

Changes in Daytime Hours of Work and Employment in Colombia*

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Abstract

We estimate the effect on hourly wages and hours of work, of an increase in the number of hours of work, defined by law as daytime hours of work. To identify the parameter of interest, we estimate difference in difference models. Although we do not know the working hour schedule; we exploit the necessary conditions for the intervention to affect them, to define treatment and comparison groups. We find that wages of males older than 25 working in industry in metropolitan areas decreased more than 11% due to the reform, while females older than 25 working in industry in metropolitan areas reduced their hours of work per week in 3.6 hours. There is evidence, although weaker, of increases in hourly wages for male workers in the other sectors of the economy. This suggests that employers increased labor demand in those sectors. Overall, the reform would have had positive effects on all workers but those in industry.

Keywords: Labor Reform, Labor Market Regulation, Difference in Difference Models, Labor Supply, Labor Demand

JEL Codes: K31, J20, J30

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1. Introduction

In 2002, after Colombia had gone through the worst economic crisis since decades, which caused a deep labor market crisis, Colombian Congress approved Law 789, a reform to labor market regulation. The reform sought to promote active labor market policies and to make current legislation more flexible. The active labor market policies included incentives to hiring of hard-to-employ workers, a reduction of firing costs, unemployment insurance and employment subsidy. On the other hand, the other part of the reform dealt with making legislation more flexible by increasing daytime working hours, reducing the overpayment for working on Sunday and holydays, and making it possible to make more flexible the work schedule. Nonetheless, the law was approved with a constraint on its continuity: if it did not render positive results 2 years ahead, it could be modified or rescinded. Accordingly, formal evaluations of its effects on labor market performance are necessary.

The scope of the reform can be quantified by estimating the aggregate savings employers would have, if we assumed that nothing but daytime hours of work changed. The reform only affects formal employees, which are only 33% of total number of employees, and only 53% of the work force in the formal sector could be treated since the exceptions of the law exclude 47% of workers in the formal sector. Finally, let us assume that on average, these workers worked at most one out of their 8 daily hours between 6:00 p.m. and 10:00 p.m., five days per week. We take the quantities shown in table 1 for measuring this effect in terms of earnings of formal employees. The resulting upper bound represents 2.7% of that figure, close to what Colombia annually collects out of the formal employees' payroll for child care.¹

Table 1. People and wages for measuring the effects of the reform

	Number of persons	Mean of the hourly wage
Formal Employees	(A) : 6'621.815	\$ 2,520
Treated Hours/Wages	(A)*0.53*8/8*5*52=(B): 912,486,107	\$ 2,900
Savings	(B) * 0.35 * 2,900 :	\$ 926,934,973,548
% of Earnings of Formal Employees		2.7%

This study estimates the effect of the part of the reform which dealt with the change in the number of daytime hours of work, on hourly wages and hours of work. The effects on male and female workers were estimated for people younger and older than 25. To identify the parameter of interest we apply differences in differences. We use Households Survey for years before and after the reform (2004 versus 2001).

We find that wages of males older than 25 working in industrial jobs in the metropolitan areas decreased more than 11% due to the reform, while females older than 25 working in the industrial sector in the metropolitan areas reduced their hours of work per week by 3.6 hours. We also find an increase of up to 8% in hourly wages of males older than 25 not working in industries of the metropolitan areas, and an increase in the hours worked by

¹ Those resources are administered by the *Instituto Colombiano de Bienestar Familiar*, ICBF.

those in the industrial sector of up to 3.2 hours per week; although these results are not as robust as we would want them to be. On the whole, even though the most reliable results we get would not be good news to male industrial workers, there are signs of increases in hourly wages for male workers belonging to other sectors of the economy, which might bring good news in the short-run.

Seven sessions compose this study. The first is this introduction. The second one presents the labor market situation after the economic crisis, which motivated the reform. The third session makes a detailed presentation of the part of the labor reform which dealt with making legislation more flexible. The fourth session discusses the theoretical implications of the reform based on standard labor supply and demand models. The fifth session contains the methodological aspects of this work. All the details about the empirical inputs and strategies can be found in this latter session. The results of the estimations and a briefing on them are in the sixth session. The seventh session resumes and concludes.

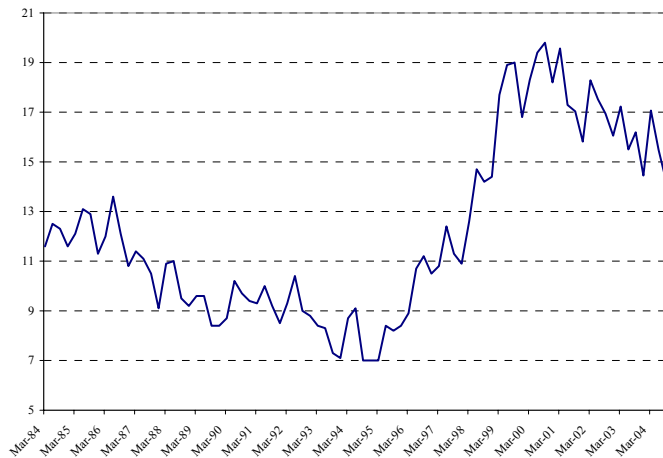
2. Labor Market Context before the Reform

In 1995, the unemployment rate for the seven major cities of Colombia matched that which was considered to be its natural unemployment rate: 7% (see Figure 1). Nonetheless, crisis symptoms extending into the 1996 economic performance (two consecutive quarters of negative GDP growth) quickly spread across the labor market. By 1997, the unemployment rate already exceeded 11%.

Internal multipliers, namely exchange rate instability, high-standing interest rates –partly a consequence of the first factor– and spending cuts, combined with the closure of capital markets in 1998 and 1999, brought about the worst crisis in Colombian history, when a -4.5% slump in the GDP was observed. A crisis of such magnitude prompted deep adjustments in the labor market, as it caused inflation to fall way below expectations, which meant a considerable increase in real wages and compelled to make adjustments in the number of employees. Thus, an announced crisis in the labor market deepened; in the year 2000, unemployment broke the 19% mark for several periods. The most vulnerable groups were the youngest and unskilled workers, who absorbed a large share of the crisis and endured unemployment levels rising beyond 20%.

Despite the fact that the economic crisis was overcome, job creation did not react in the same degree. An explanation for this is found in the rigidities of nominal salaries and, in general, in the structure of the Colombian labor market. This is the reason why a bill of reform of the labor market was proposed, having as its basic objectives those of providing flexibility to the labor market and promoting special programs of social protection that could reach the vulnerable population, with the aim of offsetting the differential impact that they had endured after the slump in employment.

Figure 1. Evolution of the unemployment rate



Source: DANE

3. Changes Introduced by the Reform

Given the difficulties in the Colombian labor market, the government sought to boost growth in employment by promoting active labor market policies and making current legislation more flexible. The promotion of active labor market policies was directed towards boosting job training programs and making them more flexible, promoting micro-credit, offering incentives to the hiring of hard-to-employ workers, lowering firing costs, and finally, establishing unemployment insurance and employment subsidy. Since most of the target population of these policies is vulnerable, this has been referred to as the social protection component of the reform. The National Development Plan of President Uribe's government estimated that these policies would generate 390,916 jobs between 2003 and 2006². A key element in the reform was article 46 of Law 789, which conditions its continuity to its having accomplished positive improvements in employment after completing its second year.

The preliminary results of these policies have been analyzed by the National Government, unions, industry, and academics³. Regrettably, little if any consensus comes out of these studies. Clearly, entrepreneurs and the government are more prone to conclude that elements of the reform were fundamental to the observed increase in employment rates during 2003 than are unions and academics. However, inferences of the latter do not converge on the government's conclusions either. Unions, on their part, demand that several points of the Law be reversed, based on article 46, claiming that, other than lowering employee wages, it has not had any positive effect on employment. As for academics, they find mixed results deriving from the Law.

² Department of National Planning (2003).

³ For examples of the different perspectives, see: in Ministry of Social Protection (2005), of the government; in ANDI (2004), of unions and industry; and, in Ferné (2004), Gaviria (2005) and López et al. (2005), of academics.

There are more expectations than actual results in some of its programs, since their implementation has not had enough time to prove their worth. That is the case of unemployment and employment insurance and employment subsidy⁴.

The other part of the reform, which dealt with making legislation more flexible, was expected, according to the National Development Plan, to generate 95,147 job places between 2003 and 2006⁵. The main components of this second part are illustrated in table 2.

Table 2. Main changes introduced to the work schedule by Law 789/2002

Article 160. Definition of day and night working hours		
	Article 25, Law 789/2002	Original Text
Daytime Working Hours	6:00 a.m. - 10:00 p.m.	6:00 a.m. - 6:00 p.m.
Nighttime Working Hours	10:00 p.m. - 6:00 a.m.	6:00 p.m. - 6:00 a.m.
Article 179. Extra payment for Sunday and holiday labor		
	Article 26, Law 789/2002	Original Text
Extra payment for Sunday and holiday labor	75% of daytime hourly wage	100% of daytime hourly
Additional extra payment when Sunday/Holiday does not belong to the daily working schedule	None	None
Exceptions	When agreed standard working hours are up to 36	When agreed standard working hours are up to 36
Article 161. Daily and weekly standard working hours		
	Article 51, Law 789/2002	Original Text
Weekly Standard Hours for Workers under 18 and over 16	Up to 8 hours/day and 48 hours/week	Up to 8 hours/day and 48 hours/week
Flexibility of daily and weekly working schedules	Employer and employee can temporarily or permanently agree on an uninterrupted working schedule as long as the employee works up to 6 hours per day and 36 hours a week ⁶ . Employer and employee can agree on a daily	Same as in Law 789/2002, but restricted to new firms or new activities.

⁴ See Gaviria (2005).

⁶ “Continuity solution” implies, among other things, that workers are paid for Sundays and holidays not worked, either fully, if worked all other days, or proportionally to the weekly days worked.

	working schedule that can go from 4 to 10 hours a day, up to 6 days per week, with no overtime payment, as long as the weekly hours, not exceeding 48, lie within the 6:00 a.m. to 10:00 p.m. daily working session.	
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From the aforementioned, significant reductions are expected in revenues of employees whose working schedules lie within time spans considered by the law; in other words, of employees whose working session before the law became effective covered some of the intervals that the reform takes into consideration, from 6:00 p.m. to 10:00 p.m., and Sundays. Unsurprisingly, the impact is not the same for revenues of those having working sessions with hours that lie between 6:00 p.m. and 10:00 p.m., nor for those having Sunday working hours with extra payment. Changes in overpayments implied by law 789 are shown in table 3.

Table 3. Changes introduced by the reform in the working schedule

Type of hours	Considered hours	Overtime Premium	
		Before the Law	After the Law
Standard	6:00 p.m.-10:00 p.m.	$W_N=1.35W$	W
Overtime	6:00 p.m.-10:00 p.m.	$W_{EN}=1.75W$	$W_E=1.25W$
Standard	Sunday or Holidays	2.00 W	1.75 W
Overtime			

That is, before the law, when standard hours included some within the 6:00 p.m. to 10:00 p.m. interval, workers were paid the night premium, $W_N=35\%$, and when these hours were not standard but extra, they were paid the night overtime premium: $W_{EN}=75\%$. After the law, these figures became $W=0\%$, and $W_E=25\%$, respectively. That is to say, night hours before the law now become standard hours, and overtime night hours become just regular overtime hours. Hours worked on Sundays or holidays receive a differential treatment; the reform introduced a direct reduction in the premium. However, the reform does not modify restrictions regarding the standard working schedule: currently, workers still cannot work more than 8 standard hours, and 2 overtime hours per day, six days a week.

Some effects are more difficult to determine, as it is the case of those deriving from the possibility of a flexible working schedule –in point of fact, the inclusion performed by sentence (d) of the law, under numeral 3 of article 161 of the Labor Code (*Código Sustantivo del Trabajo*), by means of which, under certain circumstances that are not difficult to meet, there can be a 48-hour working session without any type of overpayment.

Gaviria (2005) and Núñez (2005) assess the impact of this component of the reform on several potential outcomes, namely formality, employment, and the duration of employment and unemployment. The first of these studies does not find significant results of the reform on formality or employment, while the second one finds some favorable effects of the reform on the duration of unemployment.

4. Theoretical Implications of the Reform

This section illustrates the major implications suggested by the standard models of labor supply and demand on the basis of which the results of empirical exercises will be interpreted.

4.1 Labor Supply

The effects on the labor supply that have resulted from the measures depicted earlier can be illustrated on the basis of a standard model of labor supply.

In this model, the agent's problem is how to maximize his utility function: $U(C, L)$, while being subject to a budget constrain: $C \leq W(24 - L) + F$, in which C stands for Consumption, L for Leisure, W for his real wage per hour, and F for his non-labor income. The result of this model is the supply of labor hours: $H=24-L$, as a function of his real wage and non-labor revenues: $H(W,F)$. Corresponding to this function is the following empirical model, which allows for testing the hypothesis drawn from it.

$$H = \beta_0 + X\beta + \alpha W + \delta F + e \quad (1)$$

Even though changes in salaries have in general an ambiguous effect on the supply of labor hours, the α coefficient represents the net effect between substitution and income.

Next, the worker's response will be defined, in light of the different possibilities deriving from the changes introduced by labor reform. Specifically, a presentation follows of the modification that the different cases resulting from said reform imply over the budgetary restriction of agents, and the worker's response that is to be expected. For the purpose of that presentation, the notation to be employed in terms of salaries is previously defined, as follows:

- W = daytime-standard hourly wage
- W_E = daytime-overtime hourly wage ($1.25*W$)
- W_N = nighttime- standard hourly wage ($1.35*W$)
- W_{EN} = nighttime- overtime hourly wage ($1.75*W$)

The equivalence between the different wages and the daytime-standard wage originates in legislation now in force. That equivalence was not subject to change when the labor reform was enacted.

Cases to be considered are likewise described, always bearing in mind that the standard working session cannot exceed the 8-hour a day and 48-hour a week limits, and that the overtime working hours cannot exceed 2 hours a day and 12 hours a week.

Case 1: Working session starts before 8:00 a.m. and ends before 6:00 p.m. or begins after 10:00 p.m. and ends after 8:00 a.m.

Case 2: Working session starts after 8:00 a.m. and ends after 6:00 p.m. or begins before 12:00 p.m. and ends before 10:00 p.m.

Case 3: Working session starts after 12:00 p.m. and ends after 10:00 p.m. or begins before 10:00 p.m. and ends before 8:00 a.m.

These cases are graphically illustrated with a brief analysis of their effect on the labor supply of work. For the purpose of solving the theoretical ambiguity in the cases in which there is a reduction in the hourly wage, one of the results of the empirical models derived from estimating the (1) equation is taken as the basis, and the fact is that in all estimations performed the interest coefficient α is positive. In this sense, it will be assumed that, in general, reductions in the hourly wage will imply reductions in the number of hours worked.

Case 1: No effect on the labor supply: In this case, the working session does not include hours within the interval that is subject of consideration by the reform and, therefore, there is not any alteration of the budget constrain. Consequently, with preferences given as fixed, there will be no alteration whatsoever over the supply of work. In other words, $H^* = H^*$.

Figure 2. Case 1: No effect on labor supply

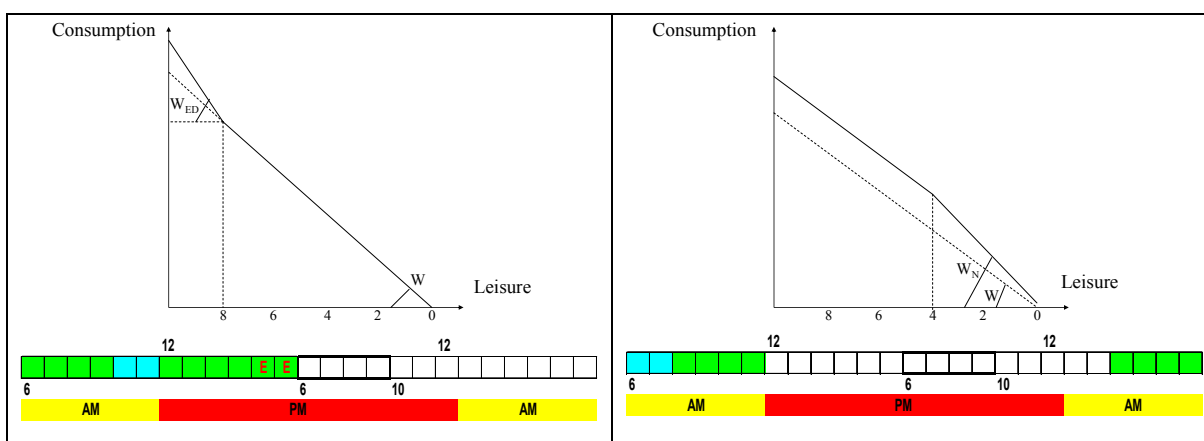
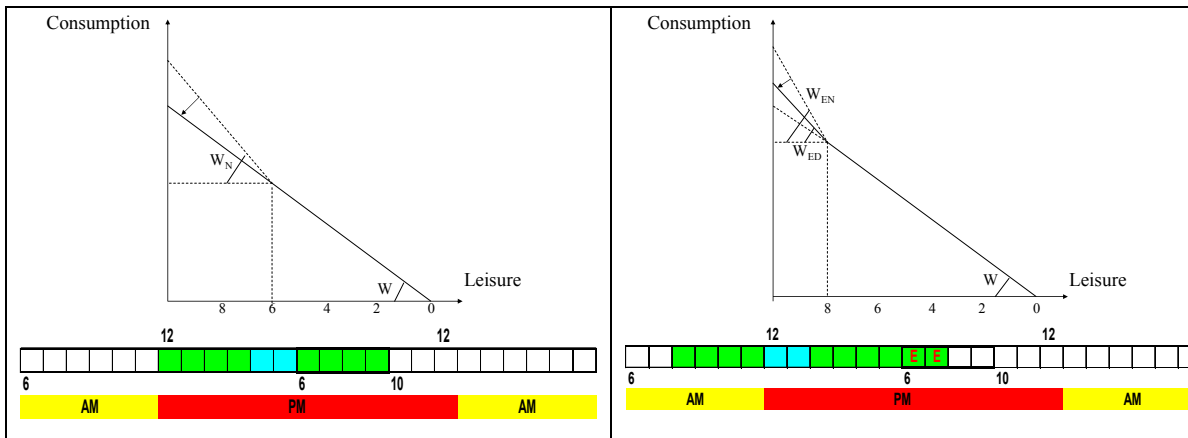
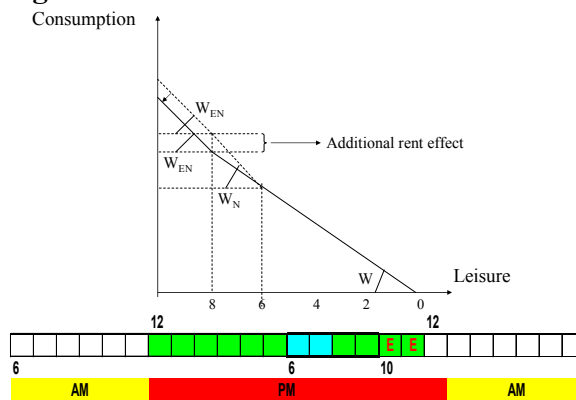


Figure 3. Case 2: Reduction in hours of work



Case 2: Reduction in hours of work: In this case, there are two situations observed. In both cases, it is assumed that the worker maximizes his utility by placing him within the interval that goes from 6:00 p.m. to 10:00 p.m. In the first, however, these are standard working hours, whereas in the second case those are extra hours. In both cases there is an hourly wage reduction, and thus, on the basis of our assumptions, working hours would be reduced without ambiguity.

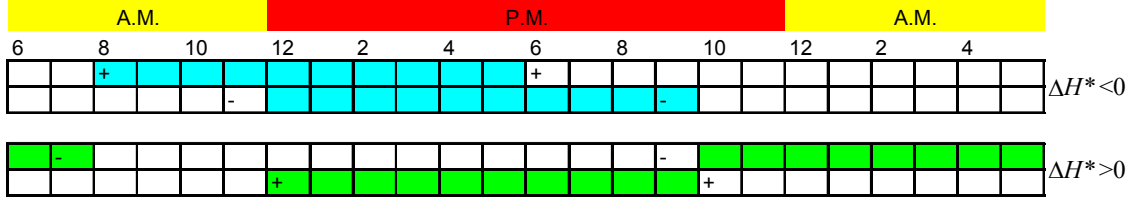
Figure 4. Case 3: Increase in hours of work



Case 3: Increment in hours of work: This case requires from the working session to include hours of work immediately before and after 10:00 p.m., and from the employee to work overtime. In this case, the marginal wage of the worker does not change, and therefore, the only effect taking place is the rent effect. Thus, it follows that in this case working hours would increase without ambiguity.

In summary, some intervals can be described which, by having non-void intersections with the session, they make these become susceptible to effects, just as figure 5 illustrates it.

Figure 5. Characterization of working hours affected by the reform



4.2 Labor Demand

In order to illustrate the effects of the reform over the labor demand, the standard firm's benefit maximization approximation is used.⁷ In this case, employers evaluate the opportunity cost of hiring new employees against contracting additional hours from current

$$\begin{aligned} \pi &= g(h, N, K) - whN - fN - pw(h - h_{-6-10})N - rK; \quad \forall h \geq h_{-6-10} \\ &= g(h, N, K) - whN - fN - rK; \quad \forall h < h_{-6-10} \end{aligned}$$

employees. That is, firms maximize

(2)

Where h are the total hours, h_{-6-10} are the hours of work that take place not between 6:00 p.m. and 10:00 p.m., N is the number of workers, f are the fixed costs per worker, r is the cost of capital rent, K is capital, and p is the premium per hours worked between 6:00 p.m. and 10:00 p.m.⁸ The marginal cost of an additional worker per h^* hours is

$$\begin{aligned} MC_N &= wh^* + f + pw(h^* - h_{-6-10}); \quad \forall h \geq h_{-6-10} \\ &= wh^* + f; \quad \forall h < h_{-6-10} \end{aligned} \quad (3) \quad \text{And the}$$

marginal cost of h^* hours worked by an already-hired employee is

$$\begin{aligned} MC_h &= (1 + p)wh^*; \quad \forall h \geq h_{-6-10} \\ &= wh^*; \quad \forall h < h_{-6-10} \end{aligned} \quad (4)$$

If the ratio between the marginal cost of a new employee and that of the extra hours of a person already hired changes by means of the reform, a change takes place in the optimum ratio of employees on overtime hours. The same thing happens if the ratio changes between the marginal cost of a new employee working on a daily shift and that of a current employee working overtime. The following table illustrates this change in the marginal costs ratio through a quantitative exercise that helps in exemplifying the employers' decision-taking model.

⁷ See Hamermesh (1993)

⁸ If hours of work are among the standard hours of work, then the premium before the reform was that for night hours (W_N), while after the reform there would be no premium (W). If those were extra hours of work, then the premium before the reform was that for extra nightly hours (W_{EN}), while after the reform it would be just that for extra hours (W_E).

Table 4. Change in relative costs due to the reform⁹

	Before the reform	After the reform
Current worker		
Overtime hours ($h \geq h_s$)	6:00 p.m.-10:00 p.m.	6:00 p.m.-10:00 p.m.
Marginal Cost	$W_{EN} = 1.75W$	$W_E = 1.25W$
Additional worker		
Standard Hours ($h < h_s$)	6:00 p.m.-10:00 p.m.	6:00 p.m.-10:00 p.m.
Marginal Cost	$W_N = 1.35W$	W
Relative Cost	$W_{EN}/W_N = 1,296$	$W_E/W = 1,25$

If employers have job requirements within the time span considered by the law, from 6:00 p.m. to 10:00 p.m., the relative cost of additional hours of the current staff in relation with that of the newly hired employees fell 4.6%. It can be deduced from this that employers have incentives for contracting more overtime hours, in detriment of the hiring of new employees.¹⁰ On the other hand, the reduction in the marginal cost due to the lower cost of hours between 6 p.m. and 10 p.m. would increase the number of employees. The total effect on employment is ambiguous.

5. Methodology

This section describes the available data for making estimations, and the way in which the effect of the reform will be identified. The starting point is the empirical method to be used; later, data are described, and finally, the treated and comparison groups are defined, as well as their advantages and limitations in relation with definitions used by other research papers.

5.1 Data

Empirical exercises herein are making use of data from the Continued Survey of Households that the national statistics agency – DANE – conducts. This survey is also known by its Spanish acronym: ECH, which we will use ahead. The objective of the said survey is to monitor the performance of the Colombian labor market throughout the year. The ECH allows us to make representative inferences about the 13 major metropolitan areas in the country, and each one of the urban and rural areas. In particular, it uses the information available for the second quarter of years 2001 through 2004, which includes a

⁹ Assumes $f=0$ for simplicity.

¹⁰ Also notice that $\frac{\partial(MC_N / MC_h)}{\partial p} = -\frac{wN(wh_s + f)}{[(1+p)wN]^2} < 0$, and since the reform is basically a reduction

in p , then it follows that because of the reform, the marginal costs of an extra employee would increase relative to the marginal cost of an extra hour of work.

special questions set (module) on informality. The latter contains information regarding affiliations to the pension system and to the social security healthcare, and also about the size of the firm where workers are employed, among others. Additionally, the ECH contains information relating to the company's economic activity (industry, retail, services, etc.), the occupation (employee, factory worker, independent, etc.) and the worker's occupational ranking (professional, technician, etc.). This survey contains only information of a transversal nature, and although it includes some retrospective information on workers, it is minimal.

5.2 Empirical Model

In order to capture the effect that the law had on the population that it took into consideration, the methodology of differences in differences¹¹ is used. The parameter of interest for being estimated is the impact of the treatment on the treated (*TT*). The spirit of this methodology is estimating the difference existing between the group that received the intervention, or treated group, a group that has not been affected by it, or a comparison group retaining the most similar possible conditions to those of the treatment group. This difference is estimated after the reform, and it compares with the same difference estimated before the reform was enacted, which is assumed as the difference that should exist between the groups after the reform, and in its absence.

Such methodology employs the interaction between the variable that identifies the treated individual and the variable that identifies if, by the moment of taking the sample, the intervention was in effect, in our case, the labor reform.

This means that any variable, y , would be explained by a set of exogenous variables, x , and the variables treated, t , reform, R , and the interaction of the treated and treatment variables, tR :

$$y = \alpha x + \beta t + \gamma R + \theta tR + \varepsilon \quad (5)$$

In which θ represents the impact of the reform, i.e. the *TT*.

Even though under the methodology's assumptions it is possible to identify the parameter of interest, these assumptions have some limitations. On one hand, the assumption that the differences existing between the treatment and comparison groups before the reform are maintained after it implies that any change in the latter, determined by reasons outside the reform, would be wrongly attributed to it by the model¹². Another limitation to the model

¹¹ See Costa (2000), Gaviria (2005), Hamermesh and Trejo (2000), Hunt (1996, 1998, 1999), Kugler (2004), and Núñez (2004) among others.

¹² Trends or hysteresis in the labor market. If it were possible to perform an experimental design in which the reform would only be implemented for some randomly selected regions of the country, one could assume that the treated regions and the non-treated ones have the same tendencies. And also, in the case that some reasons not related with the reform affected them (in our case, they might include: change in government –internal safety and economic policies-, changes in the macroeconomic scenario –interest and exchange rates, fiscal balance, etc.-, and the minimum wage), that effect would be equally transmitted to both regions. In such a situation it would be possible to apply a triple difference, obtaining a net result from our double difference, the

would be the endogenous nature of the treatment group, mainly referring to the moment of defining the adopted treatment group.

Based on the aforementioned, the importance stands clear of making an adequate selection of the treated and comparison groups, which would be appropriate for obtaining a consistent estimation of the effects from the reform.

5.3 Definition of the treatment and comparison groups

As it was said earlier, treated by the reform is the employee who before it became in force used to work between 6:00 p.m. and 10 p.m., worked on Sundays or holidays, or had a homogeneous schedule before the reform, and after it he shifted to having a flexible working hours. Also treated are those who before the reform used to be jobless or inactive, and because of the reform they altered their labor-related decisions.

The available information does not allow us to determine which unemployed or inactive persons were susceptible to treatment by the reform, and the employees who were treated by the reform cannot be perfectly determined by it either, since there are no questions on his working hours. In this restriction lies the difficulty in achieving an adequate assessment of the reform's impact. Even though it is not possible to determine the treated and comparison groups with the desired degree of accuracy, it is possible to define them based on some necessary conditions for individuals to belong to each of these groups.

For the treated group, the current legislation allows establishing a necessary condition which becomes a good approximation for its definition. In particular, under numeral 162 of the Labor Code (*Código Sustantivo de Trabajo*), the set of norms that regulate the Colombian labor market, specifies that the regulation concerning the legal maximum working session does not cover workers who perform directive or managerial activities, or have a position of trust in the employer's organization. Additionally, it is clear that this condition may be enforceable exclusively within the formal sector of the economy. Based on the aforementioned, our treatment group will be defined by all employees of the formal sector performing in jobs covered by the regulation on maximum working session. Even though this definition includes within the treated group some individuals who were not necessarily treated by the reform, we do know that anyone having been treated by it belongs to the said group. Along these lines, belonging to the treated group constitutes a necessary, though not sufficient condition, for its integrants to be treated.

As mentioned earlier, Colombian labor reform had nationwide coverage. For this reason, it is not possible to find people employed in the formal sector, performing in working posts covered by the regulation regarding the maximum working-session length, and yet not being simultaneously susceptible of receiving an impact from the reform.

difference in time of the non-treated region, and thus obtain the parameter of interest. Among the interventions that might affect differently treatment and control groups we find the changes in the minimum wage, nonetheless, changes in its level was small during the three years previous to the reform.

Forming part of the set of possible comparison groups are employees that belong to the informal sector, or those in the formal sector performing in jobs not covered by the change in the number of daytime working hours. The most convenient comparison group should have characteristics that are as similar as possible to those of the treated group. Thus the trade-off between these possible comparison groups depends on whether differences between formal and informal sectors are larger than those between employees in the formal sector affected or not by the reform.

Therefore, we define the comparison group as the one comprised by individuals belonging to the formal sector who occupy working posts that are not affected by the change in the number of daytime working hours. The reason for this is that interventions affecting the treated group would more likely have a similar impact on this group than on the one consisting in workers employed in the informal sector, which displays a different functionality than that of the formal one.

Hence, the comparison group is composed of those individuals performing in directive or managerial jobs, or who have a position of trust within an organization belonging to the formal sector.¹³

The definition of formality is the subject of ongoing controversy, both inside the borders and internationally. With the aim of defining the group of individuals belonging to the formal sector, this paper adopts a conservative definition, according to which the person employed must act as a worker or employee, in a firm with a minimum staff of 11, and must be covered by social security in terms of healthcare and pensions.¹⁴

In summary, our treatment and control groups are:

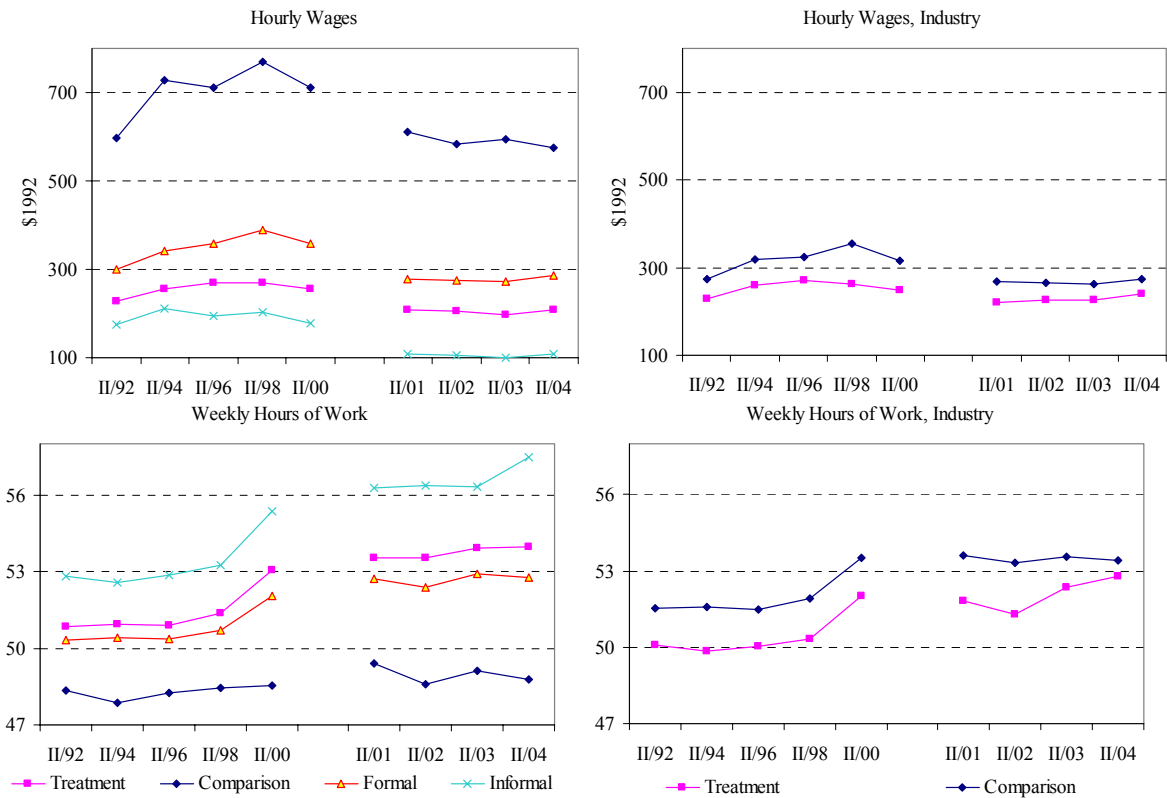
- a. Treated: employees or workers in a large company with affiliation to healthcare and pensions, who are not performing in a directive or managerial job and do not have a position of trust within the organization.
- b. Comparison: employees or workers in a large company with affiliation to healthcare and pensions, who are performing in a directive or managerial job or have a position of trust within the organization.

Figure 6 depicts the evolution of hourly wages and hour of work per week for four different types of workers: our treatment and comparison groups, and those working in the formal and informal sector respectively. The evolution is shown for the whole sample, and additionally, for workers in industry. The group of formal employees is mostly composed by our treatment group, thus the similarity in these curves. Nonetheless, as previously stated, among the formal there are several untreated individuals that are actually excluded from that group in order to compose our comparison group.

¹³ For further details on those jobs, the attached annex shows the working posts used for control, those corresponding to treated group, and some that are excluded from the exercise.

¹⁴ The incorporation of conditions additional to this one, such as having a work contract and working inside the company's facilities, do not significantly alter the definitions of the treated or comparison groups.

Figure 6. Hourly wages and weekly hours of work by type of worker



Maybe the more relevant information to extract from the figure is that our treatment and comparison groups follow similar patterns along the period, mostly between 2001 and 2003, the closest pre-treatment period. If anything, there might be a slight relative increase in weekly hours of work of the treated relative to the comparison group, which might lead to overestimate the effect of the reform on weekly hours of work.

One concern of our approach is the potential endogeneity of our treatment group. Conceptually, there should not be much discretion upon individuals in terms of their choosing whether to belong to the treatment group or not, since their being assigned to a directive or managerial job is the result of a process that takes place after several years of proving their potential, and such decision would depend relatively much more on many other variables than just what is determined by the labor reform under study. On the other hand, empirically we can show that individuals stay either in the treated or comparison groups in a very stable way. Transition's matrix between treated and comparison groups is computed with the prospective information about the past jobs, and it is shown in table 5.

Table 5. Transition's matrix

		Current Classification		
		Comparison	Treated	Total
Previous Classification	Comparison	643,616	158,136	801,752
		80.28	19.72	100
		63.51	7.88	26.54
	Treated	369,868	1,849,260	2,219,128
		16.67	83.33	100
		36.49	92.12	73.46
	Total	1,013,484	2,007,396	3,020,880
		33.55	66.45	100
		100	100	100

If one individual has already been treated, the probability of his continuing to be treated is 83%. For those initially in the comparison group, the probability of continuing being in that group is 80%. Therefore, the flow of people between the treated and comparison group is actually small.

5.4 Comparison with other definitions

Two studies precede ours in the attempt to assess labor reform. First, Gaviria (2004) defines as treatment group one made up of individuals within companies belonging to the industrial sector, in order to determine the impact of the reform on the degree of work formality, and also of individuals in larger size companies, in order to determine its effect on employment. His comparison group is the complement of the treated group. According to his line of reasoning, it is within those categories that individuals can be found who are susceptible of being treated by the law.

Secondly, Núñez (2004) conducted exercises seeking to determine the impact of the reform on the duration of employment and unemployment. From those, only the first would be somehow comparable to our exercise, the one on job duration, in which he uses the same definition as ours of the formal sector. In order to define the treatment group, he selects individuals within the formal sector, belonging to the fields of services, trade, industry and financial institutions. Additionally, given that his study focuses on the job duration, he only takes those employees of less than 10 years in service. His comparison group excludes the complement of the formal sector, which is not part of the treatment group.

In summary, both studies base their treatment and comparison groups in the economic activity sectors in which the employed persons perform. In this sense, our definitions of treatment and comparison coincide only partially with those of the other two papers, as Table 2A of the appendix shows. This means that, for the purpose of identifying the impact of the reform, only the population included in our definition would meet the necessary conditions for belonging to the treated group, and that included in our comparison group, with reasons enough for belonging to that group. Any of the two definitions used by the other studies excludes from its treated group those individuals who are effectively treated

by the reform, and includes in their comparison group those individuals that the reform effectively considers.

5.5 Determination of the comparison year

Given that the data available for performing this assessment correspond to the informality modules in the ECH survey, available only for the second quarters of 2001, 2002, 2003 and 2004, the sample is limited to 2001, 2002 and 2004, given that the reform became in force in April 2003, thereby making it impossible to determine if that year is in fact treated or not by the reform. Deduced from the latter is that the reference line, year in which the reform was not in effect and that is used in comparing against the presence of the reform in action, should be 2001, 2002, or either one. Among the possible options, 2002 is a particularly negative year for the Colombian labor market, and therefore, selecting it imposes a bias to our intention of capturing the effects of the reform. The following table shows some evidence of the poor performance of the Colombian labor market recorded in 2002, in relation with 2001.

Table 6. Evolution of key indicators of Colombian labor market, 2001-2002

	Global Participation Rate	Employment Rate	Unemployment Rate	Underemployment Rate*
2001-2002 Change	-0.4	-0.8	0.7	2.8

* Defined as the share of employed people under poor conditions of work.

5.6 Demographic groups studied

Remaining to be determined are the population groups which would allow for better distinguishing the reform's effects from other contemporary effects. Gender is already a standard population group. Additionally, it is important to differentiate the possible effect that the labor reform may have had on people who have completed their academic formation and on those who have not. The first of those groups is subject to other interventions that the labor reform incorporates. Consequently, within each gender, a group of individuals with ages up to 25 years or older.

5.7 Description of the estimation process

Equation (5) is estimated to assess the impact of the labor reform on hourly wages and the number of hours worked per week. The next step in this process is the approximation used by Mroz (1987). That is to say, using a model of participation, the equations of hourly wage and worked hours are corrected according to selection bias. The hours' equation is estimated in both its structural form (including the hourly wage as the explicative variable) and in its reduced form. The equations of wages and participation depend on all the exogenous variables of the model, which include the characteristics of the individual, its socioeconomic environment, and several interactions and transformations upon them. In the structural equation per hours the hourly wage's endogenous nature is corrected.

Understandably, the equations of wage and hours, as well as the participation equation, incorporate a considerable number of control variables of multiple origins:

- **Geographic variables:** these are dummy variables identifying the different metropolitan areas (in the sample that only considers these) or the urban and rural sectors, in the case of the sample that considers both sectors.
- **Household's demographic variables:** these are variables describing the demographic composition of the household, including: presence of children, adolescents, elderly or handicapped family members.
- **Household's socioeconomic variables:** by means of these variables, it is intended to capture some of the essence of the individual's socioeconomic environment; variables prevailing are those of revenues of the other household members, both in monetary terms as in their proximity to the minimum wage, in addition to variables such as education and the average working experience for the household.
- **Individual's variables:** also necessary are certainly variables describing the observed individual, which are of common usage in literature, namely sex, ranges of education, experience (lineal or square), non-salary income, and others.

6. RESULTS

With the purpose of verifying the sturdiness of results from the different specifications of equation (5), assessment was conducted of 7 alternative models. Of those models, 5 are defined in the universe of the 13 largest metropolitan areas, of which the survey is representative, and the remaining 2 employ a sample covering the urban and rural sectors. The first five models include three in which the only variable measuring the effect of the reform is defined on the basis of the definition by Gaviria (2004), G , Núñez (2004), N , and ours, $E&M$. Additionally, two models are presented, one of which includes the definition of treatment by $E&M$, that by N , and their interaction; and also another in which that by $E&M$ is included together with that by G , and their interaction. Even though the first three models record the separate effects of each one of the variables included, only those which continue to record the said effects in the following two models will have a final effect on the variable of interest.

The other two models present, in only one of them, the definition of treatment by $E&M$, and in the other, the three previous ones and the interactions of G with $E&M$, and of N with $E&M$.

Table 7. Impact of the reform according to different models and definitions of treatment group. Males

Men younger than 25 years

			Variables														
			Wages					Hours (structural form)					Hour (reduced form)				
			N	G	N, E&M	G, E&M	E&M	N	G	N, E&M	G, E&M	E&M	N	G	N, E&M	G, E&M	E&M
Models	Metropolitan area	N	0,14 **				-3,49					-1,96					
		G		-0,05				3,41 **					3,82 **				
		N, E&M	0,12		0,21		-0,23	-1,75		-5,55		1,14	3,59		-11,4 **		3,99
		G, E&M		-0,12		0,08	0,02		3,50 *		3,20	-5,90 *		4,24 **		2,44	-3,61
		E&M					0,04					-4,61 *					-2,42
	Urban - Rura	N, G, E&M	0,09	-0,06	0,29	-0,06	-0,24 *	-4,44	2,41	-6,57	6,18	0,85	3,62	3,61 **	-14,7 **	5,09	4,90 **
		E&M					0,04					-5,47 **					-2,42

Men older than 25 years

Models	Metropolitan area	N	-0,04				0,04 **					0,12					
		G		-0,00				0,39					0,38				
		N, E&M	-0,05		-0,12		0,18 **	-2,16		5,11 **		-2,71 *	-1,80		5,68 **		-3,66 **
		G, E&M		0,12 *		-0,19 **	0,08 *		-0,13		2,14	-1,10		-0,80		3,17 *	-1,57
		E&M					0,04					-0,62					-0,88
	Urban - Rura	N, G, E&M	-0,11	0,11 *	-0,01	-0,09	0,13 *	-1,48	-0,00	3,01	1,19	-1,19	-1,03	-0,57	3,16	1,65	-1,84
		E&M					0,04					0,14					-0,88

Men all ages

Models	Metropolitan area	N	-0,01				-0,21					-0,15					
		G		-0,10				1,04 *					1,05 *				
		N, E&M	-0,06		-0,03		0,11 **	-2,01		3,52 *		-2,22	-1,18		3,14		-2,58 *
		G, E&M		0,05		-0,12 *	0,07		0,73		2,08	-1,63 *		0,50		2,57 *	-1,85 *
		E&M					0,04					-0,93					-1,11
	Urban - Rura	N, G, E&M	-0,09	0,05	0,09	-0,07	0,05	-1,49	0,64	1,14	1,56	-0,64	-0,64	0,55	0,35	1,66	-0,70
		E&M					0,03					-0,32					-0,42

Table 8. Impact of the reform according to different models and definitions of treatment group. Females

		Women younger than 25 years																
		Variables																
		Wages					Hours (structural form)					Hour (reduced form)						
		N	G	N, E&M	G, E&M	E&M	N	G	N, E&M	G, E&M	E&M	N	G	N, E&M	G, E&M	E&M		
Models	Metropolitan area	N	0,13 **				3,88 *					1,99						
		G		0,00				1,69					1,59					
		N, E&M	0,18 *		-0,17		0,09	6,11 *		-4,11		0,25	4,35 *		-2,35		-0,80	
		G, E&M		-0,11		0,15	0,07		-0,05		-0,63	1,19		0,33		-1,20	1,11	
		E&M					0,09					1,00					0,81	
	Urban - Rura	N, G, E&M	0,12	-0,09	-0,11	0,13	0,08	7,86 **	0,65	-5,23	-1,90	0,24	5,48 **	0,60	-1,96	-1,68	-2,18	
		E&M					0,10					0,91					0,81	
		Women older than 25 years																
		Models	Metropolitan area	N	0,09 **				1,33 *					1,13 *				
				G		0,03				1,77 **					1,71 **			
N, E&M	0,09				-0,11		0,12	1,67		-0,29		-0,78	1,85		-0,50		-0,89	
G, E&M				0,06		-0,01	0,05		2,66 **		-3,55 **	0,44		2,55 **		-3,58 **	0,53	
E&M							0,05					-0,05					0,01	
Urban - Rura	N, G, E&M		0,05	0,07	-0,01	-0,04	0,05	1,31	2,60 **	0,81	-3,40 **	-1,31	1,52	2,44 **	0,44	-3,48 **	-1,17	
	E&M						0,04					-0,34					0,01	
	Women all ages																	
	Models		Metropolitan area	N	0,10 **				1,68 **					1,32 **				
				G		0,20				1,83 **					1,80 **			
N, E&M		0,10 *			-0,11		0,13 *	2,31 *		-0,94		-0,32	2,25 **		-0,82		-0,66	
G, E&M				0,02		0,02	0,06		2,47 **		-3,51 **	0,76		2,50 **		-3,66 **	0,83	
E&M							0,07 **					0,34					0,37	
Urban - Rura		N, G, E&M	0,04	0,03	-0,02	-0,01	0,58 **	2,28 *	2,45 **	0,18	-3,42 **	-1,10	1,99 *	2,33 **	0,46	-3,34 **	-1,50	
		E&M					0,06 **					0,04					-0,01	

* Significant 10% confidence level

** Significant 5% confidence level

The effect of the reform on weekly hours and hourly wages¹⁵

6.1 Males

6.1.1 Metropolitan areas

For males older than 25 we find that workers in N work 5.7 hours more per week, while those in the complement of N work 3.7 hours less due to the reform. The 3.7 reduction in hours of work for treated individuals in the complement of N , is observed simultaneously with an increase of 18% between 2001 and 2004 in their hourly wages.¹⁶ That is, for treated workers not in N , the reform reduced their hours of work and increased their hourly wages. Table 9 illustrates the relative changes in hourly wages between workers in N and in its complement, between 2001 and 2004.

Table 9. Change in relative wages of N and its complement between 2001 and 2004

		N	Complement of N	N /Complement of N
Treated/ Comparison	2004	0.631	0.677	1.073
	2001	0.595	0.538	0.905
2004/2001		1.061	1.258	1.186

Even though in all cases the treated earn lower wages than the comparison workers, their hourly wages increased relative to those of the comparison workers in both N and its complement, with a remarkable increase in the complement of N . The net unconditional increase in hourly wages of the treated relative to comparison workers was 6.1% in N and 25.8% in its complement. The increase in this ratio between workers in the complement of N and those in N was 18.6% between 2001 and 2004.

Clearly, this effect on hourly wages must have been driven by labor demand. Sectors in the complement of N include farming, mining, construction, transport and telecommunications, which grew between 2001 and 2004 about 3%, 4.4%, 12.2% and 4% respectively, in a period in which the economy grew around 3.3%.¹⁷ Since labor reform provides the same conditions to sector in and out of N , it seems difficult to argue that the better performance of the complement of N relative to N , was merely due to the reform. In addition, the comparability of these sets of sectors has another difficulty: there are not balanced by gender. As it is shown in table %%%, most of the employees in our sample, who work in sectors not in N , are males. This lack of balance is likely to produce biased results, in particular, when trying to estimate the impact of the reform for females.

¹⁵ The effect of the reform in the weekly hours is measure with the reduced form equation. That equation measures the net effect of the reform.

¹⁶ An employee could be in our definition and not in N , when he is treated and works in economic sectors like farming, mining, construction, transport and telecommunications, or when his tenure is higher than 10 years old regardless of its economic sector.

¹⁷ Industry in this period grew 3%, much closer to Colombian economy's rate.

	Núñez				Núñez complement			
	Service	Trade	Industry	Fin. I.*	Farming	Mine	Construction	T&T*
Male	35.1%	61.2%	61.2%	46.9%	86.9%	94.1%	89.8%	87.3%
Female	64.9%	38.8%	38.8%	53.1%	13.1%	5.9%	10.2%	12.7%

Fin. I.: Financial Institutions, T&T: Transport and Telecommunications.

Thus, in this case, one of the key assumptions of the differences in differences empirical strategy, namely, that interventions different to the labor reform, would affect similarly treatment and comparison group, might be violated.¹⁸

The model with definitions of G and $E\&M$ finds a negative effect of the reform on the hourly wages of treated employees working in industry and a weakly positive effect for those in the other sectors. The positive effect in the treated not in N is also a finding for the sample of all the males. According to the results, males in all sectors but industry had increases of up to 8% in hourly wages, while those in industry would have had a reduction of 11% in theirs, consistent with a much larger share of workers working continuously in the production of goods, and thus, affected in a larger proportion with the changes introduced in work schedule compensation between 6 p.m. and 10 p.m. This result emerges despite the weak increase in hourly wages in industry, what makes clearer the role of the reform in terms of affecting specifically the hourly wages of the treated relative to the comparison group. A weak positive effect on hour of work, 3.2 hours per week, is found for workers in industry.

Let us go back to the finding that workers in N work 5.7 hours more per week, while those in the complement of N work 3.7 hours less due to the reform. There are two effects that might be driving the 5.7 hours per week increase: on one side, there can be a set of employees who work during late hours, with work schedules in these sectors ending after 10:00 p.m., in which case, we know the income effect would induce them to work more hours while earning the same marginal wage, being this result consistent with the null effect found on hourly wages for this group. Nonetheless, such work schedule is unlikely to represent the median employee in sectors included in N . Also, we know that with the reduction in hourly wages from 6 to 10 p.m., employers would be willing to raise daily wage a positive amount and while still keeping a share of the savings. On the other hand, we know that it is in the interval from 6 to 10 p.m. in which firms would be willing to increase the relative number of extra hours due to the reform, thus the observed increase in hours might be driven by an increase in demand in sectors included in N relative to those in its complement. In this case, firms would offer higher hourly wages for the new extra hours, contributing this way to explain the null effect observed in hourly wages. Still, other forces might be at work to explain this increase in hours of work, and definitely, one such reason might have to do with the mentioned fact that sectors N and its complement would not be comparable.

For males under 25, the reform only has effects for the treated employees included in N , a large negative effect of 11 hours a week. This effect is consistent with the view according

¹⁸ This point must be borne in mind from now on when interpreting the inclusion of N in our models.

to which these individuals had dropped out, or reduced the intensity of their education activities during Colombian's economic crisis, in order to work; but by 2004, this process was reversed. Nonetheless, it is not clear why such effect would be only significant for young males in N but not in its complement. Notice that the effect of the reform on this specific subset of males was concealed in the estimation that included only $E\&M$ but not N . Here again, the caveats mentioned previously related to the comparability of sectors in N and its complement apply.

On the other hand, young male workers in industry increased their hours of work more than 4 hours, nonetheless, according to our treated definition, it is unlikely that such effect had been caused by the reform. No effect on wages due to the reform is observed for this group.

6.1.2 Urban and rural areas

In this sample, all significant effects of the reform are in the males younger than 25 years. The 3.6 additional hours per week in the industry is not a consequence of the reform but just a fixed effect of that sector. The reduction in hours per week for the treated employees in N found for the metropolitan areas remains. In this case though, this effect is for workers in N net of those in industry, and has a higher magnitude: 14.7 hours per week. The intuition presented for the metropolitan areas still applies in this case. For treated workers not in N (nor industry), we find a significant increase in hours of work, due to the reform, in 5 hours per week, and a sharp reduction of 24% in hourly wages, although only weakly significant.¹⁹ That is, our third case for the effects of the reform on labor supply: a net rent effect, consistent with the low significance of the effect in the hourly wages, and the increase in hours per week.

A note of caution applies here again in relation to the limitations of N to provide a useful set of sectors to identify the impact of the reform, mostly given the null effect of the reform found in the model that includes $E\&M$ unconditional on G or N .

6.2 Females

The reform does not have any significant effect on hourly wages nor hours per week, for females under 25. For females older than 25, the only effect of the reform was a reduction of 3.6 hours of work per week for the treated in industry, despite an increase of 2.6 hours of work per week registered in the sector. Effects in the hourly wages aren't significant. This case is consistent with a working day that finishes only a little time after 6 p.m. for these females. Then, the effect of the reform over the wages is not significant in average. Meanwhile, the reduction in the hours is unambiguous.

Females older than 25 years drive results of the sample of all females, over which we find the similar results.

In short, a conservative reading of the result allows us to conclude that labor reform implied a reduction of hourly wages of males older than 25 working in industry in metropolitan

¹⁹ Notice that in this case the complement of N would include rural areas.

areas, along with a weak increase in their hours of work per week; and a weak increase in the hourly wage of those working in the other sectors both in metropolitan areas, and the aggregate of the country. On the other hand, the reform reduced the hours of work per week of females older than 25 who work in industry both in metropolitan areas, and the aggregate of the country.

7. Conclusions

This study estimates the effect of labor reform contained in Law 789 of 2002, on hourly wages and hours of work of male and female workers. The analysis presents results for males and females, younger and older than 25, and for metropolitan areas and the whole Country. To identify the parameter of interest, we estimate difference in difference models. Despite we do not know the daily hours schedule of workers, we exploit a necessary condition for the intervention to affect them, from the regulation concerning the legal maximum working session that establishes that it does not cover workers who perform directive or managerial activities, or have a position of trust in the employer's organization. This definition, allow us to have treatment and control group in each economic sector, in contrast with previous approaches to this problem.

We find that wages of males older than 25 working in industry in metropolitan areas decreased more than 11% due to the reform, while females older than 25 working in industry in metropolitan areas reduced their hours of work per week in 3.6 hours. We also find an increase of up to 8% in hourly wages of males older than 25 not in industry working in metropolitan areas, and an increase in the hours of work of those in industry of up to 3.2 hours per week; although these result are not as robust. On the whole, even though the most reliable results we get would not be good news to male workers of industry, there are signals of increases in hourly wages for male workers of the other sectors of the economy that might bring good news in the short run. Thus, reform implied redistribution of labor income towards men older than 25 relative to women and younger men, along with reallocation of family labor supply.

It is important to highlight that even though the part of Law 789 that sought to make more flexible the daily and weekly work schedule, used the reduction in wages as its main instrument, our empirical evidence suggests that previous levels of wages would not have been binding by regulation in any economic sector but industry. Thus, employers seem to have responded with higher labor demand, for the hourly wages to have kept their previous levels. Overall, the reform would have had positive effects on all workers but those in industry.

Our results should be read with caution since it is still early to try to get what the definite impact of the reform has been so far and will be in the mean time. Better data would contribute substantially to get accurate and unbiased impacts of the reform. Information relative to current and past hours of work schedule is necessary to improve our estimates. The inclusion of a form containing the questions asked to distinguish formal from informal workers in the fourth quarter, would also help to get a better assessment of the reform, since it is during that quarter when firms would exploit more the advantages of the reform due to the positive seasonality in production.

In short, there is still the need to improve the estimates of current evaluations of the reform with better data, and it is important to wait more to observe the definite response from firms to the changes introduced by the reform. In light of such limitations, it is clear that having introduced in the law the need to analyze the results of the law just two years ahead, in order to introduce changes in it or propose its derogation, was highly inconvenient, and has introduced an unnecessary factor of uncertainty for both workers and employers. Hopefully, the Congress will wait longer before reversing the law, and avoid introducing this type of articles in the future.

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