintain workers’ purchasing power. From 1979 on, however, adjustments are made on an annual basis, taking effect in January of each year. With the 1991 Constitution, the minimum wage was turned into a fundamental right of the Colombian population, and in article 53 it states that labor laws shall take into account a minimum, living and mobile remuneration, proportional to the quantity and quality of the work done as one of its basic elements.

Currently, the Permanent Commission on Labor and Wage Policies is responsible for proposing minimum wage increases at the end of each year. This Commission has 15 seats and is formed by five representatives each of the government, employers and workers, and has to “fix the minimum wage in a concerted manner taking into account the inflation target for the next year set by the Board of the Central Bank, the productivity agreed by the tripartite Productivity Committee coordinated by the Ministry of Social Protection, the contribution of wages to national income, the increase in gross domestic product and the consumer price index.” This decision has to be made by the end of December, and if the Committee cannot get to a consensus, the government will decide on the new level of the minimum wage, taking into account all the previous criteria.

3 Reports of the Ministry of Labor and Social Security, 1982-1983
4 Law 278 of 1996
In 1999, and after a disinflationary period which started with the independence of the Central Bank in 1991, the Constitutional Court decided that the minimum wage had to be increased every year based on the previous year’s inflation. This decision implies that the adjustment process has to be done taking into account not the expected inflation, but the realized one, in order to “maintain” the real wage of all workers. According to the Court’s sentence, indexing the minimum wage to past inflation means that changes in productivity are less important in defining the new minimum wage, which goes against economic principles. Also, it means that in recession periods, firms will face higher labor costs and inequality will rise thanks to increases in unemployment and higher real wages.

In the period 2006-2010, Colombia, which was growing steadily after the crisis of 1998-1999, went through the effects of the global economic crisis of 2008. But somehow, the unemployment rate showed virtually no difference between times of economic boom and recession. In 2007, the country showed an annual GDP growth of 6.9%, the highest recorded since 1990. Nevertheless, this good economic behavior only reduced the unemployment rate in less than 2 percentage points, from 12% in 2006 to 10.3% in 2007.

As a result of the international recession, growth began to decline and in 2009 it was around 1.5%. It is important to highlight that, although the decrease was considerable, GDP growth never became negative, as happened in other countries in the region. However, the global recession took its toll on the country, especially in sectors like manufacturing and commerce, which in 2009 reported a negative annual variation of 6.3% and 2.9%, respectively. In that year, the total unemployment rate rose to 12% again, same value it had three years before. This relatively low response of the unemployment rate to the economic
cycle relates to the fact that the labor market in Colombia is very rigid, and inflexibilities like the minimum wage and other costs do not allow it to accommodate to different economic conditions.

Nevertheless, the period of analysis of this study is relatively short (only 5 years) and given that it includes the effects of an economic crisis, it is possible that the results might show an upward bias. Even though the economic cycle is controlled for in the analysis, this means that the effects of minimum wages on employment and wages could be overstated. Furthermore, as it will be explained in Section 5, since the country has a single national minimum wage, the real variation in the model comes from prices, which are endogenous to the economic cycle. According to all this, the results could be showing not only the effect of minimum wages but the fact that unemployment increases during economic downturns.

3. Related literature

As was mentioned before, the evidence on the positive effects on employment of increases in the minimum wage have been widely criticized and reevaluated, finding the opposite results. For instance, Machin and Manning (1993) found that there were positive (and sometimes significant) employment effects of increasing minimum wages in the United Kingdom from the late 1970s through the early 1990s. Nevertheless, a study done by Dolado et al (1996) showed that the abolition of the minimum wage in 1993 increased the levels of employment in the country, which contradicts the previous results.
However, the debate continues even when evidence supporting the neoclassical theory that predicts that increases in the minimum wage tend to reduce employment levels exists for many countries and regions of the world. For 17 countries from the OECD, Newmark and Wascher (2004) found negative effects of increases in the minimum wage on the employment levels of teenagers and youths from the mid 1970s to 2000. The authors found that this negative effect tended to decrease in countries where some kind of a “youth subminimum” existed, because firms could substitute toward cheaper employees. An interesting finding in this paper is that in countries where the minimum wage was set by a national bargaining process, increases in this wage did not seem to generate employment losses. This could indicate that minimum wages have a more adverse effect when labor standards are more restrictive and so labor market institutions play an important role in the definition of the final effect. It is also worth noting that the authors concluded that based on their results, neoclassical predictions seem to hold most strongly in economies with less regulated labor markets.

For the Latin American case, the evidence is overwhelmingly favorable to adverse effects on employment of increasing minimum wages. Feliciano (1998) used census data for Mexico from 1970, 1980 and 1990, and found that after controlling for the business cycle and including state and year fixed effects, there was evidence of disemployment effects for females over all age groups (the results for males were small and insignificant). Gindling and Terrell (2007a, 2007b) worked with data for Honduras and Costa Rica and found negative effects of increasing the minimum wage on the levels of employment in both countries. In Costa Rica, the authors used pooled time series cross sectional data for 10,000 individuals per year between 1988 and 2000. Their results show significant negative
estimates for employment and hours worked in the covered sector. In the case of Honduras, Gindling and Terrell found significant negative disemployment effects in the large firm sector between 1990 and 2004. For smaller firms their estimates were weakly positive, which might be reflecting a movement of workers from large to smaller firms.

In terms of the effect of minimum wages on the distribution of wages across the population, it is expected that, given reasonable levels of enforcement and compliance, the existence of a minimum wage will create a spike at the level set as minimum and a thinning of the lower tail of the distribution. It is also expected that firms will substitute away from lower-skilled employees who are now more costly toward workers with higher skills. This means that there will be spillovers to workers who earn more than the minimum wage, due to an increased demand for their services.

The evidence for industrialized countries (Neumark and Wascher (1992), Card and Krueger (1995), DiNardo, Fortin and Lemieux (1996), and many others) shows that, as theory predicts, the minimum wage raises the wages of lowest skilled workers while creating a spike in the wage distribution at the minimum. For developing countries, Gindling and Terrell in their analysis of labor markets in Honduras and Costa Rica, found spikes in the wage distributions for both countries, but only for workers in the covered sector. A study from the World Bank (2006) for the Latin American region, found evidence of spikes in the wage distribution not only in the formal sector but also in the informal one. The reason behind this, according to the authors, could be that employers in the informal sector have to compete with their counterparts in the formal sector, and so keep their wages
at the minimum that applies to the latter. The study also found that minimum wages have a noticeable effect on wages very high up the wage distribution.

The literature on the effects of the minimum wage on labor market outcomes in Colombia has blossomed during the last decade, in an attempt to find an explanation for the poor performance of the labor market in the country’s recent past. Much research has been done on the effects of market inflexibilities on the levels of labor informality in the country, and also on its effects on unemployment levels. The results obtained by different papers indicate that increases in the minimum wage have negative effects on employment, positive effects on informality and a regressive effect on wages.

The first paper to analyze the impact of minimum wages in labor market outcomes in Colombia was Bell (1997), which focused on industry level data for the period 1980-1987. The author found that an increase of 10% in the real minimum wage resulted in an unemployment effect for low-paid low-skilled workers from 2% to 12%. This effect was not found when analyzing similar data for Mexico, which means that in Colombia the minimum wage is effective and binding, as it is close to the mean of the wage distribution.

Similar effects were found by Arango and Pachón (2004), Hernández and Pinzón (2006) and Maloney and Núñez (2004), all of which use household-level data. According to the results from Arango and Pachón’s analysis, the household head’s likelihood of being employed diminishes with increases in the minimum wage. This result is more pronounced for youth and women household heads. For other members of the household, the impact goes in the same direction, and its magnitude depends on the level of education of the
household, with larger effects on unemployment for families with higher levels of education. The authors’ analysis, based on National Household Survey data from 1984 to 2001, also indicate that there are positive effects of minimum wages in family income, although it is only significant for households above the 20th percentile of the family per-capita income distribution. This asymmetric effect generates an important distributive impact, as it widens the distance between those households at the bottom of the income distribution relative to the median income family.

Hernández and Pinzón (2006), using National Household Survey quarterly data for the period 2000-2004, found negative and significant effects of increases in the minimum wage on employment for all age groups with the exception of young workers, for whom they found very positive effects. The explanation the authors give is that there is a high substitutability between young and adult workers as the young ones have lower hiring costs. When the minimum wage increases, the wage costs for adult workers increase in a higher degree than for young workers, and so firms can get rid of the adults and hire more youngsters. In terms of the effects on wages, the results of the paper show that for the first five deciles the effect of an increase in the minimum wage is negative but not statistically significant and for the remaining deciles, the effect is positive and significant. This means that for low-income workers the effect of the minimum wage is negative (but not significant), and as wages move forward along the distribution, the impact becomes positive, a result that mirrors Arango and Pachón’s findings.

Maloney and Núñez (2004), using rotating panel data from the National Household Survey between 1997 and 1999 for men working 30-50 hours a week, found that a rise in
the minimum wage has a statistically significant effect on the probability of becoming unemployed, which decreases as the worker advances in the wage distribution. So again, the results show that the minimum wage affects the employment levels of mostly low-wage workers. But when the authors analyze the effect of increases in the minimum wage on incomes, their results are contrary to the ones described in other papers. They found that the impact is large for salaried workers who earn around the minimum wage, but as they move up the income scale the effect remains significant up to 4 minimum wages although with decreasing magnitudes for those earning more than 4 times the minimum wage. For self-employed workers the effect of an increase in the minimum wage is significant for those workers earning below the minimum wage, but overall there seems to be little impact on the income distribution.

Hernández and Lasso (2003) found slightly different results as well. They analyzed the impact of the minimum wage on the relative demand functions of adult and young workers using National Household Survey data from 1984 to 2000. Even though their results were not statistically significant, the effect of the minimum wage was positive for those workers covered by the minimum wage (young and low-skilled workers) and negative for those uncovered. This means that with an increase in the minimum wage, low-income workers’ demand reacts favorably thanks to the higher flexibility of wages due to a large component of informal jobs, while the labor demand of higher-income workers adjusts negatively. Since the minimum wage was not statistically significant in their analysis, the authors conclude that the employment levels of young and low-skilled workers are determined by GDP growth and also by informal labor and the labor supply, measured by the global rate
of participation. For adult and high-skilled workers, employment levels are mainly
determined by the urban GDP.

In terms of non-wage costs, Kugler and Kugler (2009) explored the effects of
increasing payroll taxes on formal wages and employment. The authors used a balanced
panel of firms in the formal sector taken from the Annual Survey of Manufacturers over the
period 1982-1996 and found that a 10% increase in these types of taxes reduces wages
between 1.4% and 2.3% and employment between 4% and 5%. In addition, the results
showed that the unemployment effects tend to be larger for low-skilled workers (production
workers) than for workers with higher skills (executives).

Similarly, Cárdenas and Bernal’s (2004) analysis suggests that a 9% reduction in non-
wage costs (also known as parafiscal taxes) would increase the employment in urban areas
by 1.3% (from a long-term or dynamic approach), while the "static" effect of a reduction of
10% in those costs would generate a 5% increase in labor demand.

As stated before, the analysis that focuses on the impact of minimum wages and non-
wage costs on informality have come to the conclusion that this effect is positive, that is,
increases in these variables tend to increase labor informality. Mondragón, Peña and Wills
(2010) used data from the National Household Survey for the period 1984-2006, and found
that an increase of 10 percentage points in non-wage costs is associated with an increase in
the probability of being informal of 5 to 8 percentage points depending on the definition of
informality used. The authors also found that a raise of 20 percentage points in the
minimum wage implies an increase of 2 percentage points in the informality rate. These
results were especially significant for workers with low skills. The authors expanded their analysis to the effects on the wage distribution (Mondragón, Peña and Wills (2011)) and found that for formal workers who earn wages in the first third of the distribution, an increase in the minimum wage has a positive effect, which becomes negative for higher salaries, while an increase in non-wage costs reduces the wages of all workers. For informal workers the effect of the minimum wage is negative, becoming more negative for the extremes of the distribution, and non-wage costs have a negative effect on all salaries.

Cárdenas and Mejía (2007) found very similar results using data from the Small Firm Survey from 2002 and 2003. According to their findings, non-wage costs have a positive effect on informality with an elasticity close to 1.4%. Regarding the effect of the minimum wage, the authors also found a positive elasticity (0.83), which means that increases in the real wage are associated with increases in informality.

Finally, Sánchez, Duque and Ruiz (2009) used data from the National Household Survey from 1984 to 2006 to analyze the effects on both informality and unemployment. They found that an increase in payroll taxes generates a rise in informality, unemployment and its duration. Their estimations show that the rise in non-wage costs occurred since 1990s augmented unemployment by 3.5 percentage points, informality by 5.3 points and unemployment duration by six weeks. Their results also showed that raises of 5% in the minimum wage increases the unemployment rate between 0.6% and 1.2%.
4. **Data and descriptive statistics**

The data used for this analysis comes from the National Household Survey (Gran Encuesta Integrada de Hogares, GEIH) for the years 2006 through 2010. This Survey is an improvement over the Encuesta Nacional de Hogares (ENH) which ran from 2001 to 2006, in an attempt to consolidate the three surveys that were used to collect information on households. According to the Departamento Administrativo Nacional de Estadística (DANE), changes include the broadening of the metropolitan areas to include other departmental capitals going from 13 to 23 areas and the consequent re-stratification of the remaining municipalities, and an increase in the number of questions in the questionnaire, which goes from 80 for the ENH to almost 180 for the GEIH. There are also slight modifications in the order and wording of some questions in the labor force module, used for the identification of the economically active population and its breakdown between employed and unemployed population, and finally a change in the type of survey informant, from “ideal” which was an individual older than 18 years who informed of his/her data and those of other members of the household, to “direct” informant, in which each individual (older than 10 years) informs of his/her own data⁵.

These changes make comparing the following analysis with other studies using ENH data difficult, and could be a factor generating difference in the results. But on the plus side, this survey is more representative of the Colombian population, as it includes more cities and asks more specific questions. Nevertheless, it is important to start working and analyzing this new survey, which will be the one being used by DANE in the future.

---

⁵ For more information, see ECH – GEIH Splice Report and GEIH Methodology Notes. DANE
The sample is composed of all respondents in the labor force (either employed, unemployed or inactive) who are between 16 and 65 years of age and live in one of the 13 main cities (Bogotá, Pasto, Ibagué, Montería, Cartagena and Villavicencio, and Medellín, Cali, Barranquilla, Bucaramanga, Manizales, Pereira and Cúcuta with their metropolitan areas). There are a total of 300,107 observations divided over the five years: 35,988 (11.99% of the total) in 2006, 67,062 (22.35%) in 2007, 66,910 (22.30%) in 2008, 63,240 (21.07%) in 2009 and 66,907 (22.29%) in 2010.

Labor status is a categorical variable which takes on three different values: employed, unemployed or inactive. As it is shown in Table 1, most of the respondents (62.85%) in the sample are employed either as employees or self-employed. Of this amount, 55.62% work as employees in firms and the rest (44.38%) are independent. Unemployed individuals are only 9.41% of the sample while other 27.75% are inactive.

Employed individuals are mostly male (53.48% male vs. 46.52% female), ratio that reverses for the unemployed and inactive categories. In those cases, women are the majority, especially for inactive individuals. The reason behind this is that during the period of study, almost 30% of the inactive population were students and another 60% were housewives. Survey results indicate that female students outnumber male students at the

---

6 Even though the GEIH has information for 23 cities, the analysis will be done using only 13. The reason is that regional national accounts and CPI information are only available (for now) for the 13 cities mentioned.
7 See DANE, GEIH results by sex at http://www.dane.gov.co/index.php?option=com_content&view=article&id=125&Itemid=67
middle, high school and college levels\textsuperscript{8} and since homemakers tend to be women, this explains why most inactive individuals are females.

The descriptive statistics show that most employed individuals are either married or cohabiting (56.65\%), as are also the majority of unemployed (60.62\%) and inactive (56.78\%) respondents. Single individuals are almost 22\% of all of those employed, followed by widowers (11.35\%) and divorcees (10\%). For those either unemployed or inactive, widowers are the second largest category (16.58\% of all unemployed and 19.17\% of all inactive), followed by singles and divorced individuals.

### Table 1. Descriptive statistics

<table>
<thead>
<tr>
<th></th>
<th>Employed</th>
<th>Unemployed</th>
<th>Inactive</th>
<th>ILO criteria</th>
<th>Contributions criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Informal</td>
<td>Formal</td>
<td>Informal</td>
<td>Formal</td>
<td>Informal</td>
</tr>
<tr>
<td>Total observations</td>
<td>188,613</td>
<td>28,226</td>
<td>83,268</td>
<td>115,581</td>
<td>72,744</td>
</tr>
<tr>
<td>%</td>
<td>62.85</td>
<td>9.41</td>
<td>27.75</td>
<td>61.37</td>
<td>38.63</td>
</tr>
<tr>
<td>Age (Mean)</td>
<td>37.4</td>
<td>31.5</td>
<td>35.1</td>
<td>38.3</td>
<td>36.0</td>
</tr>
<tr>
<td>Males (%)</td>
<td>53.48</td>
<td>44.09</td>
<td>27.01</td>
<td>52.15</td>
<td>55.38</td>
</tr>
<tr>
<td>Females (%)</td>
<td>46.52</td>
<td>55.91</td>
<td>72.99</td>
<td>47.85</td>
<td>44.62</td>
</tr>
<tr>
<td>Marital status (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married or cohabiting</td>
<td>56.65</td>
<td>60.62</td>
<td>56.78</td>
<td>55.72</td>
<td>57.30</td>
</tr>
<tr>
<td>Single</td>
<td>21.98</td>
<td>14.11</td>
<td>17.56</td>
<td>24.16</td>
<td>20.59</td>
</tr>
<tr>
<td>Divorced</td>
<td>10.02</td>
<td>8.69</td>
<td>6.49</td>
<td>7.97</td>
<td>11.49</td>
</tr>
<tr>
<td>Widow</td>
<td>11.35</td>
<td>16.58</td>
<td>19.17</td>
<td>12.15</td>
<td>10.62</td>
</tr>
<tr>
<td>Education level (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No schooling</td>
<td>1.97</td>
<td>1.44</td>
<td>4.45</td>
<td>3.12</td>
<td>0.30</td>
</tr>
<tr>
<td>Preschool</td>
<td>0.00</td>
<td>0.01</td>
<td>0.03</td>
<td>0.01</td>
<td>0.00</td>
</tr>
<tr>
<td>Elementary</td>
<td>21.58</td>
<td>16.27</td>
<td>22.22</td>
<td>31.66</td>
<td>6.73</td>
</tr>
<tr>
<td>Middle</td>
<td>17.14</td>
<td>17.81</td>
<td>21.78</td>
<td>23.49</td>
<td>7.71</td>
</tr>
<tr>
<td>High</td>
<td>30.50</td>
<td>35.34</td>
<td>27.61</td>
<td>33.04</td>
<td>26.78</td>
</tr>
<tr>
<td>College</td>
<td>28.81</td>
<td>29.13</td>
<td>23.91</td>
<td>8.69</td>
<td>58.48</td>
</tr>
</tbody>
</table>

Source: Own calculations based on GEIH data

Note: The ILO definition of informality defines informal workers as those who: (i) work in firms with 10 or fewer employees, (ii) are unpaid family aids and housekeepers, (iii) are self employed (except for independent professionals and technicians), or (iv) are business owners of firms with 10 or less employees. The contributions definition defines informal workers as those who don’t contribute to old-age pensions or health insurance or both.

Regarding education levels, the concentration of higher degree completion is evident. Most people in the sample reported having completed high school and college studies. This proportion represents 64.47% of all unemployed, 59.31% of all employed and 51.52% of all inactive respondents. For the latter category, 44% graduated from either middle or elementary school, and this number is reduced to 38.71% for employed individuals and 34.07% for unemployed persons. A very small amount of respondents only finished preschool or have no education whatsoever, and this proportion is higher among those inactive (4.45%).

There are two different ways to measure informality. The first and most widely used is the one calculated by DANE based on the International Labor Organization’s (ILO) guidelines. This definition, based on firm size and occupation defines informal workers as those who: (i) work in firms with 10 or fewer employees, (ii) are unpaid family aids and housekeepers, (iii) are self employed (except for independent professionals and technicians), or (iv) are business owners of firms with 10 or less employees. The second measure is one related to social protection contributions that capture whether workers pay for access to the benefits associated with formal employment. This measure, following Mondragón, Peña and Wills (2010) defines informal workers as those who don’t contribute to old-age pensions or health insurance or both. The distribution of workers along the two categories is very similar, as shown in Table 1, and so the results of the effects of minimum wages on informality should not differ much with respect to the measure used.

Consistent with the statistics for the overall employed population, most formal and informal workers are married or cohabit with a partner (55.72% according to the ILO
criteria and 54.26% when using the contributions definition). In terms of education, both definitions indicate that formal workers tend to complete higher levels of education. While formal workers who earned college degrees are 43%-59% of employed individuals (depending on the definition used), among informal workers this category only includes 8.7%-15% of all individuals who have a job. This means that individuals who are drawn to informal jobs are those with lower schooling levels, as most of them responded to have only finished elementary and high school.

The definitions used differ in their frequencies of male and female workers. When using the ILO criteria, most informal workers are male (52.15%), but when using the contribution definition, most informal workers are female (55.70%). Probably this difference has got to do with the fact that most business owners in the country are male⁹ and so this will tend to over-represent males in the ILO definition.

Data for the regional economic cycle was obtained from the country’s regional accounts published annually by DANE. The annual growth of the 13 cities in the sample has a mean of 5.2% in the 2006-2010 period with a standard deviation of 5.5 percent.

The real minimum wage variable was constructed by dividing the actual minimum wage of the country over the CPI of each of the 13 cities in the national accounts sample. This means that there are 13 different minimum wages for each month in the sample. The

⁹According to the World Bank’s GenderStats, male employers represent 6.5% of total employment while female employers only count for 2.7% of total employment.
mean value of this variable is COP$535,228.9 which is approximately US$298.68 with a standard deviation of COP$12,985 (US$7.2).

Salaries earned by the individuals in the sample have a large variability. After disposing of the top and bottom 1% of the reported incomes, the maximum is COP$282 million a month (more than US$160,000), but the mean of the sample is approximately COP$714,200, a little over US$406 a month. Wages for employees are consistently higher than those reported by self-employed workers, but the characteristics of the distribution are very similar.

**Figure 1. Kernel density function of normalized wages**

![Kernel density function of normalized wages](image)

Source: Own calculations based on GEIH data

Note: The normalized wage is a subtraction of the natural logarithm of the minimum wage from the natural logarithm of the reported wage for each individual

Regarding the distribution of wages, a “normalized” wage variable was created in order to be able to compare across years where the minimum wage is situated with respect to the actual wages earned by individuals. The new variable is simply the subtraction of the
natural logarithm of the minimum wage from the natural logarithm of the reported wage for each individual. In this way, it is possible to aggregate all years and cities in a single graph. Figure 1 shows that there is a spike around the minimum wage as the literature suggested, which means that a large percentage of the workers earn wages close to the minimum and so the minimum wage is binding. This means that a potential increase in the minimum wage is expected to raise the wage levels of all those workers located close to the minimum, while reducing the salaries of those further away from it.

![Figure 2. Kernel density function of normalized wages](image)

Formal vs informal workers

Source: Own calculations based on GEIH data
Note: The normalized wage is a subtraction of the natural logarithm of the minimum wage from the natural logarithm of the reported wage for each individual

But after separating the reported wages by formality status, it is obvious that the above distribution is generated by the behavior of formal sector wages. The results in Figure 2 indicate that there are more informal workers earning less than the minimum wage during
the period of analysis. Also, the fact that the distribution of informal wages is not as close to the zero line as the one for formal workers indicates that the minimum wage in Colombia is not as effective in the informal labor market as it is in the formal one. This implies that it is possible that the potential effects of increasing the minimum wage will not affect informal workers as much as it will impact formal laborers.

5. Model

In order to analyze the effects of increases in the minimum wage in the probability of different labor outcomes a multinomial logit model is used. This model allows for a dependent categorical variable, which in this case takes three different values representing the probabilities of an individual being employed, unemployed and inactive.

Since in Colombia the minimum wage is only one for the whole country, it was necessary to create some degree of variability. This was done by deflating the value of the nominal minimum wage by the Consumer Price Index (CPI) of each of the 13 cities in the sample using the approach taken by Mondragón, Peña and Wills (2011). In this way, the final variable of interest is the natural logarithm of the real minimum wage by city.

The model used is the following:

\[ P(labor\text{status})_{i,c,t} = \beta_0 + \beta_1 \log(\text{real minimum wage})_{c,t} + \beta_2 \text{regional GDP}_{c,t} + \beta_3 X_{i,c,t} + \epsilon_{i,c,t} \]
where $i$ represents values that vary at the individual level, $c$ represents variations at the city level and $t$ represents variations in time. The main variables of interest, laborstatus and realminimumwage, are as described previously and the regression equation also includes controls for regional economic cycles and individual characteristics. The latter one, represented by $X_{i,c,t}$, is a vector that includes individual variables such as gender, age, marital status and highest level of education achieved.

According to labor market theory and the presented evidence, an increase in the real minimum wage in Colombia should decrease the probability of an individual being employed relative to inactive and consequently increase the probability of being unemployed relative to inactive. The reason behind this is that increases in the minimum wage elevate hiring costs for employers, especially since most of the workers in the country receive salaries which are very close to the minimum amount (Maloney and Nuñez, 2004).

Given that labor informality is so prevalent in Colombia, it is also important to explore the effects that increases in the minimum wage might have on the probability of formal workers becoming informal. Since employment decisions are made jointly, that is workers decide whether to be employees in firms or self-employed but at the same time they choose between formal or informal jobs, another multinomial model was used. The model has the same independent variables described before, as is shown below:

$$P(formalitystatus)_{i,c,t}$$

$$= \beta_0 + \beta_1 \log(realminimumwage)_{c,t} + \beta_2 \text{regional GDP}_{c,t} + \beta_3 X_{i,c,t} + \epsilon_{i,c,t}$$
The independent variable, *formalitystatus*, is a categorical variable which takes on three different values to represent if the individual works as a formal employee, an informal employee or is self-employed. The idea is to see if there is a difference in the effect of the minimum wage on labor informality, depending on whether the individual works for a firm or has his own company. It is expected that formal employees will feel stronger effects than informal employees, as increases in the minimum wage raises labor costs for firms and so they tend to become self-employed.

To complete the outlook on the effect of minimum wages, it is important to see if increases in this wage have a potential spillover effect on the wages of all other workers in the country. To this effect, a wage equation will be estimated by deciles and by gender, using the so called unconditional quantile regression method proposed by Firpo, Fortin, and Lemieux (2009). This method is useful because by modeling the expected value of the wage, the impact of a change in the distribution of an explanatory variable on the average wage of the whole population is simply obtained as the average effect of this variable on different individuals of the population, and so the estimated coefficients can be interpreted directly (Aeberhardt, Givord and Marbot, 2011).

The estimated equation then is

\[
\log(\text{realwages})_{i,c,t} = \beta_0 + \beta_1 \log(\text{realminimumwage})_{c,t} + \beta_2 \text{ regional GDP}_{c,t} + \beta_3 X_{i,c,t} \\
+ \beta_4 \text{ informalitity}_{i,c,t} + \epsilon_{i,c,t}
\]
where the variables and subscripts are the same as described in the two equations above
with the addition of a dummy variable indicating whether the individual works in the
informal sector or not. According to the literature, it is expected that increases in the
minimum wage raises salaries for workers who earn close to the minimum wage, while
having negative effects on the tails of the distribution. This is what is known as a
compression of the wage distribution.

6. Econometric estimation results:

6.1. Replication of results from previous papers

Before analyzing the effect of the minimum wage on employment and wages using the
models explained in the previous section, it is useful to do a comparison between the results
found by other recent papers and a replication of their results using GEIH data. The idea is
to see how they compare when using recent data from the new National Household Survey
and in that way confirm the robustness of the results. Specifically, the comparison will be
done with Mondragón, Peña and Wills’ (2010, 2011) results for informality and later on for
the wage distribution.

In terms of informality, replicating exactly the equations estimated by the authors, the
results with data from the 2006-2010 period are very similar, though quite a bit larger. This
could be explained by the fact that, as said before, this time period included the effects of
an economic slowdown which can be biasing the results upward, even after controlling for
the economic cycle. Table 2 shows both sets of results.
Table 2. Comparison of the effects of minimum wages on labor informality

<table>
<thead>
<tr>
<th></th>
<th>Mondragón, Peña &amp; Wills (2010)</th>
<th>Replication with new data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real minimum wage</td>
<td>0.116***</td>
<td>0.567***</td>
</tr>
<tr>
<td></td>
<td>(0.044)</td>
<td>(0.181)</td>
</tr>
</tbody>
</table>

Note: Controls include household income per capita, individual characteristics such as age, education, marital status and gender and dummies by city and industry. The definition of informality used is the one based on DANE-ILo criteria. Marginal effects are shown. Robust standard errors clustered by city and year are in parentheses *** p<0.01, ** p<0.05, * p<0.1

According to Mondragón, Peña and Wills, an increase of 10 percentage points in the minimum wage increased informality in a little more than 1 percentage point. The effects under the new dataset are larger, as the same increment in the minimum wage results in an informality raise of over 5 percentage points. According to this, and taking into account that almost 60% of the working population during the period of analysis was considered informal under the DANE-ILo criteria, 9.5% of workers (approx. 28,600 individuals) could be going into informality thanks to the 10 percentage point increase in the minimum wage.

Now, turning to the effects of increases in the minimum wage on the wage distribution, is it helpful to replicate Mondragón, Peña and Wills (2011) results. Here, the authors do not report their coefficients but have a graph where they show that, for all workers, increases in the minimum wage reduce salaries across the distribution, with larger effects for those workers at the tails. Figure 3 shows both Mondragón, Peña and Wills’ graph and the replication with the data from 2006 to 2010.
It can be seen in Figure 3 that the results of the replication are quite different. It seems that in the period between 2006 and 2010, the effects of increasing the minimum wage were less negative across the wage distribution. The replication shows that for workers in the 5th and 6th deciles, a raise in the minimum wage generates increases in their salaries. However, it is important to highlight that the results for percentiles 30, 40, 50 and 70 are not statistically different from zero.

6.2. Effects on employment and unemployment

In order to explain the effects of increases in the minimum wage on the levels of employment in the country, it is useful to include inactive individuals in the sample being analyzed. The reason behind this is that it is possible that with a raise in the minimum wage, individuals who were inactive decide to enter the labor market or on the contrary,
active workers decide to leave it. The multinomial model explained in section 5 allows for this distinction, and its results are shown in Table 3.

Table 3. Effect of the minimum wage on the probabilities of a worker being employed and unemployed
(Multinomial logit model)

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Employed</th>
<th>Unemployed</th>
<th>Employed vs unemployed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log real minimum wage</td>
<td>48.21***</td>
<td>229.3***</td>
<td>0.210**</td>
</tr>
<tr>
<td>Regional GDP</td>
<td>1.011***</td>
<td>0.998</td>
<td>1.014***</td>
</tr>
<tr>
<td>Age</td>
<td>1.531***</td>
<td>1.324***</td>
<td>1.156***</td>
</tr>
<tr>
<td>Age2</td>
<td>0.995***</td>
<td>0.996***</td>
<td>0.999***</td>
</tr>
<tr>
<td>Male</td>
<td>4.129***</td>
<td>2.491***</td>
<td>1.658***</td>
</tr>
<tr>
<td>Middle school</td>
<td>1.015</td>
<td>1.065**</td>
<td>0.953*</td>
</tr>
<tr>
<td>High school</td>
<td>1.455***</td>
<td>1.517***</td>
<td>0.959</td>
</tr>
<tr>
<td>College</td>
<td>1.534***</td>
<td>1.393***</td>
<td>1.101*</td>
</tr>
<tr>
<td>Married or cohabiting</td>
<td>1.103***</td>
<td>0.951*</td>
<td>1.160***</td>
</tr>
<tr>
<td>Separated or widower</td>
<td>1.354***</td>
<td>1.052</td>
<td>1.287***</td>
</tr>
<tr>
<td>Constant</td>
<td>0***</td>
<td>0***</td>
<td>3.353**</td>
</tr>
</tbody>
</table>

Pseudo R2 | 0.1369 | 0.1369 | 0.1369 |
Observations | 300,107 | 300,107 | 300,107 |

Note: For the first two equations, the reference variable is inactive, so the independent variable in equation (1) is the probability of being employed relative to the probability of being inactive, and the independent variable in equation (2) is the probability of being unemployed relative to being inactive. Equation (3) shows the probability of being employed relative to being unemployed. Coefficients shown are Odd Ratios. Robust standard errors clustered by city and year are in parentheses *** p<0.01, ** p<0.05, * p<0.1
The results suggest that raises in the minimum wage increase the probability of a worker being employed relative to inactive (Equation 1), which means that workers, during the period of study, tended to become employed when the minimum increased, and this result is highly statistically significant. If the minimum wage increases by one standard deviation, an individual is 9.84% more likely to be unemployed than inactive. This finding, although somewhat contrary to the results observed in the literature for Colombia, could be driven by the large influence of the informal sector in the country, which will be explored in more detail later on.

The effect of the economic cycle on employment is positive and significant for employed workers and implies pro-cyclicality, as increases in the regional GDP are associated with higher probabilities of being employed relative to inactive. Control variables such as gender, age and education have all expected positive effects on employment, with males being more likely to be employed than women and older and more educated individuals having higher probabilities of being employed relative to being inactive.

On the other hand, Equation 2 on Table 3 shows that increases in the minimum wage raise the probability of being unemployed with respect to being inactive. According to the results, an increase of one standard deviation in the minimum wage makes an individual 14% more likely to be unemployed than inactive. This estimate is highly significant and consistent with the literature for the region and the country specifically, as higher minimum wages tend to generate unemployment. For unemployed workers, the economic cycle effect is counter-cyclical, and increases in the regional GDP reduce the odds of a worker being
unemployed relative to inactive. This is consistent with the fact that higher economic activity reduces unemployment.

In short, the results indicate that increases in the minimum wage increase the probability of being employed but also the probability of being unemployed, both relative to being inactive. Even though this might look counterintuitive on a first look, it is possible that the effect on employment is generated by an increase in informal employment, and so this positive effect is not reflecting improvements in conditions for workers, but a displacement to less protected and lower paid jobs.

To untangle these seemingly conflicting effects, the probability of being employed relative to unemployed is shown in equation 3 in Table 3. The results indicate that an increase in the minimum wage decrease the probability of being employed relative to being unemployed with a 95% level of significance. An increase in one standard deviation in the minimum wage results in an individual being 3.7% less likely to be employed than unemployed. So it seems that even though increases in the minimum wage increase both employment and unemployment relative to being inactive, the effect on unemployment is stronger. The effect of the economic cycle is once again positive, as increases in the regional GDP raises the probability of being employed, just like being male and finishing college do.

Now, it is important to see how an increase in the minimum wage affects workers depending on their status. Analyzing the effect of raising the minimum wage on the probabilities of being an employee (formal or informal) versus the probability of being a
self employed worker, results in reduced probabilities of being employed relative to independent. An increase in the minimum wage reduces both the probabilities of being a formal employee and an informal employee relative to being a self-employed worker. This means that the odds of being an employed worker, whether formal or informal, are smaller than the odds of being a self-employed worker when the minimum wage increases. This is related to increasing labor costs for firms, which could prefer to outsource their employees and avoid those who are more expensive.

As Table 4 shows, the effect of increasing the minimum wage on the odds of being an informal employee are smaller than on the odds of being a formal employee, which is related to the fact that higher minimum wages affect informal workers less than they do formal workers. Specifically, after an increase of the minimum wage of one standard deviation, the probability of being a formal worker relative to a self-employed is reduced by 9%, while the relative probability for informal workers diminishes by 4%. This is reflected on the fact that increasing the minimum wage reduces the odds of being a formal worker relative to an informal one. An increase of one standard deviation in the minimum wage makes a worker 5% less likely to be formal than informal.

The economic cycle has a negative effect on the probabilities of being employed relative to self-employed. According to that, increases of one point in regional GDP growth reduce the odds of a worker being formal by nearly 2%, while it diminishes the probabilities of being an informal worker by 1.2%. This implies that when the country is growing, workers tend to go into self-employment. The effects of other control variables are as expected. Age
<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Formal employee (1)</th>
<th>Informal employee (2)</th>
<th>Formal vs informal (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log real minimum wage</td>
<td>0.0205*** (0.0175)</td>
<td>0.174** (0.133)</td>
<td>0.118*** (0.0633)</td>
</tr>
<tr>
<td>Regional GDP</td>
<td>0.981*** (0.00425)</td>
<td>0.988** (0.00501)</td>
<td>0.993 (0.00454)</td>
</tr>
<tr>
<td>Age</td>
<td>1.037*** (0.00596)</td>
<td>0.884*** (0.00507)</td>
<td>1.173*** (0.00598)</td>
</tr>
<tr>
<td>Age2</td>
<td>0.999*** (7.46e-05)</td>
<td>1.001*** (6.34e-05)</td>
<td>0.998*** (6.27e-05)</td>
</tr>
<tr>
<td>Male</td>
<td>1.095*** (0.0228)</td>
<td>0.515*** (0.0243)</td>
<td>2.126*** (0.0740)</td>
</tr>
<tr>
<td>Middle school</td>
<td>1.478*** (0.0467)</td>
<td>0.858*** (0.0171)</td>
<td>1.722*** (0.0620)</td>
</tr>
<tr>
<td>High school</td>
<td>3.571*** (0.170)</td>
<td>0.824*** (0.0218)</td>
<td>4.332*** (0.207)</td>
</tr>
<tr>
<td>College</td>
<td>7.205*** (0.562)</td>
<td>0.552*** (0.0198)</td>
<td>13.06*** (0.957)</td>
</tr>
<tr>
<td>Married or cohabiting</td>
<td>0.810*** (0.0240)</td>
<td>0.736*** (0.0201)</td>
<td>1.102*** (0.0288)</td>
</tr>
<tr>
<td>Separated or widower</td>
<td>0.800*** (0.0306)</td>
<td>0.702*** (0.0233)</td>
<td>1.140*** (0.0395)</td>
</tr>
<tr>
<td>Constant</td>
<td>9.871e+09*** (5.288e+10)</td>
<td>1.589e+06*** (7.642e+06)</td>
<td>6,214*** (21,246)</td>
</tr>
</tbody>
</table>

Note: For the first two equations, the reference variable is being self-employed, so the independent variable in equation (1) is the probability of being a formal employee relative to the probability of being self-employed, and the independent variable in equation (2) is the probability of being an informal employee relative to being self-employed. Equation (3) shows the probability of being a formal worker relative to being an informal worker. Coefficients shown are Odd Ratios. Robust standard errors clustered by city and year are in parentheses *** p<0.01, ** p<0.05, * p<0.1

tends to increase the relative probability of being a formal worker, while it reduces the odds of being an informal worker compared to self-employed workers. Higher levels of
education are related to higher probabilities of being a formal worker, which is consistent with reductions in the probability of being an informal worker as education increases.

6.3. Effects on the wage distribution

Finally, to finish the outlook of the effects of the minimum wage on labor market outcomes in Colombia, it is key to analyze its effect on the country’s wage distribution. To that end, wage equations were estimated separately for each gender, to acknowledge the differences in labor market status and outcomes between men and women. The results show that for both cases, increases in the minimum wage tend to reduce the reported wages of workers at the tails of the distribution, while increasing the salaries of those in the middle, who are workers that earn wages close to the minimum (see Figure 4). For both sexes, the negative effect of increasing the minimum wage at the upper tail of the distribution is transmitted almost completely to wages. For men, however, the negative effect on the lower tail of the distribution is not significantly different from zero. The compression effect observed at both ends of the distribution is consistent with the existing evidence for the country (Maloney and Núñez (2004), Mondragón, Peña and Wills (2011)).

The difference in the location of the spikes in the wage distributions for male and female workers is explained by the position minimum wage earners have in the distribution. For males, workers who earn the minimum are between the 4th and 5th deciles, while female minimum earners are distributed in the 5th and 6th deciles of the working population. Of course this reflects the fact that women tend to have lower wages than men.
The effects observed for female workers have to be taken with a grain of salt. The erratic effects observed in the women’s distribution may be explained by the fact that this model is not taking into account the role that female participation has in the labor market. Increases in the minimum wage could have differential effects on the female individuals’ decision to enter or exit the economically active population, depending on their position in the wage distribution, and these are not being modeled here.

As can be observed in Figure 5a, the coefficients of the negative effects of increasing the minimum wage for male workers in the first two (and the 6th) deciles of the wage distribution are not statistically significant. The economic cycle has a positive but very small effect on wages, and as expected, increases in the age of the worker are also positive along the distribution. The returns to education for males seem to be higher for high school
Figure 5a. Effects of minimum wage on the wage distribution for males
(Unconditional quantile regression)

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Decile 1</th>
<th>Decile 2</th>
<th>Decile 3</th>
<th>Decile 4</th>
<th>Decile 5</th>
<th>Decile 6</th>
<th>Decile 7</th>
<th>Decile 8</th>
<th>Decile 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log real minimum wage</td>
<td>-0.0232</td>
<td>-0.103</td>
<td>0.358***</td>
<td>0.491***</td>
<td>0.587***</td>
<td>0.145</td>
<td>-0.411***</td>
<td>-1.079***</td>
<td>-0.837***</td>
</tr>
<tr>
<td></td>
<td>(0.266)</td>
<td>(0.165)</td>
<td>(0.0466)</td>
<td>(0.0441)</td>
<td>(0.0891)</td>
<td>(0.0997)</td>
<td>(0.119)</td>
<td>(0.151)</td>
<td>(0.221)</td>
</tr>
<tr>
<td>Regional GDP</td>
<td>0.00586***</td>
<td>0.00700***</td>
<td>0.00266***</td>
<td>0.03025***</td>
<td>0.00828***</td>
<td>0.00484***</td>
<td>0.00746***</td>
<td>0.00895***</td>
<td>0.0102***</td>
</tr>
<tr>
<td></td>
<td>(0.00111)</td>
<td>(0.000703)</td>
<td>(0.000199)</td>
<td>(0.000187)</td>
<td>(0.000376)</td>
<td>(0.000423)</td>
<td>(0.000505)</td>
<td>(0.000643)</td>
<td>(0.000908)</td>
</tr>
<tr>
<td>Age</td>
<td>0.181***</td>
<td>0.128***</td>
<td>0.0355***</td>
<td>0.0320***</td>
<td>0.0627***</td>
<td>0.0660***</td>
<td>0.0656***</td>
<td>0.0629***</td>
<td>0.0580***</td>
</tr>
<tr>
<td></td>
<td>(0.00443)</td>
<td>(0.00247)</td>
<td>(0.000636)</td>
<td>(0.000564)</td>
<td>(0.00107)</td>
<td>(0.00115)</td>
<td>(0.00133)</td>
<td>(0.00165)</td>
<td>(0.00242)</td>
</tr>
<tr>
<td>Age2</td>
<td>-0.00219***</td>
<td>-0.00152***</td>
<td>-0.000414***</td>
<td>-0.000361***</td>
<td>-0.00684***</td>
<td>-0.00699***</td>
<td>-0.00658***</td>
<td>-0.00575***</td>
<td>-0.00440***</td>
</tr>
<tr>
<td></td>
<td>(5.49e-05)</td>
<td>(3.09e-05)</td>
<td>(7.98e-06)</td>
<td>(7.98e-06)</td>
<td>(1.35e-05)</td>
<td>(1.46e-05)</td>
<td>(1.70e-05)</td>
<td>(2.13e-05)</td>
<td>(3.19e-05)</td>
</tr>
<tr>
<td>Middle school</td>
<td>0.229***</td>
<td>0.241***</td>
<td>0.0807***</td>
<td>0.0793***</td>
<td>0.160***</td>
<td>0.170***</td>
<td>0.172***</td>
<td>0.176***</td>
<td>0.173***</td>
</tr>
<tr>
<td></td>
<td>(0.0226)</td>
<td>(0.0140)</td>
<td>(0.00383)</td>
<td>(0.00349)</td>
<td>(0.00668)</td>
<td>(0.00706)</td>
<td>(0.00768)</td>
<td>(0.00826)</td>
<td>(0.00947)</td>
</tr>
<tr>
<td>High school</td>
<td>0.452***</td>
<td>0.445***</td>
<td>0.152***</td>
<td>0.145***</td>
<td>0.294***</td>
<td>0.324***</td>
<td>0.361***</td>
<td>0.406***</td>
<td>0.394***</td>
</tr>
<tr>
<td></td>
<td>(0.0195)</td>
<td>(0.0123)</td>
<td>(0.00340)</td>
<td>(0.00316)</td>
<td>(0.00613)</td>
<td>(0.00661)</td>
<td>(0.00744)</td>
<td>(0.00859)</td>
<td>(0.0110)</td>
</tr>
<tr>
<td>College</td>
<td>0.278***</td>
<td>0.354***</td>
<td>0.147***</td>
<td>0.213***</td>
<td>0.543***</td>
<td>0.704***</td>
<td>0.964***</td>
<td>1.299***</td>
<td>1.663***</td>
</tr>
<tr>
<td></td>
<td>(0.0192)</td>
<td>(0.0122)</td>
<td>(0.00350)</td>
<td>(0.00339)</td>
<td>(0.00676)</td>
<td>(0.00758)</td>
<td>(0.00906)</td>
<td>(0.0119)</td>
<td>(0.0191)</td>
</tr>
<tr>
<td>Married or cohabiting</td>
<td>0.502***</td>
<td>0.297***</td>
<td>0.0688***</td>
<td>0.0763***</td>
<td>0.121***</td>
<td>0.0950***</td>
<td>0.122***</td>
<td>0.115***</td>
<td>0.111***</td>
</tr>
<tr>
<td></td>
<td>(0.0287)</td>
<td>(0.0160)</td>
<td>(0.00420)</td>
<td>(0.00380)</td>
<td>(0.00718)</td>
<td>(0.00785)</td>
<td>(0.00888)</td>
<td>(0.0112)</td>
<td>(0.0157)</td>
</tr>
<tr>
<td>Separated or widower</td>
<td>0.595***</td>
<td>0.388***</td>
<td>0.102***</td>
<td>0.114***</td>
<td>0.200***</td>
<td>0.186***</td>
<td>0.249***</td>
<td>0.270***</td>
<td>0.249***</td>
</tr>
<tr>
<td></td>
<td>(0.0305)</td>
<td>(0.0175)</td>
<td>(0.00470)</td>
<td>(0.00432)</td>
<td>(0.00834)</td>
<td>(0.00923)</td>
<td>(0.0107)</td>
<td>(0.0137)</td>
<td>(0.0196)</td>
</tr>
<tr>
<td>informalILO</td>
<td>-0.684***</td>
<td>-0.639***</td>
<td>-0.223***</td>
<td>-0.134***</td>
<td>-0.196***</td>
<td>-0.212***</td>
<td>-0.171***</td>
<td>-0.152***</td>
<td>-0.0302***</td>
</tr>
<tr>
<td></td>
<td>(0.0122)</td>
<td>(0.00797)</td>
<td>(0.00240)</td>
<td>(0.00251)</td>
<td>(0.00514)</td>
<td>(0.00579)</td>
<td>(0.00674)</td>
<td>(0.00823)</td>
<td>-0.0111</td>
</tr>
<tr>
<td>Constant</td>
<td>1.824</td>
<td>3.889***</td>
<td>3.146***</td>
<td>2.333***</td>
<td>1.006*</td>
<td>3.785***</td>
<td>7.315***</td>
<td>11.61***</td>
<td>10.36***</td>
</tr>
<tr>
<td></td>
<td>(1.677)</td>
<td>(1.040)</td>
<td>(0.293)</td>
<td>(0.278)</td>
<td>(0.560)</td>
<td>(0.627)</td>
<td>(0.745)</td>
<td>(0.948)</td>
<td>(1.387)</td>
</tr>
</tbody>
</table>

Note: Robust standard errors are in parentheses *** p<0.01, ** p<0.05, * p<0.1
**Figure 5b. Effects of minimum wage on the wage distribution for females**
(Unconditional quantile regression)

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Decile 1</th>
<th>Decile 2</th>
<th>Decile 3</th>
<th>Decile 4</th>
<th>Decile 5</th>
<th>Decile 6</th>
<th>Decile 7</th>
<th>Decile 8</th>
<th>Decile 9</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
<td>(7)</td>
<td>(8)</td>
<td>(9)</td>
</tr>
<tr>
<td>Log real minimum</td>
<td>-1.661***</td>
<td>-0.140</td>
<td>-0.714***</td>
<td>-0.734***</td>
<td>0.357***</td>
<td>0.800***</td>
<td>-0.0776</td>
<td>-1.159***</td>
<td>-0.617***</td>
</tr>
<tr>
<td>wage</td>
<td>(0.282)</td>
<td>(0.249)</td>
<td>(0.213)</td>
<td>(0.202)</td>
<td>(0.0717)</td>
<td>(0.0669)</td>
<td>(0.116)</td>
<td>(0.193)</td>
<td>(0.279)</td>
</tr>
<tr>
<td>Regional GDP</td>
<td>-0.00224*</td>
<td>0.00596***</td>
<td>0.00329***</td>
<td>0.00406***</td>
<td>0.00130***</td>
<td>0.00237***</td>
<td>0.00303***</td>
<td>0.00605***</td>
<td>0.00554***</td>
</tr>
<tr>
<td></td>
<td>(0.00123)</td>
<td>(0.00109)</td>
<td>(0.000947)</td>
<td>(0.000892)</td>
<td>(0.000313)</td>
<td>(0.000290)</td>
<td>(0.000500)</td>
<td>(0.000817)</td>
<td>(0.00112)</td>
</tr>
<tr>
<td>Age</td>
<td>0.0809***</td>
<td>0.0900***</td>
<td>0.0827***</td>
<td>0.0776***</td>
<td>0.0286***</td>
<td>0.0270***</td>
<td>0.0502***</td>
<td>0.0798***</td>
<td>0.0720***</td>
</tr>
<tr>
<td></td>
<td>(0.00444)</td>
<td>(0.00380)</td>
<td>(0.00312)</td>
<td>(0.00283)</td>
<td>(0.000963)</td>
<td>(0.000865)</td>
<td>(0.00144)</td>
<td>(0.00226)</td>
<td>(0.00310)</td>
</tr>
<tr>
<td>Age2</td>
<td>-0.00105***</td>
<td>-0.00113***</td>
<td>-0.00100***</td>
<td>-0.000906***</td>
<td>-0.000320***</td>
<td>-0.000279***</td>
<td>-0.000485***</td>
<td>-0.000698***</td>
<td>-0.000497***</td>
</tr>
<tr>
<td></td>
<td>(5.73e-05)</td>
<td>(4.87e-05)</td>
<td>(3.97e-05)</td>
<td>(3.58e-05)</td>
<td>(1.21e-05)</td>
<td>(1.08e-05)</td>
<td>(2.86e-05)</td>
<td>(4.05e-05)</td>
<td></td>
</tr>
<tr>
<td>Middle school</td>
<td>0.147***</td>
<td>0.226***</td>
<td>0.274***</td>
<td>0.308***</td>
<td>0.104***</td>
<td>0.0831***</td>
<td>0.120***</td>
<td>0.184***</td>
<td>0.185***</td>
</tr>
<tr>
<td></td>
<td>(0.0272)</td>
<td>(0.0242)</td>
<td>(0.0200)</td>
<td>(0.0176)</td>
<td>(0.0056)</td>
<td>(0.00475)</td>
<td>(0.00709)</td>
<td>(0.00940)</td>
<td>(0.0102)</td>
</tr>
<tr>
<td>High school</td>
<td>0.414***</td>
<td>0.595***</td>
<td>0.646***</td>
<td>0.745***</td>
<td>0.281***</td>
<td>0.218***</td>
<td>0.326***</td>
<td>0.415***</td>
<td>0.390***</td>
</tr>
<tr>
<td></td>
<td>(0.0229)</td>
<td>(0.0208)</td>
<td>(0.0175)</td>
<td>(0.0159)</td>
<td>(0.00526)</td>
<td>(0.00460)</td>
<td>(0.00727)</td>
<td>(0.0104)</td>
<td>(0.0124)</td>
</tr>
<tr>
<td>College</td>
<td>0.499***</td>
<td>0.712***</td>
<td>0.793***</td>
<td>0.943***</td>
<td>0.395***</td>
<td>0.469***</td>
<td>0.993***</td>
<td>1.647***</td>
<td>1.824***</td>
</tr>
<tr>
<td></td>
<td>(0.0206)</td>
<td>(0.0195)</td>
<td>(0.0173)</td>
<td>(0.0169)</td>
<td>(0.00623)</td>
<td>(0.00581)</td>
<td>(0.00977)</td>
<td>(0.0155)</td>
<td>(0.0222)</td>
</tr>
<tr>
<td>Married or</td>
<td>-0.119***</td>
<td>-0.103***</td>
<td>-0.0529***</td>
<td>-0.0313***</td>
<td>-0.00243</td>
<td>0.0182***</td>
<td>0.0352***</td>
<td>0.0318**</td>
<td>0.0450**</td>
</tr>
<tr>
<td>cohabiting</td>
<td>(0.0203)</td>
<td>(0.0188)</td>
<td>(0.0161)</td>
<td>(0.0152)</td>
<td>(0.00542)</td>
<td>(0.00507)</td>
<td>(0.00871)</td>
<td>(0.0146)</td>
<td>(0.0203)</td>
</tr>
<tr>
<td>Separated or</td>
<td>0.00843</td>
<td>0.00115</td>
<td>0.00789</td>
<td>-0.00151</td>
<td>0.00137</td>
<td>0.0261***</td>
<td>0.0594***</td>
<td>0.0724***</td>
<td>0.115***</td>
</tr>
<tr>
<td>widower</td>
<td>(0.0214)</td>
<td>(0.0200)</td>
<td>(0.0173)</td>
<td>(0.0162)</td>
<td>(0.00574)</td>
<td>(0.00536)</td>
<td>(0.00920)</td>
<td>(0.0154)</td>
<td>(0.0218)</td>
</tr>
<tr>
<td>informalILO</td>
<td>-0.578***</td>
<td>-0.834***</td>
<td>-0.984***</td>
<td>-1.217***</td>
<td>-0.497***</td>
<td>-0.328***</td>
<td>-0.401***</td>
<td>-0.483***</td>
<td>-0.347***</td>
</tr>
<tr>
<td></td>
<td>(0.0115)</td>
<td>(0.0117)</td>
<td>(0.0113)</td>
<td>(0.0120)</td>
<td>(0.00487)</td>
<td>(0.00486)</td>
<td>(0.00826)</td>
<td>(0.0124)</td>
<td>(0.0149)</td>
</tr>
<tr>
<td>Constant</td>
<td>13.69***</td>
<td>4.470***</td>
<td>8.522***</td>
<td>9.059***</td>
<td>3.822***</td>
<td>0.517</td>
<td>5.451***</td>
<td>11.56***</td>
<td>8.468***</td>
</tr>
<tr>
<td></td>
<td>(1.776)</td>
<td>(1.567)</td>
<td>(1.341)</td>
<td>(1.269)</td>
<td>(0.451)</td>
<td>(0.421)</td>
<td>(0.726)</td>
<td>(1.214)</td>
<td>(1.753)</td>
</tr>
</tbody>
</table>

Observations        | 0.060                 | 0.126                 | 0.198                 | 0.288                 | 0.356                 | 0.326                 | 0.334                 | 0.310                 | 0.195                 |

Note: Robust standard errors are in parentheses *** p<0.01, ** p<0.05, * p<0.1
graduates in the first three deciles of the distribution, but from the 4th decile on, the effect of having a college degree is larger. Marital status affects wages positively, as non single (married and cohabiting and separated and widowers) male workers tend to earn more than their single counterparts.

For female workers (Figure 5b), the already described negative effect of increasing the minimum wage is not significant for deciles 2 and 7. Again, the economic cycle has a positive and significant but very small impact on wages, except for the first decile where it is slightly negative but only marginally significant. Returns to education are always positive and significant, and the effects of having a college education are larger than lower levels of education for all female workers along the distribution. As expected, being married decreases the wages of all female workers, with the effect being larger for workers in the two first deciles of the distribution.

No matter the definition of informality used in the regression analysis, the results are very similar. The effect of informality along the wage distribution is negative as expected and very significant. Informal workers, both male and female, see reductions in their wages no matter where they are located on the distribution. Male workers in the first two deciles see larger reductions in their wages and for women the decrease is larger for workers in the first four deciles of the wage distribution. In the end, female workers seem to be more vulnerable to the negative effects of labor informality.

---

10 Reported results on Figures 5a and 5b use the DANE-ILO definition. The contributions definition generated nearly identical results.
As a final exercise, it is interesting to calculate how much the Colombian distribution of wages is compressing because of the high level of the minimum wage. To do this, it is necessary to create a counterfactual, a wage distribution where the minimum wage is lower, for instance 20% lower. So, based on the results from the quantile regression for male workers, median values for each variable were calculated to predict the value of the logarithm of the real reported wages for each decile when the minimum wage is 20% lower than the median value. Even though this is an easy way to obtain predicted values, the fact that median values are used implies that the predictions are not perfect because they are done only for the median male in each decile, not including the real data for each individual.

However, the results are very informative. According to the predictions, a high minimum wage reduces the inequality in the distribution of wages only in the upper tail of the wage distribution. With a 20% reduction in the minimum wage, the median male worker in the 9th decile earns 4.5 times what the median male worker in decile 5 makes. But, with the actual value of the minimum wage, the difference between deciles is reduced to 1.6 times. In the lower end of the distribution, with a lower minimum wage the median male worker in the 5th decile earns 0.7 times more what its counterpart in the 1st decile makes. However, with an increase in the minimum the difference between the workers in these deciles increases, and a worker in the 5th decile now earns 1.4 times more what his peer in the 1st decile does. This means that there seems to be a compression in the right tail of the distribution but not in the left tail, which was expected due to the fact that the coefficients for the lower deciles of the male wage distributions were not statistically different from zero. This result implies that the beneficial effects of increasing the
minimum wage on reducing inequality in the distribution of wages do not seem to affect the poorest male workers in the country.

7. **Conclusions and policy implications**

This paper wants to contribute to the literature on the effects of minimum wages on employment and wages in Colombia, using data from the relatively new and improved National Household Survey (GEIH). The analysis of the effects of minimum wages on probabilities of employment includes the fact that increases in the minimum wage can generate effects not only on unemployment but also on labor inactivity. In addition, when analyzing the effects on informality, it is useful to observe the effects the minimum wage has not only on employed workers, but also on self-employed individuals. In terms of effects on the wage distribution, it is very important to separate female and male workers, as the determinants of their labor decisions have important differences that can affect how the minimum wage impacts their wages.

The results show that increases in the minimum wage raise the probability of both being employed and unemployed relative to being inactive. This means that with an increase of one standard deviation in the minimum wage, workers are almost 10% more likely to be employed than inactive and 14% more likely to be unemployed than inactive. Even though the effect on unemployment is larger (a one standard deviation increase in the minimum wage results in an individual being 3.7% less likely to be employed than unemployed), there is an important positive effect on employment that at first might seem to go against the results in the existent literature. However, this effect could be driven by a
displacement of workers form formal to informal jobs, which on aggregate increases employment but it reflects a reduction in labor standards and benefits for workers.

In fact, increases in the minimum wage reduce both the probability of having a formal and an informal job relative to being an independent worker. A raise in one standard deviation in the minimum wage makes a worker 9% less likely to be a formal employee than self-employed and 4% less likely to be an informal employee than self-employed. Furthermore, the same increase in the minimum wage makes a worker 5% less likely to be formal than informal. These findings indicate that formal jobs tend to be reduced more by increases in the minimum wage than informal ones, which is logical as minimum wage regulation is compulsory for the formal sector.

In terms of wages, male workers in the first two deciles of the distribution appear to be not affected by increases in the minimum wage, while the effect is positive up to the 7th decile and negative for the last two deciles of the distribution. For women, the results have to be taken with caution, as this paper is not including the effects on female labor market participation that could be present with increases in the minimum wage. Nevertheless, female wages seem to be reduced in both tails of the distribution while increased for those workers earning close to the minimum wage. Both sets of results are consistent with compression in the wage distributions.

The results of this paper highlight the importance that labor market inflexibilities have on employment levels and its quality in Colombia. Given that one of the causes of these inflexibilities is the relatively high minimum wage, increasing it more has detrimental
effects not only on the amount of unemployed workers in the country but on the number of workers that, by own choice or not, end up displaced to the informal sector or have to become self-employed. These jobs will, by definition, have low productivity levels and therefore, will not generate much value added to the country’s production. This implies that a sizeable part of the working population in the country has mere subsistence level jobs which do not contribute to the country’s economic growth but more importantly, do not provide them any social benefits, healthcare services or old-age pensions.

In addition, a simple simulation showed that increasing the minimum wage results in reductions in wage inequality at the right tail of the distribution but not at the left tail. This means that workers who earn very low wages are not affected by minimum wage policies (and if they are the effects are regressive), although there are positive effects in reducing the differences at higher wage levels. According to this, maybe minimum wages are not the right tool to resolve poverty and inequality, especially for vulnerable individuals. Here specific welfare programs like conditional transfers could have larger impacts.

The country has to start a debate and think hard on where its priorities are. Is the benefit felt by those workers whose wages are increased when there are minimum wage raises such that it surpasses the cost (for the country and for all workers) of having high levels of informality? This debate must be linked to the fact that informality reduces opportunities for workers and their families and increases the risks of high future costs in terms of welfare expenditures.
There is a clear trade-off between reducing inequality and achieving efficiency. Even though some workers feel the benefit of having a high minimum wage, the evidence indicates that most workers are pushed to informal jobs or to unemployment because of this policy. Clearly, the minimum wage as a policy for combating poverty and inequality is not getting to those segments of the population that were supposed to benefit from it. What is worse, it is endangering the well being of the poorest individuals, by increasing the rigidities in the labor market and sending them into outright unemployment or into jobs that don’t provide for their most basic needs.

8. Bibliography


