The Effects of Changes in the Legal Work Shift on Wages and Hours Worked in Colombia[1]

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Abstract

We estimate the effect of an increase in the number of work hours, defined by law as daytime work hours, on hourly wages and hours of work. To identify the parameter of interest, we estimate difference-in-differences models. Although the data do not contain information on the work shift, we exploit the necessary conditions for the intervention to affect the work shift in order to define treatment and comparison groups. We find that wages of males older than 25 working in the manufacturing sector in Colombia's main metropolitan areas decreased by more than 11% due to the reform, while their female counterparts reduced their hours of work per week by 3.6 hours. There is (less robust) evidence of increases in hourly wages for male workers in the other sectors of the economy, suggesting that employers increased their demand for labor in those sectors. Overall, the reform appears to have had positive effects on all affected workers except those working in the manufacturing sector.

Resumen

Estimamos el efecto de un incremento en el número de horas que definen la jornada laboral diurna por ley, sobre los salarios por hora y las horas trabajadas. Para identificar el parámetro de interés, estimamos modelos de diferencias en diferencias. Aunque los datos no contienen información en cuanto al horario de las horas trabajadas, explotamos las condiciones necesarias para que la intervención tenga un efecto sobre el horario trabajado para poder definir los grupos de tratamiento y control. Encontramos que los salarios de hombres mayores de 25 años trabajando en la industria en las principales áreas metropolitanas de Colombia cayeron más de 11% debido a la reforma, mientras que sus contrapartes mujeres redujeron el número de horas trabajadas a la semana en 3.6 horas. Existe evidencia, aunque menos robusta, de incrementos en los salarios por hora de los trabajadores hombres en otros sectores de la economía, lo cual sugiere que los empleadores incrementaron su demanda por empleo en estos otros sectores. En general, la reforma parece haber tenido efectos positivos para todos los trabajadores afectados, con excepción de aquellos que trabajan en la industria.

Keywords: Labor Reform, Labor Market Regulation, Difference-in-Difference Models, Labor Supply, Labor Demand.
Palabras clave: Reforma laboral, Regulación del mercado laboral, Métodos de diferencias en diferencias, Oferta laboral, Demanda laboral.
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I. Introduction

In 2002, when Colombia was still experiencing the remnants of a deep labor market crisis caused by the worst economic downturn in six decades, the Colombian Congress passed Law 789, a reform to labor market regulation. The reform sought to promote active labor market policies and to make current labor regulation more flexible. The active labor market policies included incentives for the hiring of hard-to-employ workers, a reduction of firing costs, and the introduction of unemployment insurance and employment subsidies. The other part of the reform dealt with making labor regulation more flexible by increasing daytime working hours, reducing overtime pay for working on Sundays and national holidays, and allowing for the possibility of making the work shift more flexible. The law was approved with a constraint on its continuity: if it did not render positive results within two years, it could be modified or rescinded. Accordingly, formal evaluations of the law's effects on labor market performance are a necessary input for policy makers and the legislative branch of government.

This study estimates the effects on hourly wages and work hours of the part of the reform that dealt with the change in the number of daytime hours of work. The effects on male and female workers are estimated for workers both under and over 25 years of age. To identify the parameter of interest we apply the difference-in-differences method. We use household surveys (ECH) for years both before and after the reform (2001 versus 2004).

The scope of the reform can be quantified by estimating the aggregate savings employers would have if we assume that nothing but daytime work hours changed. The reform only affects employees working in the formal sector of the economy, representing only 33% of the total labor force.[4] Furthermore, only 53% of the formal sector work force would be affected by the reforms; the exceptions of the law exclude the remaining 47%. Finally, we assume that on average, workers affected by the reform worked at most one of their eight 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 collects annually for childcare via payroll taxes.[5]

We find that the hourly wages of males older than 25 working in the manufacturing sector in Colombia's thirteen main metropolitan areas decreased by more than 11% due to the reform, while for their female counterparts, the effect was a reduction of 3.6 hours in their number of hours worked per week. We also find an increase of up to 8% in the hourly wages of males over 25 not working in the manufacturing sector of the thirteen main metropolitan areas, and an increase in

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4 Authors' calculations based on Colombian Continuous Household Survey, ECH, 2004. In addition to the characteristics used by the Administrative Department of National Statistics of Colombia -DANE- to classify workers as in the formal sector -namely working in a firm with more than 10 employees, having a university degree if self-employed, or not being a household servant- we require that workers have a contract in order to be characterized as being in the formal sector.

5 These resources are administered by the *Colombian Family Welfare Institute*, ICBF.

Table 1
WORKERS AND WAGES FOR MEASURING THE EFFECTS OF THE REFORM
(In 2004 Colombian pesos)

	Number of workers	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%	

Source: Authors' calculations based on ECH 2004, DANE.

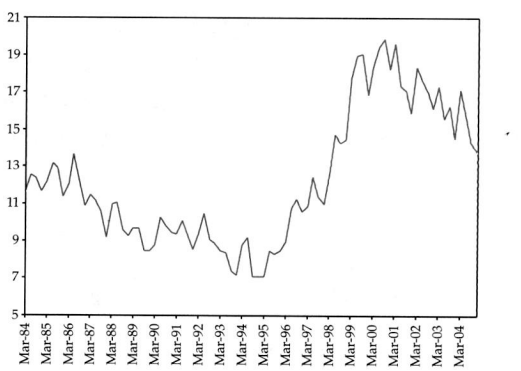
the hours worked by those in the manufacturing sector of up to 3.2 hours per week; however, these last results are not as robust. On the whole, even though the most reliable results we get do not bear good news for male manufacturing workers, there are signs of increases in the hourly wages for male workers working in non-manufacturing sectors of the economy, bringing some good news, at least in the short run, *i.e.*, in the two years following the reform.

Seven sections compose this study. The first is this introduction. The second presents the labor market situation after the economic crisis, which motivated the reform. The third section explains in detail the part of the labor reform analyzed in this study, *i.e.*, that which dealt with making labor regulation more flexible. The fourth section discuses the theoretical implications of the reform based on standard labor supply and demand models, while the fifth explains the methodological aspects of the study, including details about the empirical inputs and methods. The results of the estimations and a briefing on them are in the sixth section. The seventh section summarizes and concludes, including recommendations for further research.

II. Labor Market Context Prior to the Reform

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

Figure 1
EVOLUTION OF UNEMPLOYMENT RATE



Source: DANE .

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 economic history, when a -4.5% slump in GDP was observed. A crisis of such magnitude prompted deep adjustments in the labor market, as it caused inflation to fall way below expectations, resulting in a considerable increase in real wages which called for adjustments in the number of employees. Thus, an announced crisis in the labor market deepened even further. In the year 2000, unemployment broke the 19% barrier for several periods. The most vulnerable groups were the youngest and unskilled workers, who absorbed a large share of the crisis and endured unemployment rates rising well beyond 20%.

After 2000, despite the fact that the economic crisis was overcome, job creation did not react to the same degree. An explanation for this was found in the rigidities of nominal salaries and, in general, in the structure of the Colombian labor market. Thus, a bill reforming the labor market was proposed, with its basic objectives being those of providing flexibility to the labor market and promoting special social protection programs that could reach vulnerable populations, with the aim of offsetting the differential impact that these populations had endured during the slump in employment.

III. Changes Introduced by the Reform

Given that the Colombian labor market failed to take off in a satisfactory manner after the crisis, the Government sought to boost growth in employment by promoting active labor market policies and making the current labor regulation more flexible via Law 789 of 2002. The promotion of active labor market policies was directed towards boosting job training programs and making them more flexible, promoting microcredit, offering incentives for the hiring of hard-to-employ workers, lowering firing costs, and finally, establishing unemployment insurance and employment subsidies. Since these policies were intended to target vulnerable populations, they have been referred to as the social protection component of the reform. President Uribe's 2002-2006 National Development Plan estimated that these particular policies would generate about 390,916 jobs between 2003 and 2006.[6]

Preliminary results of the social protection component of the reform have been analyzed by the National Government, unions, the manufacturing sector, and academics.[7] Regretfully, little, if any, consensus resulted from these studies. Clearly, given their interests, entrepreneurs and the current government[8] 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.

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6 Departamento Nacional de Planeación (2003).

7 For examples of the different perspectives, see: Government view: Ministry of Social Protection (2005); unions and industry view: ANDI (2004); and academic view: Ferné (2004), Gaviria (2005) and López *et al.* (2005).

8 The current president, Álvaro Uribe, has held office since 2002. He was re-elected for a second four-year term in 2006.

However, inferences of the reform's effects do not converge even in the Government's conclusions. Unions, on their part, demand that several points of Law 789 be reversed, claiming that it has not had any positive effect on employment, and that in fact, it has reduced employee's wages. As for academics, they find mixed results deriving from the Law.

There are more expectations than actual results for some of the reform's programs, since their implementation has not been granted enough time to prove their worth. This is the case for unemployment insurance and employment subsidies.[9]

The other part of the reform, which deals with making regulation more flexible, was expected to generate 95,147 jobs between 2003 and 2006 (according to the 2002-2006 National Development Plan). The main components of this second part are illustrated in Table 2.

From the aforementioned, significant reductions are expected in incomes of employees whose work shifts lie within the time spans considered by the law; *i.e.*, employees whose work shifts 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 and national holidays. Unsurprisingly, the impact is not the same for incomes of those having work shifts with hours that lie between 6:00 p.m. and 10:00 p.m., nor for those having Sunday and holiday working hours with extra payment. Changes in overtime payments implied by Law 789 are shown in Table 3.

Before the law came into practice, when standard hours included an interval between 6:00 p.m. and 10:00 p.m., workers were paid the night premium, $W_N = 1.35W$, where W is equal to the daytime standard wage. When these hours were not standard but extra, they were paid the night overtime premium: $W_{EN} = 1.75W$. After the law, these figures became W and $W_E = 1.25W$, respectively. That is, the 6:00 p.m. to 10:00 p.m. night hours now become standard hours, and overtime night hours become just regular overtime hours. Hours worked on Sundays or holidays receive differential treatment; the reform introduced a direct reduction in the premium. However, the reform did not modify restrictions regarding the standard work shift: currently, workers are still not permitted by law to work more than eight standard hours and two overtime hours per day, six days per week.

Some effects of the reform are more difficult to determine, as is the case of those deriving from the possibility of a flexible work shift -in fact, the inclusion of phrase (d) in the law, under numeral 3 of article 161 of the Labor Code *(Código Sustantivo del Trabajo)*, determines that, under certain circumstances that are not difficult to meet, there can be a 48-hour weekly work shift 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 finds some favorable effects of the reform on the duration of unemployment.

[9] See Gaviria (2005).

Table 2

MAIN CHANGES INTRODUCED TO THE WORK SHIFT BY LAW 789/2002

	Article 160. Definition of day and nighttime 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. Overtime payment for Sunday and holiday labor	
	Article 26, Law 789/2002	**Original text**
Overtime payment for Sunday and holiday labor	75% of daytime hourly wage	100% of daytime hourly wage
Additional payment when Sunday/holidays are not included in the weekly work shift	None	None
Exceptions	When agreed standard working hours are up to 36 hours per week	When agreed standard working hours are up to 36 hours per week
	Article 161. Daily and weekly standard working hours	
	Article 51, Law 789/2002	**Original Text**
Weekly standard hours for workers under 18 and over 15	Up to 8 hours/day and 48 hours/week	Up to 8 hours/day and 48 hours/week
Flexibility of daily and weekly work shift	Employer and employee can temporally or permanently agree on an uninterrupted work shift as long as the employee works up to 6 hours per day and 36 hours a week*.	Same as in Law 789/2002, but restricted to new firms or new activities
	Employer and employee can agree on a daily work shift 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. work shift.	

* "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 days worked weekly.

Table 3

CHANGES INTRODUCED TO THE WORK SHIFT BY THE REFORM LAW 789/2002

		Overtime premium	
Type of hours	**Considered hours**	**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	Sundays or holidays	2.00 W	1.75 W
Overtime			

W_N: Night hourly wage, W_{EN}: Night overtime hourly wage, W_E: Overtime hourly wage.

IV. 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.

A. Labor Supply

The effects on the labor supply that could result 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 maximizing his utility function: $U(C, L)$, while being subject to a budget constraint: $C \leq W(24 - L) + F$, where 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 the agent's 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.

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

Changes in wage rates generally have an ambiguous effect on the supply of labor hours given both income and substitution effects. Thus, the α coefficient represents the resulting net effect.

Next, the agent's response is defined in light of the different possibilities deriving from the changes introduced by the labor reform. Specifically, we present different cases in terms of their implications upon the agent's budget constraints, as well as the expected response. For this purpose, we define the notation to be employed in terms of wage rates as follows:

- W = daytime standard hourly wage
- W_E = 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 the legislation in force before the reform. This 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 work shift cannot exceed the 8-hour-a-day and 48-hour-a-week limits, and that overtime working hours cannot exceed 2 hours a day and 12 hours a week.

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

Case 2: Work shift 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: Work shift 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 in Figures 2 through 4. 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 equation (1) is taken as the basis, and in all estimations performed the coefficient of interest is positive. In this sense, in general, it will be assumed that 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 work shift does not include hours within the interval that is subject to consideration by the reform and, therefore, there is no alteration in the agent's budget constraint. Consequently, with preferences given as fixed, there will be no alteration whatsoever in the supply of work. In other words, $H^* = H^{*\prime}$.

Case 2: Reduction in hours of work: In this case, two situations are possible. In both, it is assumed that the worker maximizes his utility by working within the interval from 6:00 p.m. to 10:00 p.m. In the first situation, however, these are standard working hours,

Figure 2

CASE 1: NO EFFECT ON LABOR SUPPLY

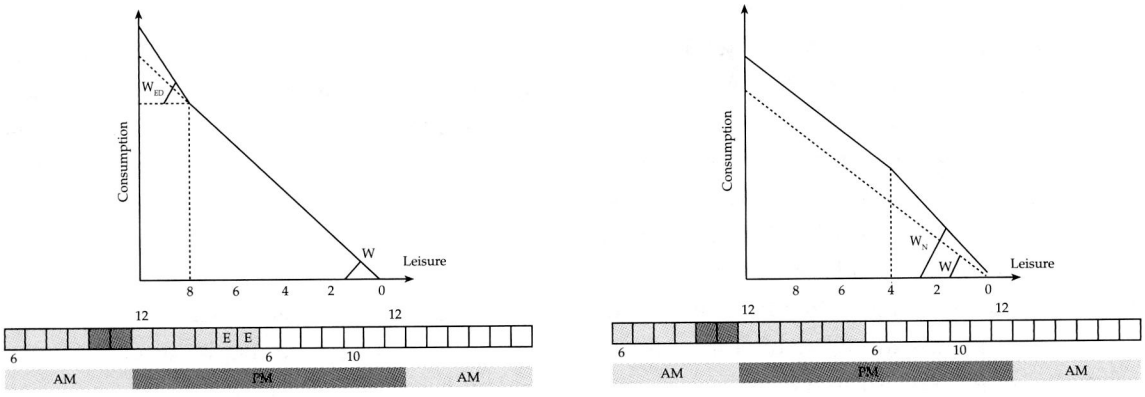
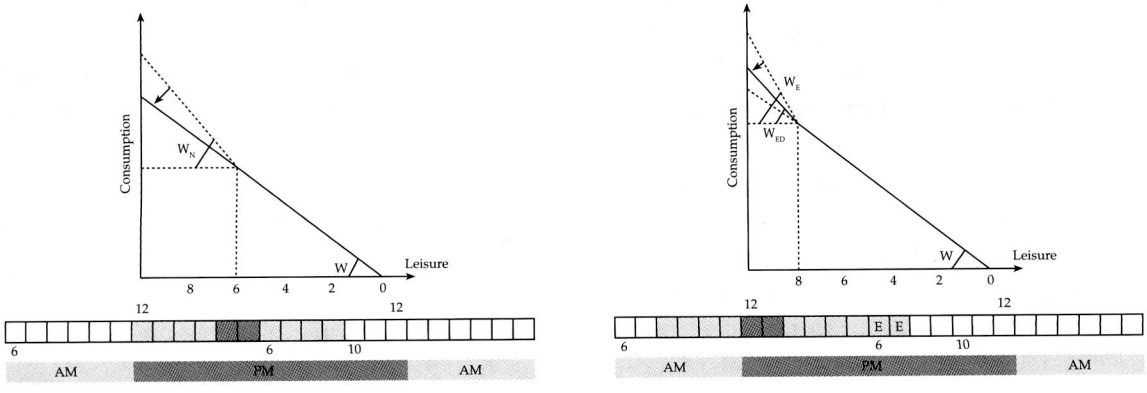


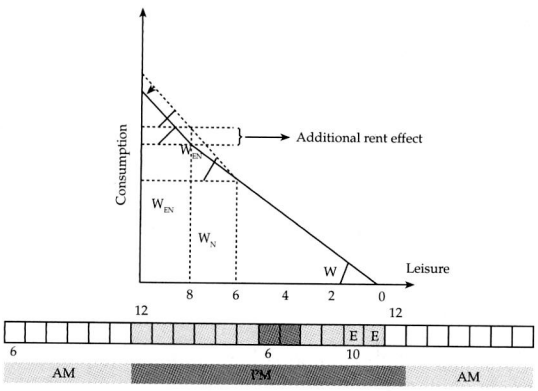
Figure 3

CASE 2: REDUCTION IN HOURS OF WORK



whereas in the second, these are overtime hours. In both cases there is an hourly wage reduction, and thus, on the basis of our assumptions, working hours would be unambiguously reduced.

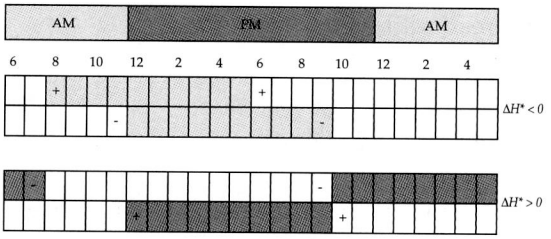
Figure 4
CASE 3: INCREASE IN HOURS OF WORK



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

In summary, in intervals including intersections with the 6:00 p.m. to 10:00 p.m. shift, there is an effect on the number of hours worked, as illustrated in Figure 5.

Figure 5
CHARACTIRIZATION OF WORKING HOURS AFFECTED BY THE REFORM



B. Labor Demand

In order to illustrate the effects of the reform on labor demand, the standard firm's profit maximization approach is used.[10] In this case, employers evaluate the opportunity cost of hiring new workers against contracting additional hours from current employees. That is, firms maximize

$$p = g(h, N, K) - whN - fN - pw(h - h_{6\text{-}10}) \quad (2)$$
$$N - rK; \quad \forall h \geq h_{6\text{-}10}$$
$$= g(h, N, K) - whN - fN - rK; \quad \forall h < h_{6\text{-}10})$$

Where h are the total hours, $h_{6\text{-}10}$ are the hours of work that take place 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, K is capital, and p is the premium per hours worked between 6:00 p.m. and 10:00 p.m.[11] The marginal cost of an additional worker per h^* hours is:

[10] See Hamermesh (1993).

[11] If hours of work are within standard working hours, then the premium before the reform was equivalent to the nighttime premium (W_N); after the reform, there would be no premium (W). If the hours of work were overtime hours, then the premium before the reform was equivalent to the nighttime overtime premium (W_{EN}); after the reform, it would solely be the premium for overtime hours (W_E).

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

And the marginal cost of h^* hours worked by an already-hired worker is

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

If the ratio between the marginal cost of a new employee and that of the extra hours of a person already hired is modified by means of the reform, a change takes place in the optimal ratio of employees working overtime hours. The same occurs if the ratio between the marginal cost of a new employee working on a daytime shift and that of a current employee working overtime changes. Table 4 illustrates this change in the marginal costs ratio through a quantitative exercise that helps to exemplify the employers' decision-making model.

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 for the current staff in relation to that of the newly hired employees falls 4.6%.[12] It can be deduced from this that employers have incentives for contracting more overtime hours, in detriment of the hiring of new employees.[13] On the other hand, the reduction in the marginal cost due to the lower cost of hours between 6:00 p.m. and 10:00 p.m. would increase the number of hired workers. The total effect on employment is thus ambiguous.

V. Methodology

This section describes the data available for estimating the effects, and the way in which these effects will be identified. The starting point is the empirical method to be used; subsequently, the

Table 4

CHANGE IN RELATIVE COSTS DUE TO THE REFORM*

	Before the reform	After the reform
	Current worker	
Overtime hours (h (hs)	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 < hs)	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	$W_{EN}/W_N = 1.296$	$W_E/W = 1.250$

* For simplicity, we assume that $f = 0$.

12 This is the result of 1.296-1.250.

13 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, due to the reform, the marginal cost of an extra employee would increase relative to the marginal cost of an extra hour of work.

data are described, and finally, the treated and comparison groups are defined, exhibiting both their advantages and limitations in relation to definitions used by other researchers.

A. Data

Empirical exercises herein make use of data from the Continuous Household Survey -hereafter referred to by its Spanish acronym, ECH- conducted by the national statistics department -DANE-. The objective of the said survey is to monitor the performance of the Colombian labor market on a quarterly basis throughout the years. The ECH allows us to make representative inferences about Colombia's thirteen main metropolitan areas, as well as both urban and rural areas. In particular, we use the data available for the second quarter of the years 2001 through 2004. The second quarters are used since they include variables related to informality. Specifically, they contain information regarding workers' affiliations to the pension system and health insurance, as well as the size of the firms where workers are employed, among others. Additionally, the contains information relating to the firm's economic sector (manufacturing, retail, services, etc.), the worker's occupation (employee, factory worker, independent, etc.) and the worker's occupational ranking (professional, technician, etc.).

B. The Empirical Model

In order to capture the effect that the reform had on the population that it took into consideration, the difference-in-differences[14] technique is used. The parameter of interest to be estimated is the impact of the treatment on the treated *(TT)*. The spirit of the difference-in-differences method is to estimate the difference existing between the group that received the intervention -*i.e.*, the treated group- and a group that has not been affected by it -*i.e.*, a comparison or control group. The comparison group should be as similar to the treatment group as possible; under ideal conditions, the only difference between the two groups should be the treatment received. The difference between the treated and comparison groups in the variable of interest is estimated both before and after the reform -*i.e.*, before and after the treatment is received-. The difference between these two differences is considered to be the impact of the treatment on the treated *(TT)*.

Such methodology employs the interaction between the variable that identifies the treated individual and the variable that identifies if, at the moment of taking the sample, the intervention was in effect or not. In our case, the intervention is the labor reform.

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

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

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

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

Even though it is possible to identify the parameter of interest under the methodology's assumptions, the latter have some limitations. On the one hand, the assumption that the existing difference between the treatment and comparison groups before the reform are maintained thereafter implies that any change in this difference determined by reasons other than the reform would be wrongly attributed to the reform by the model.[15] Another limitation to the model would be the endogenous nature of the treatment group, to which we refer below when defining the adopted treatment group.

Based on the aforementioned, the importance of making an adequate selection of the treated and comparison groups stands clear in order to obtain a consistent and unbiased estimate of the effects of the reform.

C. Definition of the Treatment and Comparison Groups

As mentioned above, a worker that was treated by the reform is one whose work shift comprised the hours between 6:00 p.m. and 10:00 p.m., worked on Sundays or holidays, or had a fixed hourly work shift before the reform and thereafter shifted to having flexible working hours. Also treated are those that were jobless or not economically active before the reform and thereafter altered their labor-related decisions in response to the reform.

The data available do not allow us to determine which unemployed or inactive persons were susceptible to treatment by the reform. Nor do the data allow us to perfectly identify the workers who were treated by the reform, since the survey does not include questions related to working hours.[16] The difficulty in achieving an adequate assessment of the reform's impact lies in this restriction. Although 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 in order for individuals to belong to each of these groups.

The current legislation allows us to establish a necessary condition that becomes a good approximation for the definition of the treated group. In particular, 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 work shift does not cover workers who perform directive or managerial

[15] If it were possible to conduct 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 phenomena not related to the reform affected them (in our case, they might include: change in government -internal security 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 difference in time of the non-treated region- and thus obtain the parameter of interest. Changes in the minimum wage are among the interventions that might differentially affect treatment and control groups; nonetheless, changes in its level were small during the three years previous to the reform.

[16] Specifically, the survey contains questions related to the number of hours worked per week, but no questions regarding the times and days of the week during which those hours are worked.

activities, or who have a position of trust in the employer's organization. Additionally, the legal work shift can be enforced exclusively within the formal sector of the economy. Based on the aforementioned, our treatment group will be defined as all formal sector employees working in jobs covered by the regulation regarding the maximum work shift. Even though this definition includes some individuals who were not necessarily treated by the reform within the treated group, we do know that anyone who did receive treatment belongs to the said group. Along these lines, belonging to the treated group constitutes a necessary, though not sufficient condition, for receiving treatment.

As mentioned earlier, the Colombian labor reform had nationwide coverage. Thus, it is not possible to find people employed in the formal sector performing in working posts covered by the regulation regarding the maximum work shift length, and yet not being simultaneously susceptible to receiving treatment from 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 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.

We define the comparison group as that comprised of individuals belonging to the formal sector who occupy working posts that are not affected by the change in the number of daytime working hours as defined by Law 789. The reason for this is that interventions affecting the treated group would more likely have a similar impact on this group than on that consisting of workers employed in the informal sector, which displays an entirely different functionality than that of the formal one.

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

The definition of formality is a subject of ongoing controversy, both nationally 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.[17]

In summary, our treatment and control groups are defined as such:

- *Treated*: employees or workers in a large firm who are affiliated to healthcare and pensions, who are not performing in a directive or managerial post and who do *not* have a position of trust within the organization.

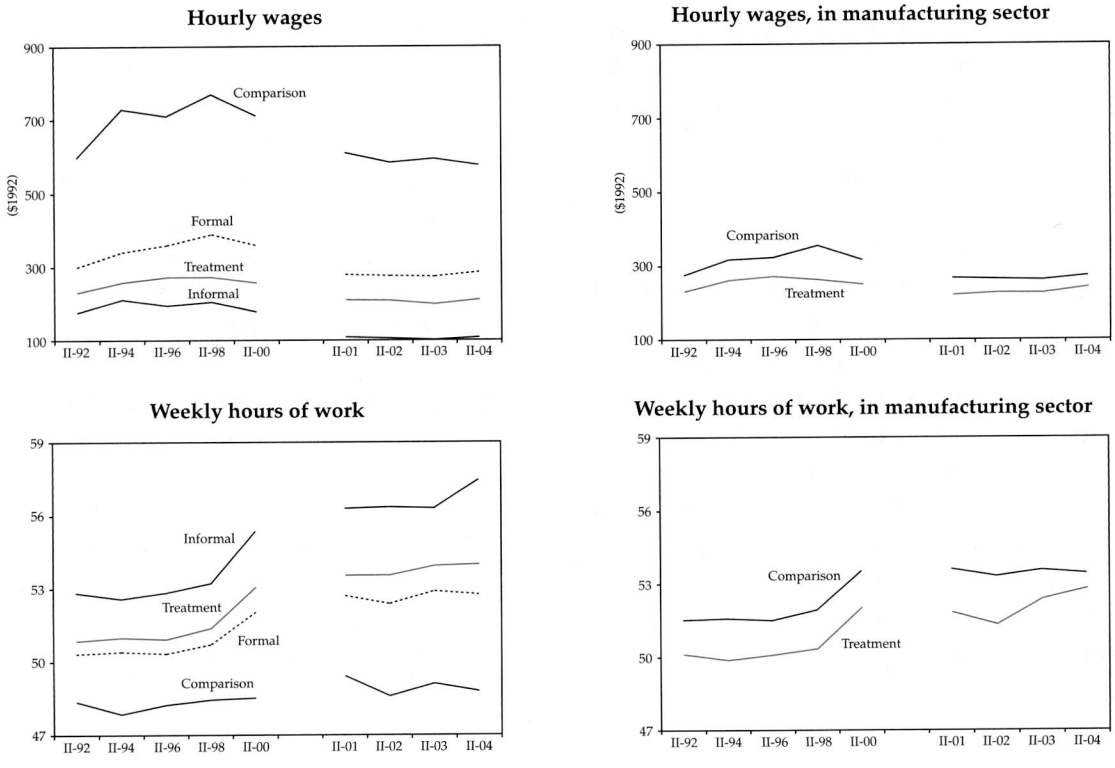
[17] The incorporation of conditions additional to this one, such as having a work contract and working inside the firm's facilities, do not significantly alter the definitions of the treated or comparison groups.

- *Comparison*: employees or workers in a large firm who are affiliated to healthcare and pensions, who are performing in a directive or managerial post or who have a position of trust within the organization.

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

Perhaps the most relevant information that can be extracted 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 for the treated group relative to the comparison group, which might

Figure 6
HOURLY WAGES AND WEEKLY HOURS OF WORK BY TYPE OF WORKER



Source: Authors' calculations.

lead to an overestimation of reform's effect 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 or not to belong to the treatment group, 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 a decision would depend relatively more on many other variables than just those determined by the labor reform under study. On the other hand, we can empirically show that individuals remain either in the treated or comparison groups in a very stable way. A transition matrix between the treated and comparison groups, shown in Table 5, is computed with the retrospective information about the past jobs.

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 to be in that group is 80%. Therefore, the flow of people between the treated and comparison group is actually relatively small.

Table 5

TRANSITION MATRIX*

	Current classification		
	Comparison	**Treated**	**Total**
Previous Classification			
Comparison	643,616 80.28 63.51	158,136 19.72 7.882	801,752 100 6.54
Treated	369,868 16.67 36.49	1,849,260 83.33 92.12	2,219,128 100 73.46
Total	1,013,484 33.55 100	2,007,396 66.45 100	3,020,880 100 100

* Includes workers in 2004 with up to 2 years of tenure.
Source: Authors' calculations.

D. Comparison with other Definitions

Two studies precede ours in the attempt to assess the 2002 labor reform. First, in order to determine the impact of the reform on the degree of work formality, Gaviria (2005) defines his treatment group as one made up of individuals working in manufacturing firms. In order to determine the law's effect on employment, he defines his treatment group as individuals working in larger-sized firms. According to his line of reasoning, it is within these categories that individuals who are susceptible to being treated by the law can be found. His comparison group is the complement of the treated group.

Secondly, Núñez (2004) conducts exercises seeking to determine the impact of the reform on the duration of employment and unemployment. From these, only the first exercise, in which he uses the same definition of the formal sector as ours, would be somehow comparable to our exercise. In order to define the treatment group, he selects individuals within the formal sector who work in the fields of services, commerce, manufacturing and financial institutions. Additionally, given that his study focuses on job duration, he only takes those employees with less than 10 years of service. His comparison group includes the complement of the formal sector, including workers in agriculture, mining, construction, and transport and telecommunications.

In summary, both studies base their treatment and comparison groups on the economic

activity sectors in which the employed persons work. In this sense, our definitions of treatment and comparison groups coincide only partially with those of the other two papers. 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; as for our comparison group, only certain workers who meet the necessary criteria would belong to the treated group. Any of the two definitions used by the other researchers excludes those individuals who are effectively treated by the reform from its treatment group, and includes in its comparison group individuals that the reform effectively considers.

E. 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; 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 baseline, *i.e.*, the year in which the reform was not in effect and that is therefore used for comparing to the presence of the reform in action, should be either 2001, 2002, or both. Among the two 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. Table 6 shows some evidence of the poor performance of the Colombian labor market in 2002, in relation to 2001. Therefore, 2001 is selected as the baseline year.

F. Demographic Groups Studied

Remaining to be determined are the population groups which would allow to better distinguish the reform's effects from other contemporary effects. Gender is already a standard population criteria. Additionally, it is important to differentiate the possible effect that the labor reform may have had on people who have completed their academic formation versus those who have not, since the former is subject to other interventions that the labor reform incorporates. Consequently, within both sexes, individuals under and over 25 years of age are analyzed separately.

G. 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

Table 6

EVOLUTION OF KEY INDICATORS OF THE 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 working conditions, i.e, those who consider they deserve a higher wage, and that their credentials do not match their current job.
Source: DANE.

step in this process is the approximation used by Mroz (1987). That is, using a model of labor force participation, the equations of hourly wages and hours worked are corrected according to selection bias. The hours equation is estimated in both its structural form (including the hourly wage as the explanatory 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, his socioeconomic environment, and several interactions and transformations upon them. In the structural hours equation, we correct for the endogenous nature of hourly wages. Understandably, the equations of wages 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 each of the thirteen main metropolitan areas (in the case of the sample that only considers these) or the urban and rural sectors, in the case of the sample that considers both sectors.

- *Household demographic variables*: These are variables describing the demographic composition of the household, including the presence of children, adolescents, elderly or handicapped family members.

- *Household socioeconomic variables*: By means of these variables, we intend to capture some of the essence of the individual's socioeconomic environment. Prevailing variables include those of incomes 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 other members of household.

- *Individual variables*: These include variables describing the observed individual that are of common usage in the literature, such as sex, ranges of education, experience (linear and squared), and non-salary income, among others.

VI. Results

We ran seven alternative models in order to verify the robustness of the results from the different specifications of equation *(5)*. Of these models, five are defined in the universe of the main thirteen metropolitan areas, of which the survey is representative, and the remaining two 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 (2005) -*G*-, Núñez (2005) -*N*-, and ours, -*E&M*-. Additionally, two models are presented, one of which includes the definition of treatment used by *E&M*, that by *N*, and their interaction; in the other definition, *E&M* is included together with that by *G*, and their interaction. Even though the first three models show the separate effects of each one of the variables included, only those which continue to show the said effects in the following two models will have a final effect on the variable of interest.

A sixth model presents the treatment definition used by *E&M*, while the seventh model presents the three previous definitions 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

	Variables													
	Wages					Hours (structural form)					Hour (reduced form)				
Models	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
Men younger than 25 years															
Metopolitan 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 - Rural															
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															
Metopolitan 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 - Rural															
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															
Metopolitan 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 - Rural															
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

* Significant 10% confidence level.

** Significant 5% confidence level.

Source: Authors' calculations.

Table 8

IMPACT OF THE REFORM ACCORDING TO DIFFERENT MODELS AND DEFINITIONS OF TREATMENT GROUP. FEMALES

	Variables													
	Wages					Hours (structural form)					Hour (reduced form)				
Models	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
Men younger than 25 years															
Metopolitan 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 - Rural															
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
Men older than 25 years															
Metopolitan 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 - Rural															
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
Men all ages															
Metopolitan 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 - Rural															
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.

Source: Authors' calculations.

VII. The Effect of the Reform on Weekly Hours and Hourly Wages[18]

A. Males

1. *Metropolitan Areas*

For males older than 25 we find that workers in *N* work 5.7 more hours per week due to the reform, while those in the complement of *N* work 3.7 less hours. The 3.7 reduction in hours of work for treated individuals in the complement of *N* is simultaneously observed with an increase of 18% in their hourly wages between 2001 and 2004.[19] 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 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

Source: Authors' claculations.

Despite the fact that, 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 agriculture, mining, construction, and transport and telecommunications, which grew about 3.0%, 4.4%, 12.2% and 4.0%, respectively, between 2001 and 2004, in a period in which the economy grew around 3.3%.[20] Since labor reform provides the same conditions to sectors both within and outside 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 the sectors included in Núñez and its complement has another difficulty: they are not balanced by gender. As shown in Table 10, 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 esti-

[18] The effect of the reform on weekly hours is measured with the reduced form equation. That equation measures the net effect of the reform.

[19] An employee could be in our definition and not in *N*, when he is treated and works in economic sectors such as agriculture, mining, construction, transport and telecommunications, or when his tenure is over 10 years, regardless of the economic sector.

[20] The manufacturing sector grew 3% during this period, much closer to the Colombian economy's rate.

Table 10

GENDER COMPOSITION OF SECTORS INCLUDED IN NÚÑEZ AND ITS COMPLEMENT

	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.
Source: Authors' calculations.

mate the impact of the reform for females. Thus, in this case, one of the key assumptions of the difference-in-differences technique, namely that interventions other than the labor reform would similarly affect the treatment and comparison groups, might be violated.[21]

The model with definitions of *G* and *E&M* exhibits a negative effect of the reform on the hourly wages of treated employees working in the manufacturing sector and a weakly positive effect for those in the other sectors. A positive effect on the treated not in *N* is also found for the sample of all the males. According to the results, males in all sectors but the manufacturing sector experienced increases of up to 8% in their hourly wages, while those in manufacturing had a reduction of 11%; the latter is consistent with a much larger share of workers working continuously in the production of goods, and thus, affected by the changes introduced in the work shift compensation between 6:00 p.m. and 10:00 p.m. in a larger proportion. This result emerges despite the weak increase in hourly wages in the manufacturing sector, clarifying the role of the reform in terms of specifically affecting the hourly wages of the treated group relative to the comparison group. A weak positive effect on hours of work, 3.2 hours per week, is found for workers in manufacturing.

Now we return 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 the one hand, there can be a set of employees in these sectors who work during late hours with work shifts 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. This result is consistent with the null effect found on hourly wages for this group. Nonetheless, such a work shift is unlikely to represent the median employee in sectors included in *N*. Also, we know that with the reduction in hourly wages from 6:00 p.m. to 10:00 p.m., employers may be willing to raise daily wages, while still keeping a share of the savings. On the other hand, we know that it is in the interval from 6:00 p.m. to 10:00 p.m. in which firms would be willing to increase the relative

[21] This point must be borne in mind from now on when interpreting the inclusion of *N* in our models.

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, thus explaining the null effect observed on hourly wages. Still, other forces might be at work in explaining this increase in hours of work, including the mentioned fact that sectors N and its complement may 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 fact that many of these individuals ceased to attend school or reduced the intensity of their educational activities during Colombia's economic crisis in order to work, but reversed this process by 2004. Nonetheless, it is not clear why such an effect would only be significant for young males in *N* and not in its complement. Notice that the effect of the reform on this specific subset of males disappears in the estimation that included only *E&M* but not *N*. Once again, the caveats previously mentioned related to the comparability of sectors in *N* and its complement apply.

On the other hand, young male workers in manufacturing increased their hours of work by more than four hours. Nonetheless, according to our treated definition, manufacturing is just an economic sector, not our treatment indicator. In other words, the effect should not be attributed to the reform. Once controlling for all socioeconomic covariates and economic sectors, no effect on wages due to the reform is observed for this group.[22]

2. *Urban and rural areas*

In this sample, all significant effects of the reform are found in males under 25. The 3.6 additional hours per week in the manufacturing sector is not a consequence of the reform but rather a fixed effect of that sector. The reduction in hours per week for the treated employees in *N* found for the thirteen main metropolitan areas remains. In this case, however, this effect is for workers in *N* net of those in manufacturing, 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 manufacturing), we find a significant increase in hours of work due to the reformof 5 hours per week, and a sharp reduction of 24% in hourly wages, although only weakly significant.[23] That is, our third case for the effects of the reform on labor supply shows a net income effect, consistent with the low significance of the effect on hourly wages, and the increase in hours per week.

A note of caution applies once again in relation to the limitations of *N* in providing 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*.

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22 In addition, we must bear in mind that the control group for youth is small, thus limiting the power of our inferences.

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

B. 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 group working in manufacturing, despite an increase of 2.6 hours of work per week registered in the sector. Effects on hourly wages are not significant. This case is consistent with a working day that ends only shortly after 6:00 p.m. for these females. Then, the effect of the reform over wages is not significant on average.

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

In short, a conservative reading of the results allows us to conclude that the labor reform implied a reduction of hourly wages for males older than 25 working in manufacturing in metropolitan 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 other sectors, both in metropolitan areas and the aggregate of the country. On the other hand, the reform reduced hours of work per week for females older than 25 who work in manufacturing both in metropolitan areas and the aggregate of the country.

VIII. Conclusions

This study estimates the effects of labor reform on hourly wages and hours of work contained in Law 789 of 2002. The analysis presents results for males and females, both younger and older than 25, and for the country's thirteen main metropolitan areas and the country as a whole. To identify the parameter of interest, we estimate difference-in-differences models. Despite the fact that the available data do not allow us to know the daily shift of workers, we exploit a necessary condition for the intervention to affect them: the regulation concerning the legal maximum work shift 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 allows us to define treatment and control groups for each economic sector, in contrast with previous approaches to this problem.

We find that wages of males older than 25 working in the manufacturing sector in metropolitan areas fell more than 11% due to the reform, while their female counterparts 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 working in metropolitan areas but not in the manufacturing sector, and an increase in the hours of work of those in the manufacturing sector of up to 3.2 hours per week; the latter results are not as robust, however. On the whole, even though the most reliable results we get would not be good news to male workers in manufacturing, there are signals of increases in hourly wages for male workers working in non-manufacturing sectors of the economy, bearing good news in the short run. Thus, the reform implied redistribution of labor income towards men older than 25 relative to women and younger men, along with a reallocation of household labor supply.

It is important to highlight that even though the part of Law 789 that sought to make the daily and weekly work shift more flexible 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 manufacturing. Thus, for the hourly wages to keep their previous levels, employers would have had to respond with higher labor demand. Overall, the reform would have had positive effects on all workers but those in the manufacturing sector.

Our results should be read with caution, since it is still too early to try to estimate the definitive impact of the reform. Better data would contribute substantially to getting more accurate and unbiased impacts of the reform. Information related to current and past work shifts is necessary to improve our estimates. The inclusion of questions during the fourth quarter of year in the T that allow researchers to distinguish formal from informal workers would also help to get a better assessment of the reform, since it is during this quarter when firms are most likely exploit 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 let more time pass by in order to observe the definite response from firms to changes introduced by the reform. In light of such limitations, it is clear that having included as part of the law the need to analyze its results just two years into its implementation in order to make changes to it or propose its derogation was highly inconvenient, and has introduced an unnecessary factor of uncertainty for both workers and employers. Hopefully, Congress will wait for more robust evidence before reversing the law, and avoid introducing this type of articles in future laws.

References

ANDI (2004), "Crecimiento y competitividad: Factores claves para la solución del desempleo en Colombia", mimeo.

Costa, D. L. (2000), "Hours of Work and the Fair Labor Standards Act: A Study of Retail and Wholesale Trade, 1938-1950", *Industrial and Labor relations Review*, Vol. 53, No. 4.

Departamento Nacional de Planeación (2003), "Plan Nacional de Desarrollo 2002-2006: Hacia un Estado Comunitario", Bogotá, Colombia.

Díaz, C. J. (2005), "Dumping social para la competitividad" mimeo http://www.banrep.gov.co/economia/seminar.reforma-laboral-Col-abr-05-4.htm.

Farné, S. (2004), "La reforma laboral colombiana, Ley 789 de 2002: ¿Éxito o fracaso?" mimeo.

Gaviria, A. (2005), "La Reforma Laboral de 2002: Funcionó o no?" *Coyuntura Económica*, Vol. 34, No. 1, Fedesarrollo.

Hamermesh, D. (1993), *Labor Demand*. Princeton: Princeton University Press.

Hamermesh, D. and S. Trejo (2000), "The Demand for Hours of Labor: Direct Evidence from California" *The Review of Economic and Statistics*, Vol. 82, No. 1, February.

Hunt, J. (1996), "The Response of Wages and Actual Hours Worked to the Reduction of Standard Hours", NATIONAL BUREAU OF ECONOMIC RESEARCH *Working Paper* No. 5716.

_____(1998), "Hours Reduction as Work Sharing" Brookings Papers on Economic Activity, No. 1.

_____(1999), "Has Work-Sharing Worked in Germany?" *The Quarterly Journal of Economics*, MIT Press, Vol. 114, No.1, February.

Kugler, A. (2004), "The Effect of Job Security Regulations on Labor Market Flexibility: Evidence from the Colombian Labor Market Reform" NATIONAL BUREAU OF ECONOMIC RESEARCH *Working Paper* No. 10215.

López, H., Rhenals, R. and E. Castaño (2005), "Impacto de la reforma laboral sobre la generación y calidad del empleo", mimeo http://www.banrep.gov.co/economia/seminar.reforma-laboral-Col-abr-05-4.htm.

Ministerio de Protección Social (2005), "Reforma laboral: Orígenes, estructura y resultados" http://www.banrep.gov.co/economia/seminar.reforma-laboral-Col-abr-05-4.htm.

Mroz, T. A. (1987), "The Sensitivity of an Empirical Model of Married Women's Hours of Work to Economic and Statistical Assumptions" *Econometrica*, Vol. 55, No. 4, July.

Núñez, J. (2005), "Éxitos y fracasos de la reforma laboral", mimeo.

Trejo, S. J. (1993), "Overtime Pay, Overtime Hours, and Labor Unions" *Journal of Labor Economics*, Vol. 11, No. 2.