

Payroll taxes, wage rigidities and youth unemployment: Evidence from colombian labor market.

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Abstract

This paper studies the effect on youth employment of a payroll tax cut for new hires young workers under the age of 28 in Colombia. We exploit differential degrees of exposure to wage rigidities to identify the effect. We measure an individual's exposure to wage rigidities as the distance, in the city in which the individual lives, from the median salary by educational level with respect to the minimum wage. We have two different treatment groups and use a difference-in-difference model. The effect of reduced payroll taxes is asymmetric for youth who earn below and above the minimum wage. Reducing payroll taxes increased youth labor participation, rather than reducing informality.

(JEL: H25, H32, J21, J31, J46).

Keywords: youth unemployment, payroll taxes, nominal rigidities.

1. Introduction

One of the great challenges facing both developed and developing economies is the high and persistent youth unemployment rates (Egebark and Kaunitz, 2014; OIT, 2018). It is well known that these difficulties during first years of working have long-term consequences on the probability of getting a job. (Nordstrom, 2004; Gregg and Tominey, 2005). Payroll taxes can worsen youth unemployment. Theoretically, we know that payroll taxes particularly affect those who experience greater wage rigidities (Houseman, 1998; Bell, 1997; Blinder and Choi, 1990; Campbell and Kam-lani, 1997). However, very little is known about how prevalent wage rigidities are in young people, which would make them more or less exposed to changes in payroll taxes when it comes to finding employment.

This paper wants to answer how exposure to wage rigidities affects the probability of finding employment for young people when payroll taxes are reduced. We measure an individual's wage rigidity as the gap between the median salary, by educational level, of people employed in the city where the individual lives and the minimum wage, as an exogenous measure of wage rigidity of a person.

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We exploited a reform in Colombia that reduced payroll taxes in the formal sector by 11 percentage points out of a total of 42 for young people under the age of 28. From the comparison between people younger and older than 28 years before and after the reform, and using data from household surveys, we estimate the effect of the reduction of payroll taxes on five outcome variables: wage, probability of being part of the labor force, probability of being employed, probability of being a formal employee, and probability of being an informal employee.

When there is a connection between payroll tax and the benefit it brings to the worker, changes in payroll taxes should be reflected, to a greater extent, in changes in wages, with little or no effect on employment. However, if wages are not flexible enough, they will not absorb payroll taxes causing changes in total labor costs and hence a variation in the employment or transfer of workers to the informal sector (Kugler et al., 2017; Almeida and Carneiro, 2012). Therefore, the introduction of payroll taxes could generate a drop in formal employment that would be concentrated in groups whose wages are more rigid downward. Since young people have lower levels of experience, they are more likely to face such rigidities. For this reason, they may be particularly exposed to job losses due to the introduction of payroll taxes, and to improvements in their employability when such taxes are reduced or eliminated.

Economic literature has shown that changes in payroll taxes have an effect on the level of employment in the economy. Some studies find a negative and significant effect of an increase in payroll taxes on employment (Blanchard and Wolfers, 2000; Heckman and Pagés, 2004). Similarly, other authors find a positive effect on youth employment as a consequence of reductions in payroll taxes (Katz, 1998; Kugler et al., 2002; Saez, Schoefer y Seim, 2019). However, other authors find low or null effect (Egebark and Kaunitz, 2018; Skedinger, 2014). The difference in results may lie in the fact that workers, depending on their level of education, may be exposed to different degrees of exposure to wage rigidities. None of the studies mentioned in this paragraph use differential degrees of exposure to wage rigidities to see the effect on employment and wages of a reduction in payroll taxes. Furthermore, in these studies no worker is hired for less than the minimum wage, being in the informal market, which may be the case in most developing countries.

This article contributes to the literature on the incidence of payroll taxes on labor market variables in young people exploiting differential degrees of exposure to wage rigidities. This contribution is relevant to understand when reducing payroll taxes can help decrease youth unemployment, which is more important now to aid in the economic recovery of many countries that have been affected by COVID-19. This article is related to two great literatures. On the one hand, active programs to reduce youth unemployment, in particular employment subsidy programs, such as reducing payroll taxes for youth (Kluve et al., 2016; Saez, Schoefer and Seim, 2019). This article contributes to this literature by showing that one of the reasons why reducing payroll taxes can have important effects on reducing youth unemployment in the economy is the wage rigidity to which young peo-

ple are exposed. On the other hand, it contributes to the literature on the role of wage rigidities in the incidence of payroll taxes on variables of the economy's labor market, innovating in the way wage rigidities are measured. This article is the first to combine exposure to wage rigidities and the incidence of payroll taxes on youth to better understand youth unemployment.

A payroll tax will result in a lower wage if the worker benefits directly from the tax, and if the wage is flexible enough to absorb the tax (Summers, 1989), this is known as the pass-through effect. Similarly, if pass-through effect is large, a reduction in payroll taxes must be reflected in a considerable increase in wages. For the case of United States and Chile, Gruber (1994, 1997) finds a high pass-through effect and therefore an increase in workers' wages due to reductions in payroll taxes, which is supported by other authors (Cruces et al., 2010; Kugler and Kugler, 2009; Bernal et al., 2017; Kugler et al., 2017). This article shows that an explanation of these results is the low wage rigidities of the workers that these authors use in their samples. In contrast, Heckman and Pagés (2004) report a null pass-through effect for a sample of OECD countries without distinguishing between types of workers, which may be explained by high wage rigidities in those countries.

Based on a differences-in-differences model, we estimate that the effect of reducing payroll taxes is asymmetric for young people who earn below and above the minimum wage. On the one hand, for young people earning below the minimum wage, the reduction in payroll taxes increases the wage for those who experience greater nominal rigidities, while the effect on employment is almost nil, contrary to what the theory predicts. On the other hand, the reduction of payroll taxes had a positive and significant effect on wages and increase the probability of getting formal employment for young people earning above the minimum wage. Furthermore, rather than reducing informality, reducing payroll taxes increased youth labor participation.

This paper is organized as follows. Section 2 presents the theoretical model on which we base our hypotheses on the relationship between payroll taxes and labor market variables. Section 3 describes the institutional framework. Section 4 makes a description of the data we use. Section 5 presents the empirical strategy. Section 6 shows and discuss the results. Section 7 presents some extensions of the methodology and section 8 concludes.

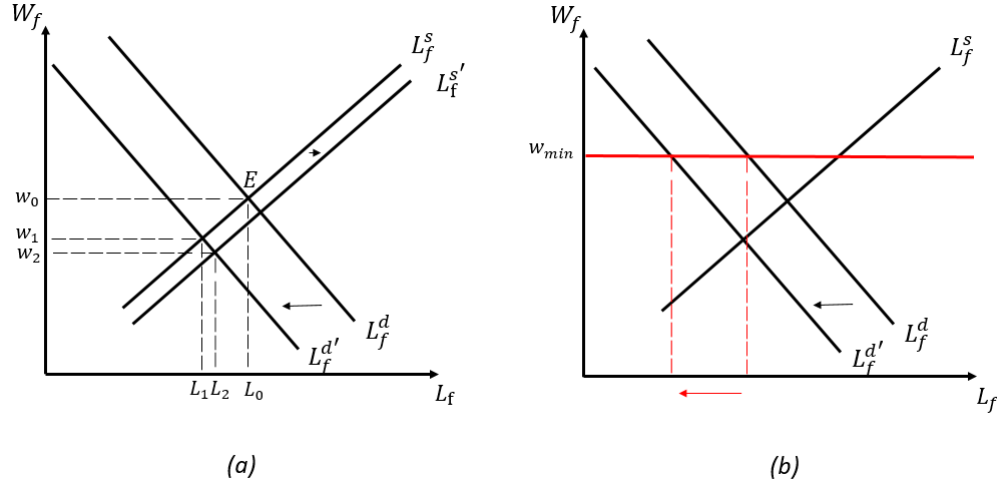
2. Theoretical framework

Summers (1989), Lazear (1990), and Gruber and Krueger (1991) developed a theoretical framework to explain the incidence of payroll taxes in the labor market. In this framework, the incidence of such taxes depends on the degree to which they can pass through wages. The introduction of a payroll tax shifts the demand for labor in figure 1 to the left. Under the assumption of perfect competition, as shown in panel (a) of graph 1, employment fall from L_0 to L_1 , and the wage fall from w_0 to w_1 . However, if there is a direct link between the tax and the benefit it brings to the worker,

the job offer will shift to the right, so the salary will drop even further to w_2 and employment will be higher, L_2 , compared to the case where workers don't value payroll taxes. The change in salary due to the introduction of the tax will be given by:

$$\Delta w = \frac{-(\eta^D - \alpha\eta^S)}{\eta^D - \eta^S}$$

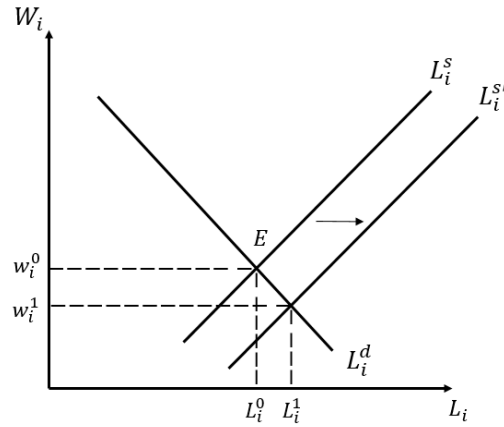
Figure 1: Effect of an increase in payroll taxes on the formal labor market



Source: Houseman (1998)

Where η^D is the elasticity of labor demand, η^S is the elasticity of the labor supply, and α is the fraction of the payroll taxes that the worker values. If α is equal to 1, payroll taxes are fully absorbed via wages without affecting employment in the economy. On the other hand, if α is equal to 0, workers do not value payroll taxes, so the labor supply does not shift, in this case the equilibrium would be given by L_1 y w_1 . On the other hand, if there is a minimum wage in the formal labor market that is above the equilibrium wage of the group of workers under analysis, payroll taxes would be reflected in changes in formal employment and not in wages (Houseman, 1998) as shown in panel (b) of figure 1. Workers who cannot find job in the formal sector due to the introduction of payroll taxes will be absorbed by the informal labor market as it is shown in figure 2, where the labor supply shifts to the right due to the entry of workers into this market, resulting in an increase in informal employment and a fall in equilibrium wages in this market.

Figure 2: Effect of an increase in payroll taxes on the informal labor market

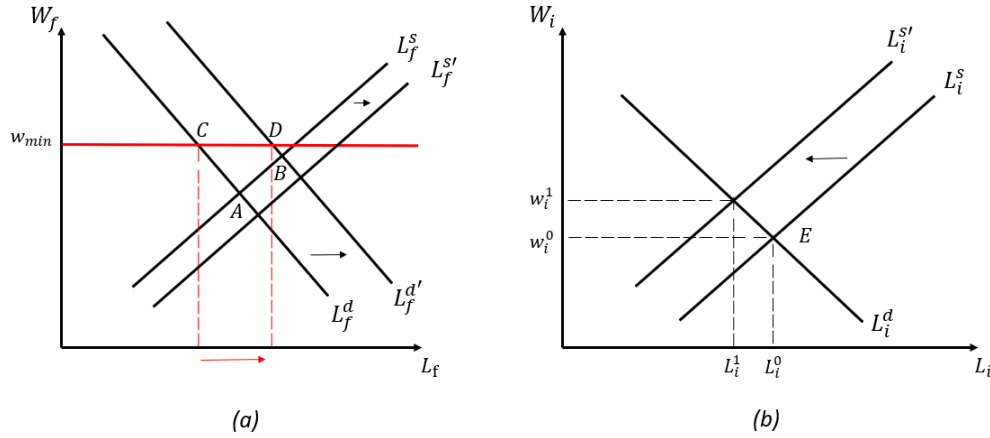


Source: Almeida y Carneiro (2012)

In the case of a reduction in payroll taxes, under the assumption of a perfectly competitive labor market, we should observe an effect on both wages and employment. The size of the effect will depend on the elasticity of labor demand and labor supply. The more inelastic the labor supply, the greater the pass-through effect of a reduction in payroll taxes. However, if there is a minimum wage above the equilibrium wage, panel (a) of figure 3, the effect of the reduction in payroll taxes should be reflected to a greater extent in employment and to a lesser extent in wages, especially for those people who are earning below but close to the minimum wage. Intuitively, the presence of a minimum wage limits formal employment to such a level that its marginal productivity exceeds the labor cost given by the minimum wage plus payroll taxes. If these taxes are reduced, that minimum labor cost is reduced, making their marginal productivity compatible with a higher level of formal employment.

Additionally, the reduction of payroll taxes should decrease informal employment, especially for those workers who earn close to the minimum wage below, as shown in panel (b) of figure 3, where informal unemployment decreases and formal employment increases. Therefore, according to the theory, those workers whose salary is slightly below the minimum wage, should experience greater changes in employment than in wages due to a reduction in payroll taxes. While those workers who, due to their productivity, earn above the minimum wage, should experience both an effect on wages and employment depending on how elastic the labor supply is.

Figure 3: Effect of a reduction in payroll taxes on the formal and informal labor market



Fuente: Houseman (1998); Almeida y Carneiro (2012).

3. Institutional framework

In late 2010, *First Employment Law* (FEL) was issued in Colombia. FEL allowed firms that hired new workers under the age of 28 to deduct from the income tax an amount equivalent to 11 percentage points of the taxes paid on the payroll of these new workers. Deductible contributions corresponded to payroll taxes intended to finance public goods (SENA, ICBF, and public health system) and mandated benefits. Eligibility to be a beneficiary of the Law was based on the age of the worker at the beginning of the contract, and the benefits granted by FEL could extend for a maximum of two years. Since the intention of the Law was to promote the creation of new jobs, the employer could benefit from the Law as long as its payroll was effectively increased at the end of the year, which was verified from the social security payment of its workers. The discount was applied at the time of settlement of the income statement.

After the enactment of this Law, a series of Decrees and Resolutions were issued to regulate the benefits provided by FEL. In February 2011, Decree 545 described who could benefit from FEL. However, all of this occurred without significant dissemination of the benefits provided by the Law. It was not until December 2011 with the issuance of Decree 4910 that the number of companies benefiting from FEL started to increase more rapidly. Decree 4910 detailed the conditions for a company to be able to benefit from the deduction of payroll taxes and more solidly regulated the Law.

This suggests two moments of implementation of FEL: a weak implementation that would be all 2011, and a strong implementation starting in 2012. The period of analysis in this paper runs until 2014, because by that date Colombian government promoted new programs to develop skills in youth, and therefore, there would be other reasons different from First Employment Law, for which

employment within this group could also have increased after 2014. It is important to highlight that in December 2012, another law was issued in Colombia that reduced payroll taxes for all workers who earned less than 10 minimum wages, regardless of worker's age³. However, given that the 2012 Law did not particularly affect young people, it would not be biasing the effect that we want to capture from FEL on labor market variables.

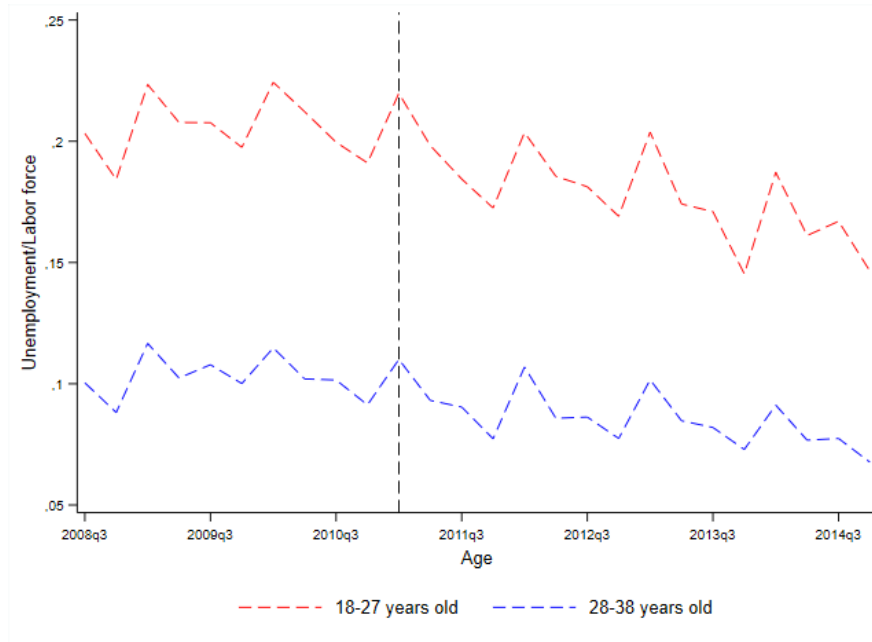
4. Data

To answer the research question, we used The Household Survey (GEIH), designed by DANE. This survey is the basis of the indicators of the labor market in Colombia. The GEIH is made up of repeated cross-sectional data and is available from 2008 to 2019. This survey requests information on the employment conditions of the people who make up the household, and general characteristics of the population such as sex, age, marital status and educational level.

As in many countries, one characteristic of youth labor market in Colombia is the high and persistent youth unemployment rates. From figure 4, youth unemployment rate for young people between 18 and 27 years old before 2011 was double compared with people between 28 and 38 years old. FEL was aimed at reducing youth unemployment in the group of young people under 28 years of age. Figure 4 effectively shows a decrease in youth unemployment rate after the issuance of the First Employment Law, apparently greater than the decrease in unemployment in the group between 28 and 38 years old. The pattern is consistent with a possible effectiveness of the mentioned Law, which will be investigated with a more precise identification strategy in section 5.

³Law 1607.

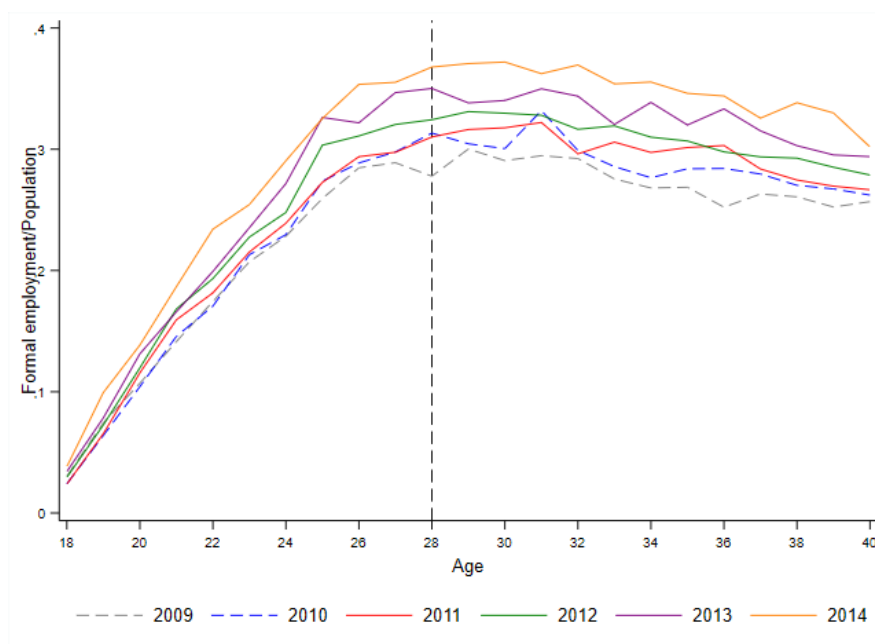
Figure 4: Youth unemployment rate



Source: GEIH.

To analyze the effect of the Law on formal youth employment, we first examined the formal employment rate by age group for two years before and four years after the reform. We adopt a strict definition of labor formality in which a worker is formal if they contribute to a pension fund at the time the survey is carried out (Raquel, 2009). The formal employment rate is defined as the percentage of formal workers in the economy, defined for each age group. Figure 5 shows the occupancy rate of the formal sector for different ages and time periods. Two important observations from this graph. First, formal employment rates are a growing function with age up to age 31, with their minimum being 4% at age 18, and peaking at 38% at age 31, thereafter the formal employment rate has a slight downward slope with respect to age. Second, it is not clear that growth in the formal employment rate is more marked for a certain age group. This is simply an observation of correlations, which neither dismisses nor demonstrates that the reform has had or is no longer effective. What it does point out is the importance of controlling for time effects.

Figure 5: Employment rate - Formal sector



Source: GEIH.

Table 1 presents the mean of the control and treatment group before and after the reform for the participation rate in the labor market, employment rate, employment rate in the formal and informal sectors. To calculate these rates, we are using a population of working age instead of the labor force, since the latter is an outcome variable. In the appendix is the same table using labor force instead of population to calculate these rates. Particularly striking is the increase in the formal employment rate after the reform for the treatment group. These descriptive statistics will later help us interpret the results.

Table 1
Average of labor market variables before and after First Employment Law

Variable	Control			Treated		
	2009-2010	2011-2014	p-value	2009-2010	2011-2014	p-value
Labor force	0.834	0.859	0.0000	0.713	0.768	0.0000
Employment	0.724	0.765	0.0000	0.545	0.627	0.0000
Formal employment	0.279	0.319	0.0000	0.160	0.241	0.0000
Informal employment	0.444	0.445	0.4700	0.385	0.386	0.7271

Treated: Youth that at december 2014 were not 28 years old.

Control: People that at december 2010 were 28 years old or more.

5. Methodology

For all the analyzes from now on we are going to limit the sample observations to young people who were between 22 and 34 years old at the time of the survey in order to have comparable groups. Young people under 28 years old at december 2014 will be part of the treatment group, while young people over 28 in december 2010 will be part of the control group. The treatment group are young people who had not reached the age of 28 until december 2014. These people were exposed to treatment in all the years of the sample for not exceeding that age in any of those years. It is important to highlight that the benefits granted by the Law could be extended for a maximum of two years once the new hired worker was under 28.

For clarity, we first propose a basic empirical strategy of a differences-in-differences model that looks at the effect of the Law on outcome variables, without considering the effect of wage rigidities yet. In the following specification we contrast our treated group against our control group.

$$Y_{im} = \alpha_m + \beta_1 S_{im} + \beta_2 S_{im} Post_m + \beta_3 X_{im} + \varepsilon_{im} \quad (1)$$

- Y_{im} = Work outcome of person i in month m
- α_m : Month fixed effects.
- $S_{im} = 1$ if the age of the individual i is less than 28 years until December 2014 included; 0 oc.
- $Post_m = 1$ if $m > \text{December 2010}$; 0 oc.
- X_{im} : Controls vector: gender, having a partner, years of schooling.

Five work outcomes are considered for an individual i in month m : being part of the workforce, being employed, being employed in the formal sector, and being employed in the informal sector. Additionally, we have the logarithm of the person's salary i in the month m . The coefficient β_2 in equation (1) tells us the effect that FEL had on treaties related to controls on each of the outcome variables.

The identification strategy exploits the fact that the reduction in payroll taxes by firms is proportional to the number of people who are on the payroll of the company that hires groups covered by the law. To correct for pre-existing differences in older and younger 28-year-olds, we used a difference-in-difference model with repeated cross-section. If the entry of the reform does not affect the probability of obtaining employment of young people over 28, the result of the comparison of employment rates between those over 28 and under is an estimate of the effect of the tax reduction on the probability of getting a job for youth.

Subsequently, we expanded this strategy to incorporate the effect of wage rigidities. The variable of wage rigidity denoted by $Flex_{cem}$ is a measure of how exposed are individuals of city c , with a

level of education e , in month m , to wage rigidities and we measure it as the distance in the city in which the individual live, from the median wage by educational level with respect to the minimum wage in the month m , divided by the minimum wage, in order to see that distance as a percentage of the minimum wage. We use 6 levels of education: having no education, primary education dropout, primary education, high school dropout, high school and higher education. For clarity, the variable $Flex_{cem}$ will be equal to:

$$Flex_{cem} = \frac{MedianWage_{cem} - Wagemin_m}{Wagemin_m} \quad (2)$$

According to the theoretical model, the greater the distance between the median wage and the minimum wage below, we should expect that wages should be more reluctant to rise because we are talking about informal jobs, which do not comply with the minimum wage regulation. Therefore, a change in payroll taxes should not affect them. On the other hand, if the difference is positive and large, then the minimum wage is less binding and therefore the effect on employment should be lower. The magnitude of the effect on wages and employment will depend on the elasticity of the labor supply.

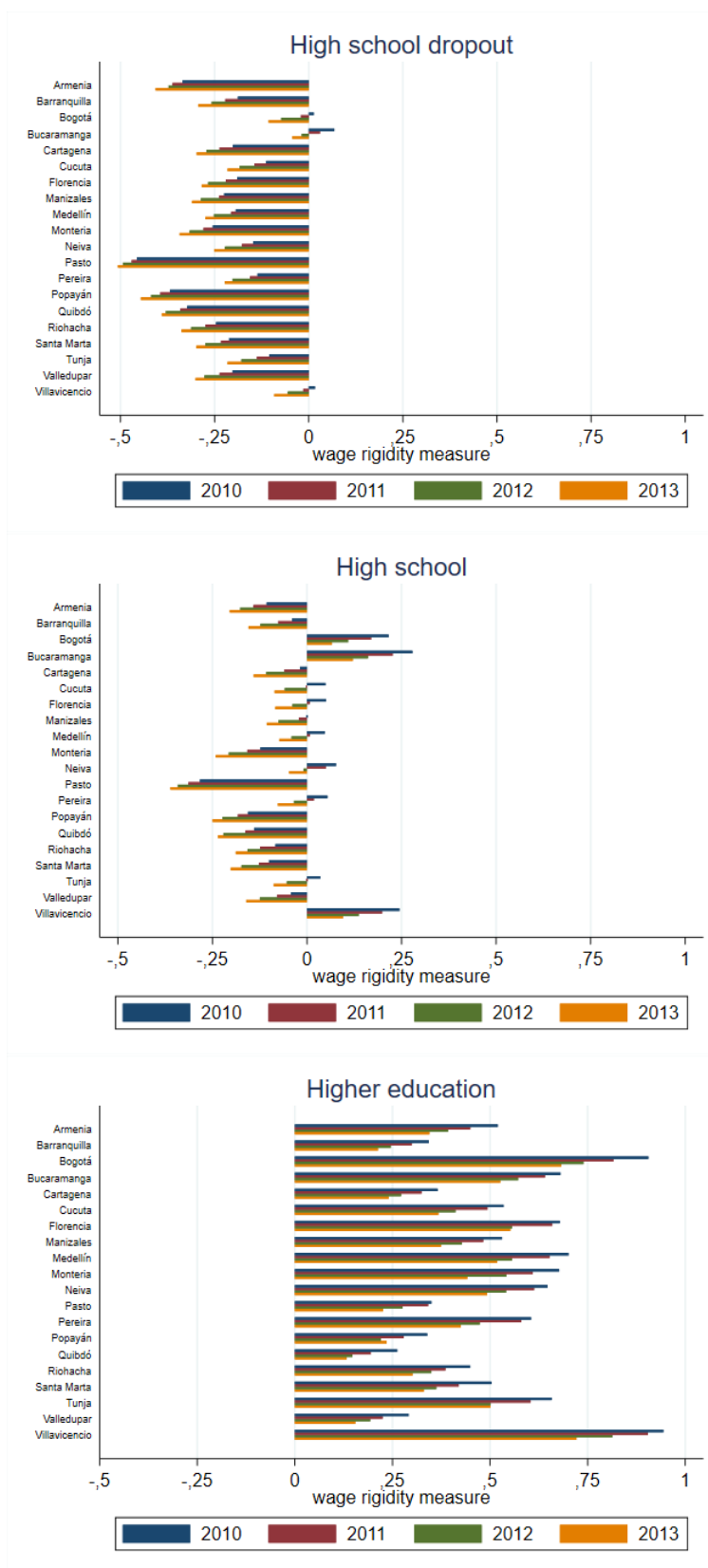
Figure 6 shows the variability we have in the measure of wage rigidity within Colombian municipal heads aggregated in three educational levels for 2010, 2011, 2012 and 2013. As it would be expected, workers with less education experiences few wage rigidities because they earn well below the minimum wage, which suggests they work in the informal sector of the economy. In the same direction, those young people with higher education in all the main cities of Colombia earn well above the minimum wage, who also experience low nominal rigidities. Finally, young people with a high school education are those who tend to experience greater nominal rigidities as they are the group of the population whose median salary is closest to the minimum wage. This variability is what we want to exploit to identify the effect that nominal rigidities can have on the incidence of payroll taxes on labor market variables.

The effect of payroll taxes on labor market variables may be different for individuals who earn below the minimum wage and for those who earn above it. For this reason, the main equation to be estimated is an expanded version of the previous equation, which includes an interaction of the treatment with the measure of nominal rigidities and the variable of being or not below the minimum wage, $deba jo_{cem}$, which takes the value of 1 if $Flex_{cem}$ is negative, that is, if the median salary in the city c for the education group e in the month m is below the minimum wage in m , and 0 if $Flex_{cem}$ is positive.

$$\begin{aligned}
Y_{im} = & \alpha_m + \gamma_c + \beta_1 S_{im} + \beta_2 Flex_{cem} + \beta_3 debajo_{cem} + \beta_4 S_{im} Post_m + \beta_5 S_{im} Flex_{cem} + \\
& \beta_6 Post_m Flex_{cem} + \beta_7 Flex_{cem} debajo_{cem} + \beta_8 S_{im} debajo_{cem} + \beta_9 Post_m debajo_{cem} + \\
& \beta_{10} S_{im} Flex_{cem} debajo_{cem} + \beta_{11} Post_m Flex_{cem} debajo_{cem} + \\
& \beta_{12} S_{im} Post_m Flex_{cem} + \beta_{13} S_{im} Post_m debajo_{cem} + \\
& \beta_{14} Post_m S_{im} Flex_{cem} debajo_{cem} + \beta_{15} X_{im} + \epsilon_{im}
\end{aligned} \tag{3}$$

Where γ_c are city fixed effects. From equation (3), we are mainly interested in the coefficients β_4 , β_{12} , β_{13} y β_{14} . The coefficient β_4 tells us what the marginal effect of reducing payroll taxes is on the outcome variables for the treaties, after the reform, that earn above the minimum wage when $Flex_{cem}$ is very close to zero, that is, when the nominal stiffness is very high. Now, if we want to know what is the marginal effect on the result variables of an increase of 1% in the variable $Flex_{cem}$ when individuals earn above the minimum wage, we must add the coefficients β_4 and β_{12} . If what interests us is the marginal effect of the reduction of payroll taxes on the outcome variables for those who earn very close to the minimum wage, but below, we must add the coefficients β_4 y β_{13} . Finally, the sum of the coefficients β_4 , β_{12} , β_{13} and β_{14} give us the marginal effects of an increase of 1% of nominal rigidity for those who earn below the minimum wage.

Figure 6: Measure of wage rigidity for different levels of education in different colombian cities



Source: GEIH.

For each model, we estimate the effect of the reduction of payroll taxes on labor market variables, restricting the sample to 24 months before and 48 months after the implementation of the Law and taking into account only people who are between 22 and 34 years old at the time of being observed in the sample.

6. Results

In this section we present the results of specification (1) and (3) proposed in the methodology. Table 2 shows the results of the first specification. According to Table 2, the reduction of payroll taxes had a positive and significant effect on both employment and wages. In particular, the reduction in payroll taxes increased the probability of obtaining formal employment by 4.86 percentage points, which is equivalent to an increase, on average, of 17 % in the probability of obtaining formal employment for the treaties with respect to control group. Likewise, the salary, on average, increased by 9 % for the treaties after the reform. However, informal employment did not decrease. So the increase in formal employment came from new young workers who became part of the workforce as a result of lower payroll taxes.

Table 2
Efecto de la reduccion de impuestos sobre salario y variables del mercado laboral

VARIABLES	Salario	Fuerza laboral	Ocupado	Ocupa formal	Ocupa informal
S*Post	0.0969*** (0.0245)	0.0415*** (0.0039)	0.0549*** (0.0079)	0.0488*** (0.0113)	0.0061 (0.0053)
Observaciones	327,611	507,487	507,487	507,487	507,487
R-cuadrado	0.0922	0.0828	0.0868	0.1656	0.0869
Controles	Si	Si	Si	Si	Si
EF Mes	Si	Si	Si	Si	Si
EF Area	Si	Si	Si	Si	Si
Media de grupo de control	12.9508	0.834	0.7235	0.2791	0.4444

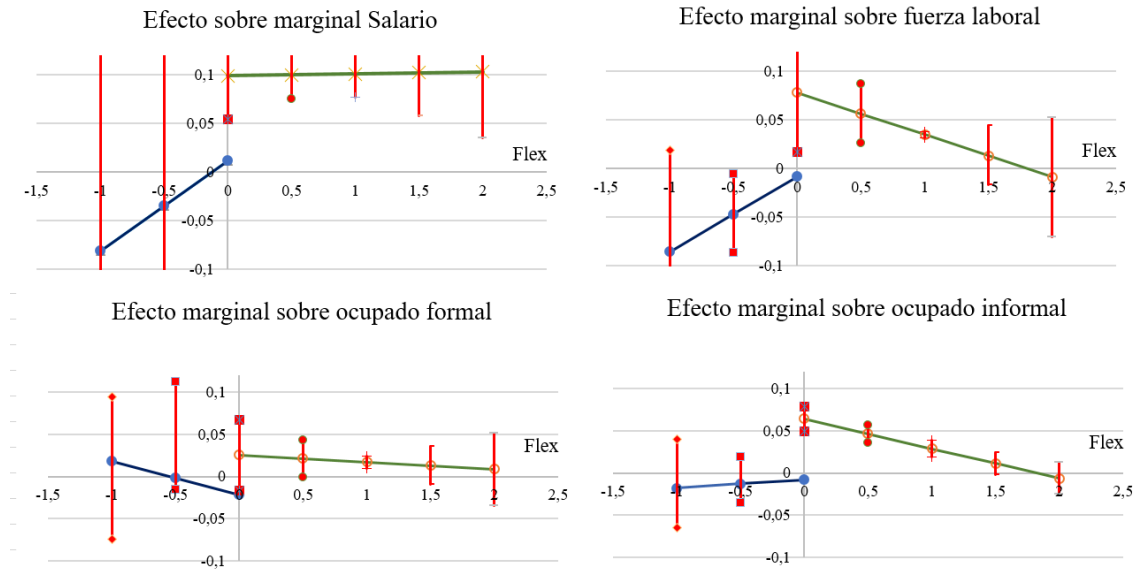
Nota: *** Significativo al 1%, ** significativo al 5% y * significativo al 10%. Errores estándar clusterizados a nivel ciudad.

Table 3
Effect of payroll tax cut on wage and employment

Variables	Ln wage	Labor force	Employment	Formal Emp	Informal Emp
S*Post	0.0990*** (0.0217)	0.0782** (0.0294)	0.0899*** (0.0209)	0.0256 (0.0204)	0.0643*** (0.0073)
S*Post*debajo	-0.0874 (0.1235)	-0.0865* (0.0441)	-0.1192*** (0.0296)	-0.0469** (0.0220)	-0.0723*** (0.0134)
S*Post*Flex	0.0020 (0.0250)	-0.0435 (0.0294)	-0.0436* (0.0239)	-0.0083 (0.0203)	-0.0353*** (0.0069)
S*Post*Flex*debajo	0.0905 (0.5533)	0.1207* (0.0606)	0.0135 (0.0769)	-0.0315 (0.0431)	0.0450 (0.0722)
Observations	327,611	507,487	507,487	507,487	507,487
R-squared	0.1341	0.1344	0.2219	0.7571	0.2975
Controls	Si	Si	Si	Si	Si
FE Month	Si	Si	Si	Si	Si
FE Area	Si	Si	Si	Si	Si
Mean of the control group	12.9508	0.834	0.7235	0.2791	0.4444

Note: *** Significant al 1%, ** significant al 5% y * significant al 10%. Standard errors clustered at the city level.

Figure 7: Marginal effects of the payroll tax cut on labor market variables

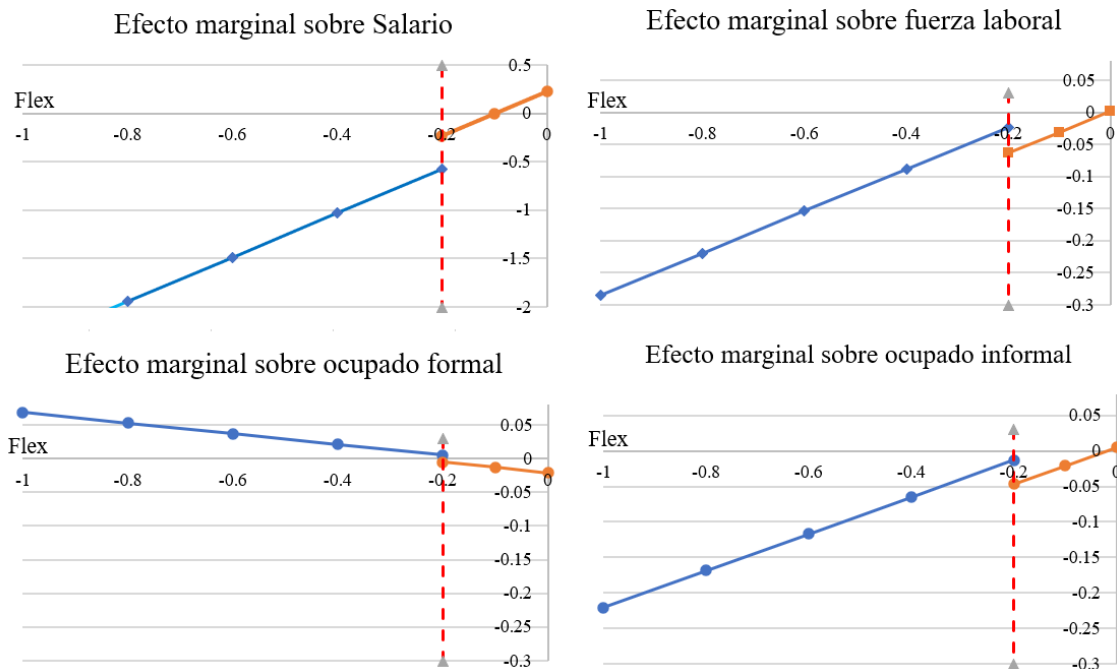


Note: Sum of $\beta_4, \beta_{12}, \beta_{13}, \beta_{14}$ of specification (3) for young workers earning below and above the minimum wage. The effect over labor market variables is asymmetric.

Now, Table 3 shows the results of the specification (3) of the coefficients of interest: $\beta_4, \beta_{12}, \beta_{13}$ and β_{14} . Graph 7 helps us to make a simple reading of these coefficients. From this graph we

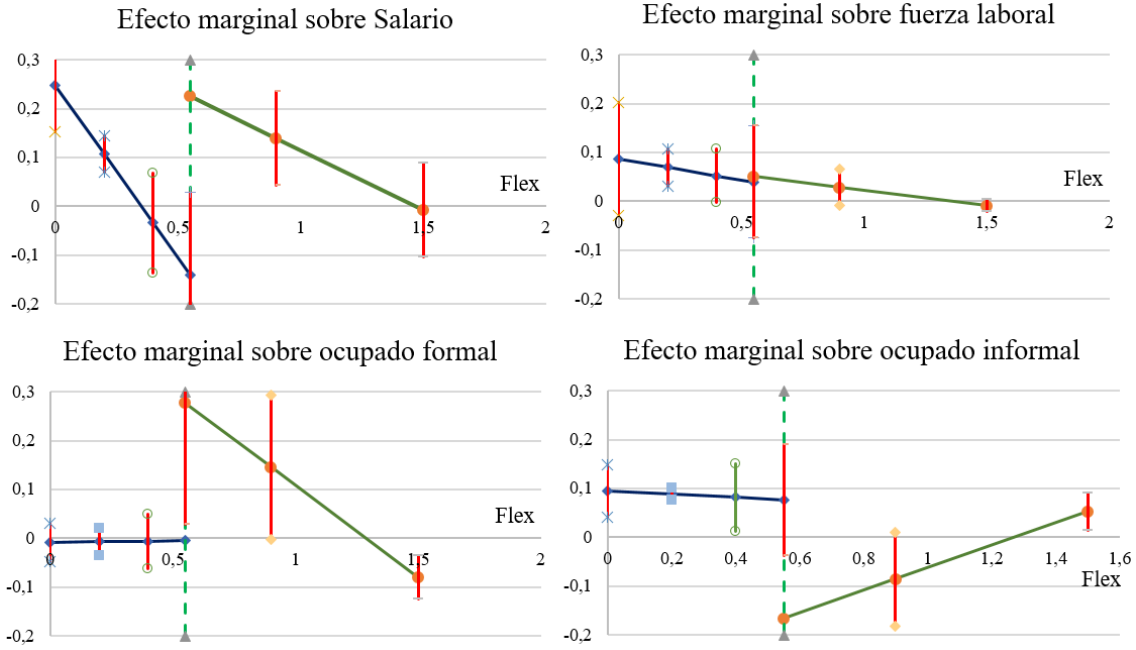
observe that the effect on wages, labor force, formal and informal occupation is asymmetric. It is young people who earn above the minimum wage that have positive effects on wages and formal occupation. However, it is striking that the probability of being informally employed has also increased significantly for young trainees who earn above the minimum wage, contrary to what we expected. One possible explanation for these results is that those workers who earn well below the minimum wage may have different effects from those who earn below but close to the minimum wage. Likewise, those who earn above the minimum can have different effects if they are near or far from the minimum wage. To corroborate this hypothesis we carry out an additional exercise where we see the effect on labor market variables only for those who earn below the minimum wage and then for those who earn above the minimum wage.

Figure 8: Marginal effects of payroll tax cut on labor market variables for workers earning below the minimum wage



Note: The marginal effect on labor market variables is not asymmetric for those earning below the minimum wage. The limit to separate those who earn close to the minimum wage below from those who earn far away from the minimum wage below is the mean of variable *Flex_{cem}* for those who earn below the minimum wage.

Figure 9: Marginal effects of payroll tax cut on labor market variables for workers earning above the minimum wage



Note: The marginal effect on labor market variables is asymmetric for those earning above the minimum wage. The limit to separate those who earn close to the minimum wage above from those who earn far away from the minimum wage above is the mean of variable $Flex_{cem}$ for those who earn above the minimum wage.

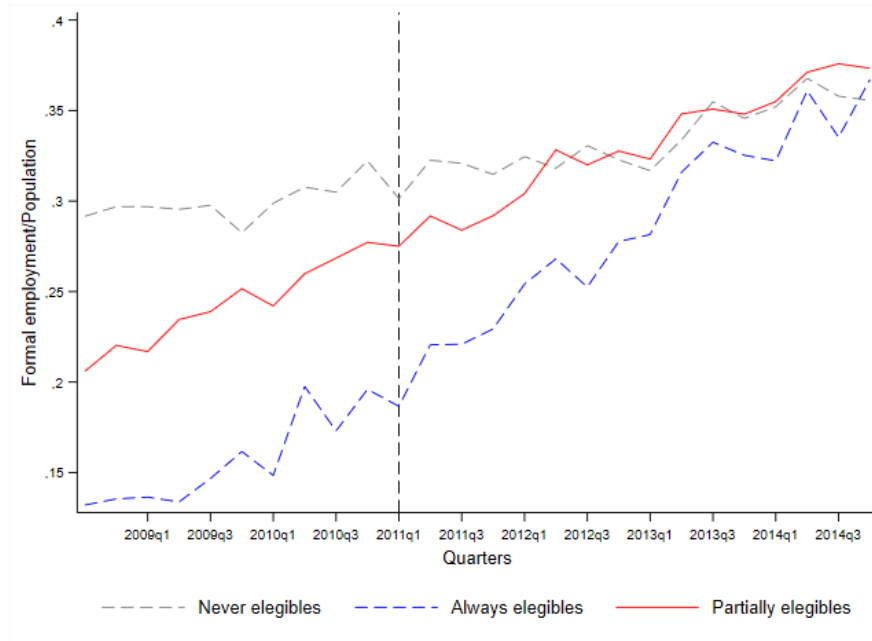
Figures 8 and 9 show the marginal effects on wages, labor force, formal and informal employment for those who earn below, near and far from the minimum wage and for those who earn above, near and far from the minimum wage, respectively. Figure 8 shows that the effect of the reduction of payroll taxes on the labor market variables studied here, does not present asymmetries in young people who earn well below the minimum wage of young people who earn below but close to the minimum wage. For its part, figure 9 shows that young people who earn near and far from the minimum wage do have significant differences. The reduction in payroll taxes has been translated into both a salary increase for young people who earn near and far from the minimum wage, although decreasing as nominal rigidity decreases. It is particularly striking that formal employment has increased significantly for young people who earn above the minimum wage, especially for those who are very close to the mean of the variable $Flex_{cem}$ above.

7. Extensions

In order to see if there is a differential effect on young people who were always exposed to treatment and young people who were exposed to only part of the period analyzed, we will classify young people eligible by law into two different groups of treatment: always eligible and partially eligible. In the group of partially eligible are young people who, during 2011 to 2014, were 28

years old, which means that they were eligible only for part of the period under consideration, since in any new contract signed after reaching that age they were not sheltered. the benefits. Again, it is important to note that once hired, regardless of the age of the worker, as long as he was under 28 years of age, the benefits for the employer could be extended for a maximum of two years.

Figure 10: Employment rate - Formal sector



Source: GEIH.

Figure 4 shows the employment rate in the formal sector before and after the reduction of payroll taxes for young people who are partially eligible and those who are always eligible. For young people who are always eligible formal employment rate experiences a high growth rate after First Employment Law, until it reached a level similar to the employment rate of slightly older youth. This would be consistent with people between the ages of 22 and 24 being more attractive to businesses as a result of the reform.

To capture the effect of FEL on employment for always eligible, S_{im} , and partially eligible, P_{im} , we use the following specification in our differences-in-differences model:

$$\begin{aligned}
Y_{im} = & \alpha_m + \gamma_c + \beta_1 S_{im} + \beta_2 P_{im} + \beta_3 Flex_{cem} + \beta_4 debajo_{cem} + \beta_5 S_{im} Post_m + \\
& \beta_6 P_{im} Post_m + \beta_7 S_{im} Flex_{cem} + \beta_8 P_{im} Flex_{cem} + \beta_9 Post_m Flex_{cem} + \\
& \beta_{10} Flex_{cem} debajo_{cem} + \beta_{11} S_{im} debajo_{cem} + \beta_{12} P_{im} debajo_{cem} + \beta_{13} Post_m debajo_{cem} + \\
& \beta_{14} S_{im} Flex_{cem} debajo_{cem} + \beta_{15} P_{im} Flex_{cem} debajo_{cem} + \beta_{16} Post_m Flex_{cem} debajo_{cem} + \\
& \beta_{17} S_{im} Post_m Flex_{cem} + \beta_{18} P_{im} Post_m Flex_{cem} + \beta_{19} S_{im} Post_m debajo_{cem} + \\
& \beta_{20} P_{im} Post_m debajo_{cem} + \beta_{21} Post_m S_{im} Flex_{cem} debajo_{cem} + \beta_{22} Post_m P_{im} Flex_{cem} debajo_{cem} \\
& \beta_{23} X_{im} + \epsilon_{im}
\end{aligned}
\tag{4}$$

Table 4
Effect of payroll tax cut on wage and employment for always and partially eligible

Variables	Ln wage	Labor force	Employment	Formal Emp	Informal Emp
S*Post	0.0773 (0.0456)	0.0816*** (0.0156)	0.0779*** (0.0112)	-0.0790** (0.0315)	0.1569*** (0.0225)
P*Post	0.0390 (0.0251)	0.0639*** (0.0038)	0.0684*** (0.0170)	-0.0714*** (0.0224)	0.1398*** (0.0067)
S*Post*debajo	0.1965*** (0.0688)	0.0086 (0.0159)	0.0369 (0.0335)	0.3375*** (0.0576)	-0.3006*** (0.0328)
P*Post*debajo	0.3137*** (0.0928)	0.0218 (0.0275)	0.0691 (0.0519)	0.3366*** (0.0441)	-0.2675*** (0.0278)
S*Post*Flex	0.0738 (0.0446)	-0.0457*** (0.0149)	-0.0340*** (0.0083)	0.0786** (0.0358)	-0.1126*** (0.0295)
P*Post*Flex	0.0793** (0.0336)	-0.0444*** (0.0040)	-0.0466*** (0.0121)	0.0666*** (0.0221)	-0.1133*** (0.0107)
S*Post*Flex*debajo	0.8249 (0.5105)	0.3654*** (0.0866)	0.3719*** (0.1214)	0.8994*** (0.1489)	-0.5275*** (0.1345)
P*Post*Flex*debajo	1.1380*** (0.2745)	0.2833** (0.1101)	0.3983*** (0.1343)	1.0017*** (0.1530)	-0.6035*** (0.1553)
Observations	487,648	757,273	757,273	757,273	757,273
R-squared	0.1350	0.1520	0.2518	0.8113	0.2968
Controls	Si	Si	Si	Si	Si
FE Month	Si	Si	Si	Si	Si
FE Area	Si	Si	Si	Si	Si
Mean of the control group	12.9506	0.834	0.7235	0.279	0.4445

Note: *** Significant at 1%, ** significant at 5% y * significant at 10%. Standard errors clustered at the city level.

8. Conclusions

In this article we evaluate the effect of a reduction in payroll taxes on the creation of formal employment, in young people under 28 years of age, taking into account differential degrees of exposure to wage rigidities. Using a difference-in-difference model, we estimate that the effect of the reduction in payroll taxes is asymmetric for young people who earn below and above the minimum wage. On the one hand, for young people who earn below the minimum wage, the reduction in payroll taxes increases wages for those who experience greater nominal rigidities, while the effect on employment is almost nil, contrary to what the theory predicts. On the other hand, for young people who earn above the minimum wage, the reduction in payroll taxes had a positive and significant effect on wages and the probability of obtaining a formal job.

In addition, rather than reducing informality, the reduction of payroll taxes increased youth labor participation.

References

- Almeida, R. and Carneiro, P. (2012). Enforcement of Labor Regulation and Informality. *American Economic Journal: Applied Economics*, 4(3): 64-89.
- Bell, L. (1997). The impact of minimum wages in Mexico and Colombia. *Journal of Labor Economics*, 15(3): 102135.
- Bernal, R. (2009). The Informal Labor Market in Colombia: Identification and Characterization. *Desarrollo y Sociedad*, 145-208.
- Bernal, R., Eslava, M., Melndez, M. and Pinzn A. (2017). Switching from Payroll Taxes to Corporate Income Taxes: Firms Employment and Wages after the 2012 Colombian Tax Reform. *Economia: Journal of the Latin American and Caribbean Economic Association*, 18(1): 41-74.
- Blanchard, O. and Wolfers, J. (2001). The Role of Shocks and Institutions in the Rise of European Unemployment: the Aggregate Evidence. *The Economic Journal*, 110(462): 1-33.
- Blinder, A., and Choi, D. (1990). A Shred of Evidence on Theories of Wage Stickiness. *Quarterly Journal of Economics*, 105(4): 100315.
- Campbell, C. and Kamlani, K. (1997). The Reasons for Wage Rigidity: Evidence from a Survey of Firms. *Quarterly Journal of Economics*, 112(3): 759-789.
- Cruces, G. Galiani, S. and Kidyba, S. (2010). Payroll taxes, wages and employment: Identification through policy changes. *Labour Economics*, 17(4):743 749.
- Egebark, J., and Kaunitz, N. (2014). Do Payroll Tax Cuts Raise Youth Employment? Institute for Evaluation of Labour Market and Education Policy Working Paper 2013:27.
- Egebark, J., and Kaunitz, N. (2018). Payroll Taxes and Youth Labor Demand. *Labour Economics* 55: 16377.
- Gregg, P. and Tominey, E. (2005). The wage scar from male youth unemployment. *Labour Economics*, 12(4): 487-509.
- Gruber, J. (1997). The Incidence of Payroll Taxation: Evidence from Chile. *Journal of Labor Economics*, 15(3): 73-100.

Gruber, J. (2000). Payroll taxation, employer mandates, and the labor market. *Employee benefits and labor markets in Canada and the United States*. Pags. 183-233.

Gruber, J. and Krueger, A. (1991). The Incidence of Mandated Employer-Provided Insurance: Lessons from Workers' Compensation Insurance. *Tax Policy and the Economy*, pp. 111-144.

Heckman, J. and Pags, C. (2004). Introduction. In: Heckman J, Pags C (ed) *Law and Employment: Lessons from Latin America and the Caribbean*. University of Chicago Press, Chicago.

Houseman, S. (1998). The Effects of Employer Mandates. In *Generating Jobs: How to Increase Demand for Less-Skilled Workers*, edited by Richard B. Freeman, and Peter Gottschalk. New York: Russell Sage Foundation, pp. 154-191.

Katz, L. (1998). Wage Subsidies for the Disadvantaged. In: Freeman RB, Gottschalk P *Generating Jobs*. New York: Russell Sage Foundation. pp. 21-53.

Kluge, J. et al. (2016). Do Youth Employment Programs Improve Labor Market Outcomes? A Systematic Review. IZA Discussion Paper No. 10263.

Kugler, A., Jimeno, J. and Hernanz, V. (2002). Employment Consequences of Restrictive Permanent Contracts: Evidence from Spanish Labor Market Reforms. IZA Discussion Paper No. 657.

Kugler, A., Kugler, M. (2009). Labor Markets Effects of Payroll Taxes in Developing Countries: Evidence from Colombia. *Economic Development and Cultural Change*, 57(2): 335-358.

Kugler, A., Kugler, M. and Herrera-Prada, L. (2017). Do Payroll Tax Breaks Stimulate Formality? Evidence from Colombia's Reform. *Economia: Journal of the Latin American and Caribbean Economic Association*, 18(1): 3-40.

Lazear, E. (1990). Job Security Provisions and Employment. *The Quarterly Journal of Economics*, 105(3): 699-726.

Maloney, W. (2004). Informality Revisited. *World Development*, 32(7): 1159-1178.

Nordstrom, O. (2011). Scarring Effects of the First Labor Market Experience. *IZA Discussion Paper No. 5565*.

International Labor Organization (2018). *Panorama Laboral 2018 América Latina y el Caribe*.

Saez, E., Schoefer, B. and Seim D. (2019). Payroll Taxes, Firm Behavior, and Rent Sharing: Evidence from a Young Workers' Tax Cut in Sweden. *American Economic Review*, 109(5): 1717-1763.

Skedinger, P. (2014). Effects of Payroll Tax Cuts for Young Workers. *IFN Working Paper*, 1031.

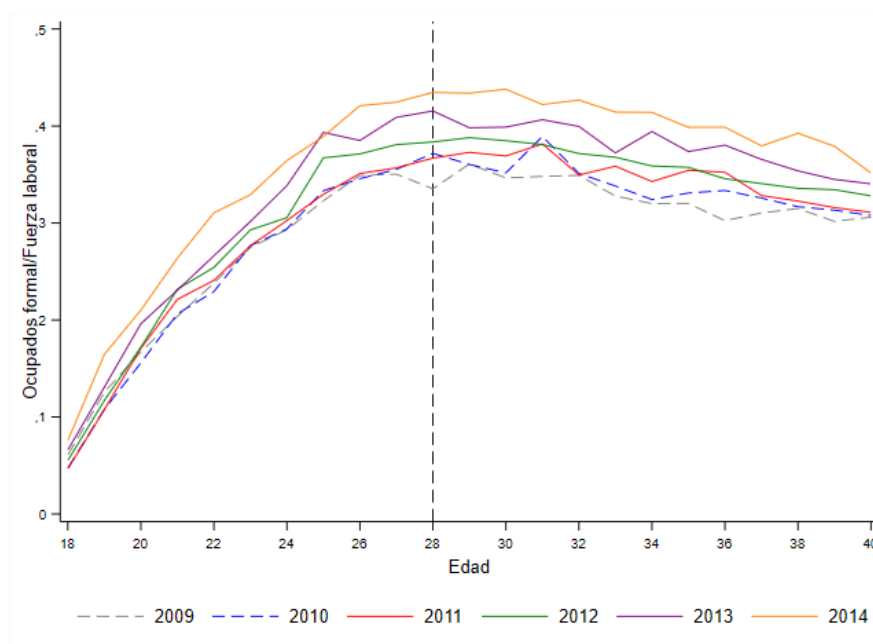
Summers, L. (1989). Some Simple Economics of Mandated Benefits. *The American Economic Review*, 79(2): 177-183.

Appendix

Table A1
Average of labor market variables before and after First Employment Law

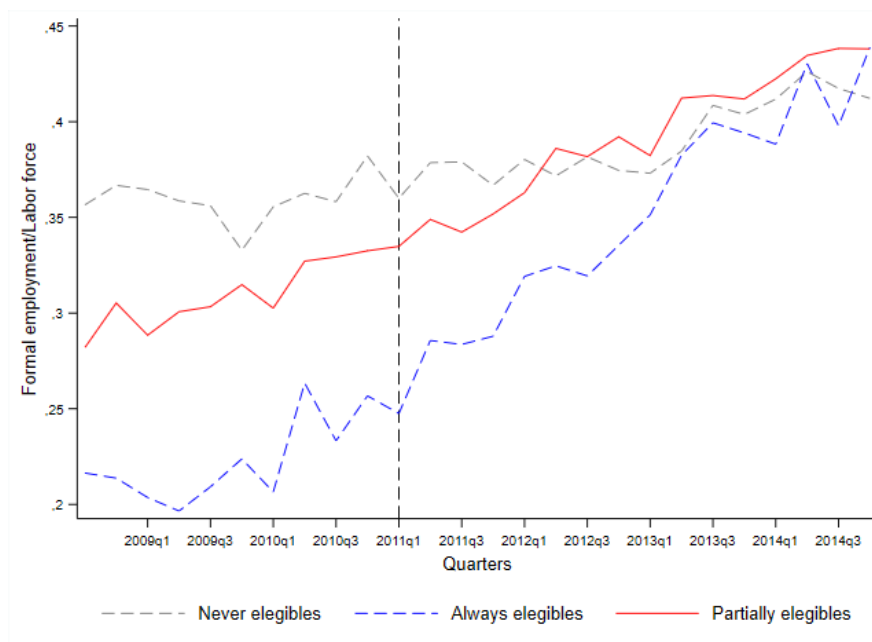
Variable	2009-2010			2011-2014		
	Control	Always	Partially	Control	Always	Partially
Labor force	0.838	0.697	0.794	0.861	0.810	0.845
Employment	0.735	0.534	0.647	0.775	0.679	0.737
Formal employment	0.275	0.162	0.247	0.315	0.283	0.320
Informal employment	0.460	0.372	0.400	0.460	0.397	0.417

Figure 11: Employment rate - Formal sector



Fuente: Elaboracin propia - GEIH.

Figure 12: Employment rate - Formal sector



Source: GEIH.