ADRIANA D. KUGLER
Georgetown University

MAURICE D. KUGLER
World Bank

LUIS O. HERRERA-PRADA
World Bank

Do Payroll Tax Breaks Stimulate Formality? Evidence from Colombia's Reform

ABSTRACT Alternative work arrangements have grown rapidly around the world. In Latin America, these alternative work arrangements have long been part of the labor market and have continued to grow. The informal sector grew rapidly in Latin America over the past few decades comprising up to half of the working population in many countries. Some attribute the growth in alternative work arrangements and informality to regulations and taxes, while others argue that it is precisely the lack of enforcement of regulations that allows unprotected employment arrangements to flourish. We examine whether reducing taxes associated with employment stimulates formal sector employment. We exploit the fact that the tax reform introduced in Colombia in 2012 affected only certain types of workers and not others. In particular, workers earning less than ten times the minimum wage and self-employed workers with more than two employees experienced a reduction of payroll taxes of 13.5 percent between 2013 and 2014. We use the Colombian household surveys, social security records and the monthly manufacturing sample to conduct difference-in-differences analyses of the reform. We find evidence of increased formal employment for the affected groups after the reform using all three data sets. We find that the probability of formal employment and the likelihood of transitioning into registered employment increased for the affected groups after the reform. We also find that the level and share of permanent employment relative to temporary employment grew after the reform for those earnings less than ten times the minimum wage. The results are greatest for those in smaller firms and for those earnings close to the minimum wage.

JEL Codes: H2, J2, J24, and J31

Keywords: Payroll taxes, informality, tax reform, permanent employment

Latin America and other developing regions depend on payroll taxes to finance pensions, disability and maternity benefits, and workers' compensation for those suffering from workplace injuries. In the case of Colombia,

ACKNOWLEDGMENTS We are grateful to Mariano Bosch, Matías Busso, Santiago Levy, Carmen Pagés, and an anonymous referee, as well as participants of the workshop organized by the IADB in Washington DC for this project and at the Latin American and Caribbean Economic Association 2016 Conference in Medellin and at the International Monetary Fund for their helpful comments. This research was funded by the Labor Markets and Social Security Unit of the Inter-American Development Bank.

payroll taxes are also used to finance the National Vocational Training Service (Servicio Nacional de Aprendizaje, SENA) and the Colombian Institute for Family Welfare (Instituto Colombiano de Bienestar Familiar, ICBF). Until very recently, mandatory contributions in Colombia were close to the European median, where the payroll tax rate was about 40 percent. However, payroll contributions are much higher compared to countries with relatively less regulated labor markets, such as the United Kingdom and the United States, where contributions have fluctuated between 15 and 20 percent of total compensation.[1]

In Latin America and continental Europe, high payroll taxes are thought to increase the labor costs that companies have to pay, thus possibly discouraging companies from hiring workers. Nonetheless, from a theoretical perspective, the impact of payroll taxes on the labor market is ambiguous. On the one hand, when workers value the benefits paid for with payroll taxes as much as the amount they contribute, increases in payroll taxes should be fully passed through from companies to employees in the form of lower salaries, with a neutral effect on unemployment. Consequently, in this case, employers would not experience increases in their overall labor costs. On the other hand, if wages are not fully flexible or if payroll taxes fund services that do not directly benefit all employees (such as SENA or ICBF), then wages would not absorb the total payroll taxes as lower wages, and there would be an increase in labor costs and a reduction in employment.

Empirical studies from various countries show mixed evidence regarding the impact of payroll taxes on employment and wages. For instance, several studies find neutral effects on employment in the United States (that is, full pass-through of taxes onto wages).[2] Nevertheless, Vroman and Hamermesh find that there is partial pass-through with non-neutral effects on wages and employment.[3] Kaestner finds that there is no pass-through from payroll taxes onto wages for young workers in the United States.[4]

In most Latin American countries, minimum wages are relatively high and constitute a binding restriction on formal sector employment.[5] As a result, it is

1. OECD (2015).

2. Gruber and Krueger (1991); Gruber (1994). Gordon (1972) also finds full pass-through to wages, but no impact on employment in the United States.

3. Vroman (1974); Hamermesh (1996).

4. Kaestner (1996).

5. See, for example, Maloney (1999, 2004); Maloney and Bosch (2006); Maloney, Goni, and Bosch (2007); Maloney and Núnez (2004).

not feasible to pass through higher payroll taxes to employees as lower wages, so increases in payroll taxes are more likely to reduce formal employment.[6] Gruber finds that a reduction in payroll taxes is completely passed through to employees in the form of higher wages, without an impact on employment, in Chile.[7] By contrast, Kugler and Kugler find that a 10 percent increase in payroll taxes reduces manufacturing employment by 5 percent among the least skilled workers.[8] In this context, the increase in payroll taxes was not transferred to employees through lower wages.[9] This finding is consistent with evidence provided by Maloney and Núnez that the minimum wage was binding in Colombia at the time.[10]

In the current study, we explore the effects of the recent drop in the payroll tax rate associated with the tax reform, Law 1607, implemented at the end of 2012. The goal of this reform was to increase employment and, in particular, formal employment. As a result, we focus on evaluating the impact of the reform on formal employment. Although the effects of changes in payroll taxes have already been studied in the Colombian context, it is important to study the effects of this particular reform for two reasons. First, the effects of changes in payroll taxes are likely to be asymmetrical depending on whether there is a hike or a decline. Due to a binding minimum wage, it is more feasible for a reduction in payroll taxes to be passed through to employees as higher wages than for an increase to be passed through as lower wages. On the other hand, changes in the tax rate would have larger effects on employment if the taxes were used to finance services that do not directly benefit contributors and that, as a result, cannot be passed through to workers' wages.

In Colombia, the link between benefits and contributions was relatively weak before the introduction of Law 1607. This made workers less willing to accept the lower wages offered by employers in response to increases in nonwage labor costs. This implies that there is less formal employment and, consequently, it becomes harder to find a formal sector job. Kugler and Kugler provide evidence that reductions in payroll taxes—often proposed to stimulate demand for low-wage labor—are an effective measure to reduce

6. Kugler (2011).
7. Gruber (1997).
8. A recent study by Saez, Seim, and Schoefer (2017) similarly finds large employment effects and little evidence of pass through examining Swedish data that exploits changes in payroll taxes for younger workers.
9. Kugler and Kugler (2009).
10. Maloney and Núnez (2004). See also Bell (1997); Kugler (1999, 2004, 2005).

unemployment and informality among young and low-skilled workers, especially if the tax cuts are focused on indirect benefits (like SENA and ICBF).[11]

The analysis in this paper examines the effects of Law 1607, which reduced payroll taxes for those earning less than ten times the minimum wage and for self-employed workers who hire two employees or more. These are the two groups that qualify for payroll tax reductions under the reform. The analysis exploits the fact that specific groups of employers and employees were affected by the reform to estimate the impact of the reduction in the payroll tax using a quasi-experimental evaluation design. The analysis consists of comparisons of the following two pairs of groups: (i) workers earning less and more than ten times the minimum wage, before and after the reform; and (ii) self-employed workers with two or more employees, and others who either are not self-employed or who are self-employed but hire fewer than two employees, before and after the reform.

Our analysis uses three different data sets to examine the effects of the reform: the household surveys collected by the Colombian National Administrative Department of Statistics (Gran Encuesta Integrada de Hogares, or GEIH), administrative data from the social security system (Planilla Integrada de Liquidación de Aportes, or PILA), and survey data from the monthly manufacturing sample (MMS). The data from the household surveys and from the social security records enable us to examine individual-level data to analyze effects on levels and transitions to the formal sector. The data from the MMS allow us to examine the effects of the reform on permanent employment at the establishment level.

The results from the three data sets consistently show positive effects of the reform on formal employment. The results from the household surveys show an increase of 6 percentage points or a 9.5 percent increase in the probability of having a signed contract, and an increase of 6.8 percentage points or a 10 percent increase in the probability of contributing to the pension and/or health schemes for those with less than ten minimum wages after the reform. The effects are bigger among smaller companies. Likewise, the results using social security records show an increase of 3.5 percentage points or 15.2 percent in the probability of going from informality or unemployment to formality for those paid under ten minimum wages after the reform.

The results also show small positive effects for self-employed workers with more than three employees using both the household survey and social security data. The probability of employment and of transitioning to a job with health

11. Kugler and Kugler (2009).

benefits and pensions increases by 2 and 16 percentage points after the reform for self-employed workers with more than three employees.

The results using the manufacturing sample also show that the reform increased permanent employment in the manufacturing sector. The evidence shows that manufacturing establishments that pay less than ten times the minimum wage on average increased their number of permanent employees by forty-six workers. They also show that the percentage of permanent workers employed by those establishments increased by 10 percent following the reform. In general, the reform is associated with an increase in formal employment for individuals earning less than ten minimum wages and for companies with such workers after the reform. The effects are robust to different specifications and are greater among smaller companies.

Changes in the Structure of Payroll Taxes

In 2012, Colombia introduced important legislative changes to reduce payroll taxes. The most important reform in payroll taxes since the 1990s, Law 1607 reduced payroll taxes for workers with low wages, who a priori should have experienced greater distortions and had fewer formal job opportunities due to the higher labor costs before the reform. Payroll taxes were 29.5 percent in 2012, fell to 24.5 percent in 2013, and reached 16 percent in 2014, after the tax reform was fully implemented.

A couple of years before, in 2010, the First Employment Law reduced effective payroll taxes by allowing companies to deduct them from their income tax, for employers hiring young workers and others entering the labor force. As a result, in this analysis we try to distinguish the First Employment Law effects from those of the more expansive reforms introduced by Law 1607.

Law 1607 of 2013

The tax reform introduced with Law 1607 included exemptions to employer payroll taxes used to finance training programs, family and childcare programs, and compulsory health benefits. While Congress ratified the law in 2012, the exemptions were only first granted in May 2013 for contributions going to training programs (SENA, 2 percent) and family and childcare programs (ICBF, 3 percent), for a total exemption of 5 percent in payroll taxes. Importantly, those who contribute payroll taxes to these programs typically use neither training nor family and childcare programs. This means that the link between the benefits and contributions to the programs is weak. Beginning

in January 2014, the exemptions were also applied to employer contributions to the contributory health scheme (of 8.5 percent), first introduced in 1993 by article 204 of Law 100. In our analysis, we evaluate the differential impact on formal employment for workers exempted and not exempted from these taxes by the new law starting in 2013.

According to Law 1607, issued by decree 862 on April 26, 2013, the exemption on payroll taxes applies to two groups of individuals. First, it applies to all legal, contributing for-profit entities that pay taxes and that have on their payroll workers who individually accrue fewer than ten times the legal monthly minimum wage. Second, it applied to all self-employed individuals who employ two or more workers. The law also indicates individuals who do not benefit from the exemptions, specifically excluding all employees who earn more than ten times the minimum wage and self-employed individuals who employ fewer than two employees.[12]

At the same time, the Colombian government introduced its Plan to Increase Productivity and Employment (Plan de Impulso a la Productividad y el Empleo, or PIPE), which was intended to replace the revenues lost from the exemptions for SENA, ICBF, and public health insurance through other sources of funding. To offset the revenue losses from the exemptions, the tax reform included an equity income tax, or CREE (Impuesto sobre la Renta para la Equidad). The CREE rate started at 9 percent in 2013, increased to 14 percent in 2015, and continued to increase by 1 percent every year until 2018.

The CREE percentage was distributed as follows: 1.4 percentage points go to SENA, 2.2 percentage points go to ICBF, and 4.4 percentage points go to the social security health scheme. The additional 1.2 percentage point charged during the first three years was devoted to financing public institutions of higher education (40 percent), the subsidized health scheme (30 percent), and social investments in the agricultural sector (30 percent). Importantly, the equity income tax is levied on profits and thus tends to affect the most profitable firms, which are also the largest firms.

12. Others excluded from the exemptions are legal entities that do not pay income taxes, such as unions, community action boards, horizontal joint ownership boards, those listed in articles 22, 23, 23-1, and 23-2 of the National Tax Code, legal nonprofit entities, such as cooperatives, employee funds, associations, corporations, and foundations. Also excluded are those operating in free-trade zones established by 2012 or with pending applications at that time, as well as users of previous free-trade zones that have qualified or could qualify in the future for these zones and that are subject to the special income tax rate of 15 percent established by the first subsection of article 240-1 of the National Tax Code.

In conclusion, beneficiaries of the payroll tax exemptions instituted by Law 1607 from 2012 are CREE contributors who hire workers earning less than ten minimum wages and self-employed individuals who hire two or more workers. The reduction of the employer payroll tax rates for SENA and ICBF by 5 percent and of health contributions by 8.5 percent is intended not only to reduce informal employment, but also to generate new formal jobs. The reason why this would encourage employment creation is that payroll taxes, which are associated with formal employment, would fall. Even though the equity income tax was introduced, this tax is on profits and not associated with employment, thus delinking the new taxes from the costs associated with formal job creation.

Law 1429 of 2010

Before the implementation of the Tax Reform, the First Employment Law was introduced in 2010. This reform also reduced the effective labor costs generated by payroll taxes to certain types of recently hired workers. The First Employment Law allows companies to deduct from their income tax contributions the payroll tax payments destined to finance services not directly benefiting all their employees, including tax contributions to finance SENA, ICBF, as well as contributions to the Solidarity Guarantee Fund, or FOSYGA (Fondo de Solidaridad y Garantias), which subsidizes health services for the poorest, and the contributions to the Minimum Pension Guarantee Fund or SGP (Sistema General de Pensiones) which subsidizes pensions for the poorest.[13] Although this law also covered pensions, the First Employment Law is more limited in the number of individuals to which it applies relative to the payroll tax reform. It is only valid for new hires who are young workers, women over forty, and earning less than one and a half times the minimum wage, as opposed to the ten minimum wage threshold in the 2012 tax reform.

In addition, the benefits only apply to new workers. The law defines new workers as those who appear for the first time in the administrative social security records, or those who were previously in the system identified as self-employed workers. This prevents companies from trying to claim exemptions

13. These deductions applied to companies that hired workers younger than twenty-eight years of age; female heads of households; individuals who have been displaced or are in the process of reintegration; individuals who are disabled; women over forty years of age; and workers earning less than 1.5 times the minimum wage.

for workers who are laid off and rehired or new hires that are simply replacing previously hired workers.

To benefit from the deductions of Law 1429, employers must also fulfill the following requirements established by the law. Companies have to be formally registered and have to hire the type of workers described by the law. Also, they have to increase their payrolls and not replace old personnel. That is, the number of employees must increase relative to the number of employees that were contributing in the previous year, and the total value of the payroll must increase by the month of December of the previous year in which the discounts are applied.

In the empirical analysis presented in this paper, we will focus on the impacts of the Tax Reform (Law 1607) by exploiting the fact that the reform covered certain groups but not others. Moreover, we will attempt to disentangle the effects of the tax reform from those of the First Employment Law (Law 1429) since the latter preceded the tax reform and some of the coverage may have overlapped.

Data

Colombia has collected cross-sectional data on labor force participation, earnings, and quality of life indicators of households since the 1960s. However, since the start of this data collection process and up to 2006, data were only available for thirteen cities and their metropolitan areas. Starting in 2006, the entire survey covers twenty-four cities and their metropolitan areas. In addition, the modules on labor markets and household earnings also cover rural sectors.

The purpose of this data collection effort is to provide information about the size and structure of the labor force (employed, unemployed, and inactive) and the sociodemographic characteristics of the population. Consequently, the household surveys allow us to classify the population according to the concepts detailed by the International Conference of Labor Statisticians (CIET); to calculate the main labor market indicators (participation rate, occupation rate, unemployment rate, and so on); to measure general population characteristics (characteristics of dwellings, access to public services); to obtain sociodemographic information from the population (sex, schooling levels, civil status, and so on), and to measure employment characteristics.

The existing database is the result of a probabilistic sampling of several stages, stratified by unequal conglomerates, and weighed for the twenty-four

capital cities and their metropolitan areas. The universe is the entire civilian, noninstitutionalized population residing in Colombia. The sampling unit is a segment of ten contiguous households. The sample size is 20,669 households. The sampling error is no greater than 5 percent and possesses national coverage, including differentiation by zone, department, and large regions. Data were collected weekly for big cities and monthly for capital cities.

To construct the treatment group that was exempt because they earned less than ten times the minimum wage, we calculated a variable called Times Minimum Wage (MW) as the ratio of nominal yearly earnings to the yearly minimum wage (515,000 Colombian pesos for 2010; 535,600 Colombian pesos for 2011; 566,700 Colombian pesos for 2012; and 589,500 Colombian pesos for 2013). We then used this variable to construct a dummy variable for ten times the MW. We also constructed variables for self-employment, employers, and contract type for wage earners. We construct firm-size variables that identify if firms have fewer than three employees; between four and ten; between ten and fifty, and more than fifty employees. This allows us to construct an indicator for the second treatment group by interacting the self-employment dummy with the fewer-than-three-employees dummy variable. We also created an indicator for 2013 to capture the effects of the reform by interacting the post-reform period with the indicators of whether workers earned less than ten times the MW and whether they were self-employed and hired at least two employees.

For the dependent variables, we constructed five different measures of formality: an indicator that takes the value of one if the employee has a written contract and zero otherwise; an indicator that takes the value of one if the employer or employee contributed to social security and zero otherwise; and an indicator that takes the value of one if the employer or employee contributed either to the health system, pensions, and workers' compensation and zero otherwise.

Among the control variables, we include data on socioeconomic factors about individuals, such as age, age squared, marital status, whether the person is literate (that is, can read and write), years of schooling, department dummies, and year dummies.

Finally, to corroborate the robustness of the results, we created additional variables to generate placebos by replacing some criteria, and controls for the First Employment Law. In particular, we generated a variable for fewer than twenty times the minimum wage, as well as variables for individuals younger than twenty-nine years of age, women older than forty years, and individuals with salaries below 1.5 times the minimum wage in order to control for the First Employment Law.

Table 1 shows different measures of formality for the years from 2010 to 2013. The table shows that formality has increased over time, regardless of the measure used. For example, the proportion of people who contribute to health or pension schemes or both increased from 67.7 percent in 2010 to 70.7 percent in 2013. Similarly, the proportion of people contributing to workers' compensation increased from 59.2 percent in 2010 to 64.5 percent in 2013. The proportion of individuals with a written contract rose from 63.5 percent in 2010, to 66.1 percent in 2013. The coverage of the reform was broad, since 99.6 percent of workers in 2012 (the year that the reform was approved) earned less than ten times the minimum wage. Also, 16.2 percent of individuals were self-employed workers and 11.1 percent were self-employed with more than three employees in 2012. Finally, about half of the individuals in the sample, 50.8 percent, are men; about 23.2 percent are married; 52.8 percent have a high school degree, and a minority has no high school in 2013.

Table 2 presents results from simple correlations between the less than 10 MW dummy variable with the various measures of formality as well as individual characteristics. The table shows that those with less than 10 MW are less likely to have a written contract, to have their employer make contributions to the health system or a pension fund, and to have their employer make contributions to workers' compensation. This is contrary our finding below of a positive effect on formality after the introduction of the reform. The table also shows that those with less than 10 MW are more likely to be women, are more likely to be employed in smaller firms, and are less likely to be married. Those with less than 10 MW are also more likely to illiterate, to be high school drop outs, to be high school graduates, and to have degree a from a training college, but less likely to have a university degree. This is why, below, we control for all of these characteristics in the estimations below.

Social Security Administrative Records

The social security records come from the PILA system, which maintains a database of all payroll contributions. These records contain contributors' reported information for each of the funds to which workers are required to contribute. It is the responsibility of the contributor to provide information in order for the contributions to be paid by the social security system.

The PILA database analyzed in this study has around 1.25 billion registries that reflect the tracking of 16.8 million individuals over seven years (from 2008 through 2014). The data have no defined periodicity, since they are based on the contribution reports to the health and pension systems made by

TABLE 1. Descriptive Statistics for Household Surveys, 2010–13[a]

Statistic	*2010 (1)*	*2011 (2)*	*2012 (3)*	*2013 (4)*
Employer or employee contributes to pension fund	0.697	0.706	0.721	0.737
	(0.46)	(0.456)	(0.448)	(0.44)
Employer or employee contributes to health system	0.747	0.758	0.768	0.78
	(0.435)	(0.428)	(0.422)	(0.414)
Workers' compensation	0.683	0.696	0.717	0.734
	(0.465)	(0.46)	(0.451)	(0.442)
Employer or employee contributes to pension/health fund	0.753	0.763	0.774	0.785
	(0.431)	(0.425)	(0.418)	(0.411)
Self-employed	0.176	0.183	0.197	0.202
	(0.381)	(0.387)	(0.398)	(0.401)
Employee	0.812	0.805	0.791	0.787
	(0.391)	(0.396)	(0.407)	(0.41)
Works for the same company that pays	0.807	0.861	0.864	0.863
	(0.395)	(0.346)	(0.343)	(0.344)
Written contract	0.716	0.721	0.729	0.742
	(0.451)	(0.449)	(0.444)	(0.437)
Self-employed with more than 3 people hired	0.137	0.141	0.156	0.162
	(0.344)	(0.348)	(0.363)	(0.368)
Firm with less than 10 employees	0.298	0.292	0.282	0.272
	(0.457)	(0.455)	(0.45)	(0.445)
Female	0.477	0.474	0.473	0.482
	(0.499)	(0.499)	(0.499)	(0.5)
Cohabitants for less than 2 years	0.031	0.033	0.036	0.036
	(0.173)	(0.179)	(0.186)	(0.187)
Cohabitants for more than 2 years	0.261	0.266	0.267	0.272
	(0.439)	(0.442)	(0.443)	(0.445)
Married	0.265	0.253	0.249	0.245
	(0.442)	(0.435)	(0.432)	(0.43)
Other marital status	0.443	0.447	0.448	0.447
	(0.497)	(0.497)	(0.497)	(0.497)
Less than high school	0.022	0.021	0.02	0.02
	(0.146)	(0.143)	(0.141)	(0.139)
High-school degree	0.524	0.523	0.512	0.49
	(0.499)	(0.499)	(0.5)	(0.5)
Training college degree	0.186	0.199	0.216	0.238
	(0.389)	(0.399)	(0.411)	(0.426)
University degree or more	0.268	0.257	0.252	0.252
	(0.443)	(0.437)	(0.434)	(0.434)
Illiterate	0.012	0.011	0.011	0.011
	(0.108)	(0.103)	(0.105)	(0.102)
Observations	83,310	88,058	91,096	91,422

a. Table reports means and standard deviation of all socioeconomic and work characteristics from 2010 to 2013.

TABLE 2. Differences in Outputs and Controls for People Earning Less Than Ten Minimum Wages[a]

	2010	
Statistic	*More than 10 MW Mean (1)*	*Less than 10 MW Effect (sd) (2)*
Employer or employee contributes to pension fund	0.958	−0.212***
		(0.017)
Employer or employee contributes to health system	0.986	−0.194***
		(0.01)
Workers' compensation	0.977	−0.236***
		(0.011)
Employer or employee contributes to pension/health fund	0.994	−0.196***
		(0.006)
Self-employed	0.106	0.052**
		(0.023)
Employee	0.894	−0.064***
		(0.023)
Works for the same company that pays	0.952	−0.168***
		(0.016)
Written contract	0.983	−0.23***
		(0.01)
Self-employed with more than 3 people hired	0.106	0.02
		(0.023)
Firm with less than 10 employees	0.021	0.241***
		(0.011)
Female	0.244	0.216***
		(0.034)
Cohabitants for less than 2 years	0.018	0.018
		(0.011)
Cohabitants for more than 2 years	0.077	0.179***
		(0.02)
Married	0.66	−0.4***
		(0.038)
Other marital status	0.245	0.204***
		(0.034)
Less than high school	0	0.023***
		(0.001)
High-school degree	0.045	0.486***
		(0.015)
Training college degree	0.046	0.15***
		(0.015)
University degree or more	0.909	−0.659***
		(0.021)
Illiterate	0	0.009***
		(0)
Observations	83,310	

* Statistically significant at 10 percent.
** Statistically significant at 5 percent.
*** Statistically significant at 1 percent.
a. Table reports the difference between treatment and control groups for all socioeconomic and work characteristics from 2010 to 2013. Ten minimun wages reported, with no missing observations.

individuals at any point in time during the period from 2008–14. This means that a person may register more than one monthly payment to the same fund and that the number of days quoted in a month can be greater than the duration of the month.

For this analysis, we consolidated all the payment reports and quoted days for each fund in each month. The total monthly income was converted to constant December 2014 prices using the monthly inflation rate for each state.[14] This was then used to estimate the worker's wages as a multiple of the minimum wage. In addition, the database contains reports from the contributing company and reports related to employees. Using this code, we added individuals who reported monthly for one company and used this to infer the firm-size. The database has no information regarding date of birth or age for individuals before 2014, so we did not consider these characteristics. The control variables were constructed for each month, year, type of industry, and state.

We consider workers who have a payment report as being in the formal labor market at that moment in time. Thus, we estimate transitions from nonemployment to formal or registered employment as those in which an individual was not in the system the previous month and then appears as contributing into the system the next month. The results of contributions to the health and pension funds are very similar, but there is a possibility of registering payments to the health scheme without actually working. For this reason, we rely only on registries into the pension funds to identify transitions into formal employment.[15]

The analysis includes an unbalanced panel by individual year-month. Consequently, some of the controls in later periods do not contain any information. These are considered as additional categories in the fixed effects.

Table 3 shows the descriptive statistics for the PILA database for the entire sample used in the analysis and by company size. The proportion of employees transitioning from outside the labor force, unemployment, or informality towards formality or the fraction of individuals who enter into registered employment is, on average, about 23 percent per month. The average size of registered companies in the PILA database is of 840 employees.

14. There are thirty-three states or geographic units in Colombia. These geographic units include twenty-six departments, the capital city, the islands of San Andres and Providencia, and five territories.

15. We use a randomized sample of 25 percent from the universe of individuals in social security records for all of our estimations. We restricted our estimations to the 25 percent sample due to the long computation time associated with processing the full sample.

TABLE 3. Descriptive Statistics for Social Security Records, 2008–14[a]

Statistic	Full sample (1)	Firms < 3 employees (2)	Firms 4–10 employees (3)	Firms 11–50 employees (4)	Firms > 50 employees (5)
Firm Size	840.3	1.33	6.57	26.4	3,259.9
	(4,121.20)	(0.59)	(2.05)	(11.42)	(7,625.30)
Average wages/Minimum wages	0.52	0.33	0.70	0.89	1.67
	(1.94)	(1.24)	(1.90)	(2.11)	(3.30)
Probability of transition from non-employment to employment	0.23	0.50	0.56	0.55	0.53
	(0.42)	(0.54)	(0.50)	(0.50)	(0.50)
Observations	368,310,936	32,240,555	9,402,418	20,038,184	94,741,231

a. This table shows the mean and standard deviation in parentheses. Full sample estimated using a 25 percent randomized sample of the universe of social security records from January 2008 to December 2014. Firm size estimations use 12.5 percent randomized sample of the universe of social security records from January 2008 to December 2014. Firm size is estimated as the number of people who report their payment for the same company.

The Monthly Manufacturing Sample

The monthly manufacturing sample (MMS) includes data on employment, wages, production, and characteristics of establishments in the manufacturing sector, that is, those with International Standard Industrial Classification (ISIC) rev. 3.[16] The MMS data are used to detect changes that could occur in the manufacturing sector in the short-term, including changes in employment, wages, hours worked, production, and sales of Colombian manufacturing establishments. At the same time, the sample allows us to determine the performance of the sector in different industrial activities; to determine the size and evolution of different sectors; to create competiveness indices; to analyze the impact of the economic dynamics on the productive sector; and to construct an index to temporarily estimate gross domestic product (GDP).

The accountant, manager, owner, or the person in charge of accounting in the establishment provides information on the establishment to DANE (the National Administrative Statistics Department). The MMS uses as sampling, observation, and analytical unit the industrial establishment, and it is part of the Annual Manufacturing Sample with a 5 percent error rate at the

16. This data set dates back to May 1962, when the country started compiling industrial sampling data in order to build employment and wage indicators. In parallel, the country also collected data on industrial production, an effort that was stopped in 1970 when the data collection process was unified under a single system, using industrial codes based on ISIC rev. 1. This design was in use until 1980. In 1978, the design of the sample was modified to comply with the adoption of new industrial codes, ISIC rev. 2. This design was maintained until 1990. In the late 1990s and early 2000s, the current design of the MMS was adopted to include changes in the representativeness of the sample and to include a third revision of the ISIC industrial codes.

national level. It includes stratified probabilistic sampling (although random for each stratum), and stratification is done by production, personnel, and type of industry. The compilation of the information is performed within the first twenty days of each month.

These data are subject to confidentiality restrictions and statistical reserve. Although we had access to the data through DANE computers, it is not possible to get access to these data outside of the country. For this reason, the descriptive information we obtained from the database is limited. One of the reasons for such restricted access is that a company that meets certain characteristics (for instance, size, production, and type of industry) may be the only company in a region and, as a result, confidentiality would be lost. Confidentiality is one of the main agreements with the companies providing information.

In this study, we use the MMS to examine the impacts of the reform on employment and hours worked of different types of workers in the manufacturing sector. The data to which we had access have about 120,770 entries (about 16,400 annual entries). The database we used had information on the establishment characteristics previously mentioned as well as monthly temporary jobs from January 2007 through April 2014. Even though there is an identifying number that may seem unique, it is not possible to do a panel-like tracking because the response of each unit is voluntary and it is sometimes forcefully imputed because of probabilistic matters.

We constructed several variables with the MMS for analysis. Unlike the household surveys and the social security data, the MMS does not have individual level wages. We can, however, estimate the ratio of the average wage in the establishment to the minimum wage of 515,000 in 2010 Colombian pesos. Then, we estimate a dummy variable for establishments whose average wages are less than ten times the minimum wage to identify establishments in which employees are most likely affected by the payroll tax reform. Our outcomes are the total number of production and nonproduction permanent employees and the proportion of permanent production and nonproduction workers out of the total number of employees (both permanent and temporary).

The idea is that permanent employment should increase both in levels and as a proportion of total employment, since payroll taxes are required for permanent workers but largely exempt for temporary workers.[17] We also examine the

17. Temporary workers mostly operate under the modality of "prestación de servicios" (provision of service contracts). Under these contracts, temporary workers are hired without benefits and are not employees as such. They get their own healthcare and have to set aside 13 percent for income taxes to pay the "retención en la fuente" tax.

TABLE 4. Descriptive Statistics for the Monthly Manufacturing Sample, 2007–14[a]

Statistic	*Mean (1)*
Share of permanent nonproduction employees	52.2
	(109.0)
Share of permanent production employees	99.5
	(171.4)
Regular hours permanent nonproduction employees	19,587.1
	(34,327.25)
Extra hours permanent nonproduction employees	1,725.0
	(4,599.4)
Salary of permanent nonproduction employees	160,799.1
	(387,913.7)
Salary of permanent production employees	150,674.0
	(307,710.6)
Observations	120,770

a. This table reports the mean and standard deviations in parentheses of the share of production and nonproduction employees, their regular and extraordinary hours, and their salaries.

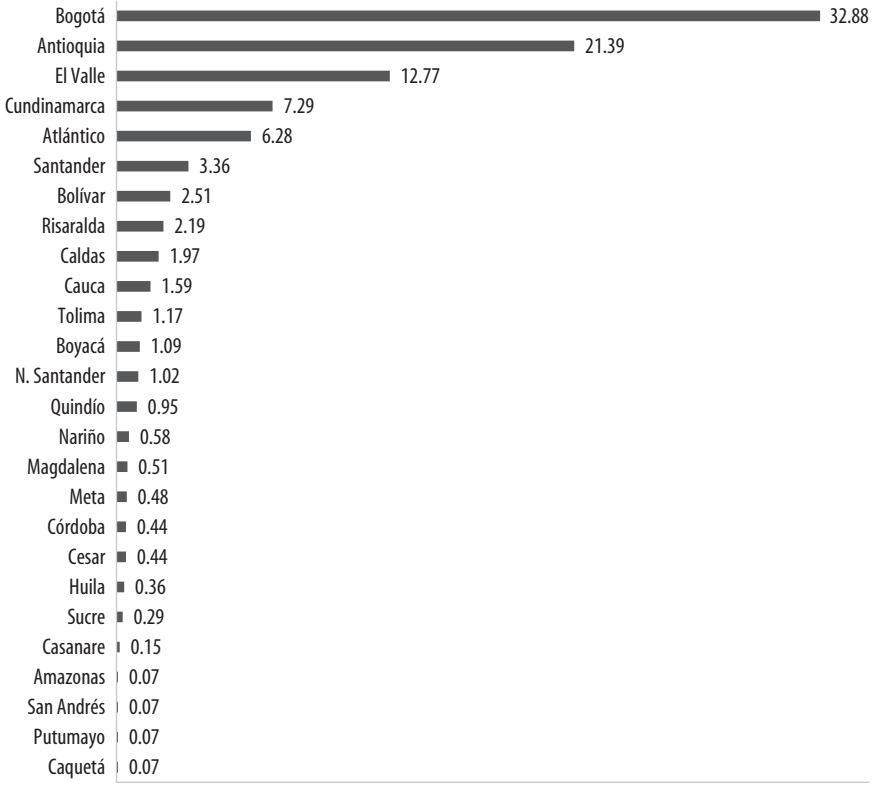
impact of the reform on the number of hours worked by permanent employees. Since the fixed cost of hiring a permanent worker goes down, employers should now prefer hiring more permanent workers and reducing their hours worked. We also construct a placebo of fewer than 20 MW, to check that our results are driven by the reform and not by some other factor that affects firms paying lower wages.[18]

Table 4 shows descriptive statistics for the MMS data. The average share of permanent nonproduction and permanent production employees in the sample are 52.2 percent and 99.5 percent, respectively. The average number of yearly regular and extraordinary hours worked for permanent nonproduction employees are 19,587 and 1,725, respectively.

Figure 1 shows the distribution of establishments by state. The vast majority of manufacturing establishments are in Bogotá, Antioquia, and El Valle; the rest of the establishments are distributed throughout the country. Bogotá, the capital of Colombia, has 32.9 percent of the establishments, and 7.3 percent are located in the state of Cundinamarca (a state right next to Bogotá); 21.4 percent are in the state of Antioquia; 12.8 percent are in the state of Valle; 6.3 percent are in the state of Atlántico; and 3.4 percent are in the state of Santander. The rest are distributed throughout the country with no more than 2.5 percent of the establishments located in any one of the other states.

18. The share with earnings above 10 MW is 0.8 percent and of those one quarter earn over 20 MW, after we apply expansion factors to the sample.

FIGURE 1. Share of Firms by State in the MMS[a]



a. This figure reports share of establishments in each department from MMS data for the years 2008–14.

Empirical Evidence

We explore empirically whether the reduction of payroll taxes and restructuring of taxes generated incentives to create formal jobs. We also evaluate if the reform increases employment at the extensive margin (number of employees) and reduces employment at the intensive margin (number of hours) using data at the individual, household, and establishment levels. We use the Colombian household surveys, social security records, and the monthly manufacturing sample to conduct difference-in-differences (DiD) analyses of the reform.

Results from the Household Surveys

We estimate the following model to calculate the probability of having a formal job using data from the household surveys:

$$P(F_{it}) = b\mathbf{X}_{it} + l_s + f_r + \tau_t + \delta_0 \text{Less 10 MW}_{it} + \delta_1 \text{Post}_t \times \text{Less 10 MW}_{it} + \delta_2 \text{Post}_t \times \text{Self-Employed\_More 3 Employees}_{it} + u_{it},$$

where $P(F_{it})$ is the probability of having formal employment and where formal employment is equal to one if the individual has a formal job defined as (a) having a written contract, (b) the individual or employer pays for health benefits, (c) the individual or employer contributes to a pension fund, (d) the individual or employer contributes to a health and/or pension scheme, or (e) the individual or employer pays for workers' compensation. Less ten MW_{it} is a dummy variable that equals one if the person receives fewer than 10 minimum wages (10 MW). Self-Employed More 3 Employees_{it} is an indicator that equals one if the employee is self-employed and hires three or more workers.[19] Post_t is an indicator for whether the person is observed after 2013. Thus, the coefficients on the interaction terms, δ_1 and δ_2, capture the effects of the reform on formal employment. $\mathbf{X}_{it}$ is a vector of controls that includes characteristics such as age, marital status, gender, schooling level, firm-size, and an indicator for whether the employee is self-employed or not as well as interactions between this last indicator with firm-size.[20] The sectoral, geographic, and temporal effects are captured by l_s, f_r and τ_t, respectively. We cluster standard errors by state.[21]

Table 5 reports coefficients δ_1 and δ_2, which capture the effects of the individuals with fewer than ten minimum wages and on self-employed with

19. The data do not allow distinguishing two or more employees, so we construct a variable for three or more employees.

20. Our treatment group is composed of workers earning below ten minimum wages and the comparison group of those with earnings above the ten-minimum-wage threshold. Since a potential concern is baseline unbalance among individuals in each group, we control for possible baseline differences in education, experience, age, race, and gender.

21. Another potential concern is that lower-wage individuals—say, those earning above but close to the minimum wage—may be more prone to transitioning into and out of formal employment. To explore that issue, figure A1 presents the probability of formal employment (defined as contributing to health or pensions) as a function of the fraction of wages out of the minimum wage in 2010. We find that this plot is roughly flat (except at low multiples of the minimum wage), implying that the probability of being formal is not directly related to wages as multiples of the minimum wage. Below, we perform robustness tests by leaving out of the control group those with wages very close to the minimum wage.

TABLE 5. Effects of the Payroll Tax Reform on Formality, Household Surveys[a]

Interaction term	*Written contract (1)*	*Health contribution (2)*	*Pension contribution (3)*	*Health and pension contribution (4)*	*Workers' compensation (5)*
A. Full sample (353,886 observations)					
Less than 10 minimum wages × Reform	0.060*** (0.008)	0.062*** (0.017)	0.069*** (0.018)	0.068*** (0.014)	0.057** (0.025)
Self-employed with more than 3 workers × Reform	0.011* (0.006)	0.019*** (0.003)	0.020*** (0.002)	0.016*** (0.003)	0.020*** (0.002)
B. Women (168,589 observations)					
Less than 10 minimum wages × Reform	0.123*** (0.008)	0.096*** (0.033)	0.105*** (0.034)	0.105*** (0.030)	0.086* (0.047)
Self-employed with more than 3 workers × Reform	0.021*** (0.003)	0.023*** (0.004)	0.015*** (0.003)	0.021*** (0.004)	0.022*** (0.005)
C. Men (185,297 observations)					
Less than 10 minimum wages × Reform	0.029*** (0.009)	0.040*** (0.012)	0.046*** (0.012)	0.044*** (0.010)	0.038* (0.018)
Self-employed with more than 3 workers × Reform	0.008 (0.008)	0.018*** (0.004)	0.024*** (0.004)	0.014*** (0.004)	0.021*** (0.003)

* Statistically significant at 10 percent.
** Statistically significant at 5 percent.
*** Statistically significant at 1 percent.

a. The table reports coefficients and clustered standard errors by department in parentheses of linear probability models of different measures of formality on the interaction terms of the post-reform dummy with indicators of whether the worker earns less than ten minimum wages or the workers is self-employed and hires more than three employees. The formality measures include: a Written Contract dummy; an indicator of whether the employer or employee pay Health and Pension Contributions; an indicator of whether the employee is covered by Workers' Compensation. To estimate the share of workers paid less than 10 MW, wages (deflated to their real value at 2013 prices) were divided by the Colombian minimum wage of 589,500 pesos in 2013 pesos. All regressions control for age, age squared, years of education, education squared, a female dummy, dummies for marital status, the number of MW the individual earns, the worker's type, firm size, the interaction between firm size and worker type and fixed effects for industry and year.

more than three employees.[22] The results show that the reform generated an increase in the probability of having formal employment. Specifically, the probability of having a written contract after the reform is 6 percentage points greater for employees with wages less than 10 MW. The probability of contributing to health benefits is 6.2 percentage points higher. The probability of contributing to a pension scheme increased by 6.9 percentage points and the probability of contributing to either health or pension system increased by 6.8 percentage points for workers with fewer than 10 MW after the reform.

22. As a baseline, we separate out the impact of lower payroll taxes, by first estimating a simple DiD design including only wage earners (comparing those above and below the 10 MW threshold) and then individually estimating the effect on self-employed individuals (by comparing those above and below the three-worker threshold).

Finally, the probability of contributing to workers' compensation increased by 5.7 percentage points. These coefficients are robust and are significant even with clustered standard errors. To understand the magnitude of these effects, we estimated the elasticity of employment with respect to nonwage labor costs. The effects translate into elasticities of 0.2 and 0.22 for the effects regarding written contracts and jobs that contribute to health or pensions. These effects are in line with the effects at the lower end of the range of 0.15–0.75 reported by Hamermesh.[23]

Table 5 also reports coefficients of the post-reform indicator interacted with the indicator for self-employed workers with three or more employees. The results show that the probability of paying for health benefits or a pension fund increases by 1.6 and 2 percentage points among self-employed workers with more than three employees after the reform. This effect translates into an elasticity of employment of 0.07, which is about a third of the elasticity we calculated for workers earning less than ten times the minimum wage.[24]

When the effects are estimated separately for men and women, we continue to find effects for those with less than 10 MW, as well as effects for the self-employed with more than three employees for both men and women. Panel B of table 5 shows the effects for women and panel C for men. The results for those earning less than 10 MW are greater for women and they are observed across all measures of formality. For example, the probability of having a written contract increases to 12.3 percentage points, while the probability of contributing to either health or pension benefits increases to 10.5 percentage points for women earning more than 10 MW after the reform, which correspond to elasticities of 0.42 and 0.34, respectively. The results in panel C show equivalent effects on these measures of formality of 2.9 and 4.4 percentage points for men, which correspond to elasticities of 0.1 and 0.14, respectively. By contrast, the effects on the probability of

23. Hamermesh (1996).

24. We also estimated the effects in separate regressions when we only include the interaction of Less than 10 MW with the reform dummy and when we only include the interaction of Self-employed with More than 3 Workers with the reform dummy. These results are reported in appendix tables A1 and A2. The regressions reported in appendix table A1 for those with Less than 10 MW are estimated only for those with positive earnings. The regressions reported in appendix table A2 for the Self-Employed with More than 3 Workers are estimated only for the self-employed. Since the two variables were shown not to be correlated in table 2, it is not surprising that the results are very similar to those reported in table 5 when both effects are included simultaneously.

TABLE 6. Effects of the Tax Reform on Formality by Firm Size, Household Surveys[a]

Interaction term	*Written contract (1)*	*Health contribution (2)*	*Pension contribution (3)*	*Health and pension contribution (4)*	*Workers' compensation (5)*
A. Full sample (353,886 observations)					
Less than 10 minimum wages ×	0.060***	0.062***	0.069***	0.068***	0.057**
Reform	(0.008)	(0.017)	(0.018)	(0.014)	(0.025)
Self-employed with more than	0.011*	0.019***	0.020***	0.016***	0.020***
3 workers × Reform	(0.006)	(0.003)	(0.002)	(0.003)	(0.002)
B. 10 and less employees (101,062 observations)					
Less than 10 minimum wages ×	1.088***	0.818	0.698	0.896*	0.601
Reform	(0.321)	(0.521)	(0.467)	(0.497)	(0.486)
Self-employed with more than	0.073***	0.084***	0.078***	0.082***	0.068***
3 workers × Reform	(0.011)	(0.009)	(0.006)	(0.008)	(0.009)
C. 11–49 employees (61,666 observations)					
Less than 10 minimum wages ×	0.177***	0.206**	0.215***	0.205**	0.178*
Reform	(0.057)	(0.078)	(0.065)	(0.077)	(0.087)
Self-employed with more than	0.002	0.013	0.024***	0.010	0.018*
3 workers × Reform	(0.019)	(0.009)	(0.008)	(0.009)	(0.010)
D. 50 and more employees (191,158 observations)					
Less than 10 minimum wages ×	0.005	0.010*	0.018*	0.013***	0.012
Reform	(0.005)	(0.005)	(0.010)	(0.004)	(0.015)
Self-employed with more than	−0.004*	0.002	0.002	−0.001	0.006**
3 workers × Reform	(0.002)	(0.001)	(0.002)	(0.001)	(0.003)

* Statistically significant at 10 percent.
** Statistically significant at 5 percent.
*** Statistically significant at 1 percent.

a. The table reports coefficients and clustered standard errors by department in parentheses of linear probability models of formality on interactions of Less than ten minimum wages and Self-Employed who hire more than three Workers by firm size. The following measures of formality are used: a Written Contract Dummy; an indicator of whether the employer or employee contributes to Health and Pension funds; an indicator of whether the worker is covered by Workers' Compensation. All regressions include controls for: age, age squared, year of education, education squared, a male dummy, marital status dummy, the share of wages out of the MW, firm size, type of worker indicators and interaction of firm size with type of worker and fixed effects by industry.

formality on the self-employed with more than three employees is similar for women and men, except for the probability of having a written contract.[25]

Table 6 shows the results of the effects of the tax reform by firm-size. The results show that Law 1607 had greater effects on formal employment among those working in the smallest firms. Panel A reports estimates for the

25. To allow for the possibility that those closer to the minimum wage may be much more likely to go from informality to formality, we restrict the treatment group to exclude workers close to the minimum wage. Appendix table A3 excludes those workers with wages that are 10 percent around the minimum wage. The results are very similar to the ones reported in table 4.

full sample; panel B reports estimates for those in firms with ten or fewer employees; panel C reports results for firms between eleven and forty-nine employees, and panel D reports results for those in firms with fifty or more employees. The effects for those working in firms with ten or fewer employees are larger than those for the entire sample. The probability of having a written contract and the probability of making health and pension contributions increases by about 6 percentage points for self-employed workers with more than three employees and it increases tenfold for those with less than ten minimum wages. The effects for workers with less than ten minimum wages and who work in firms with eleven to forty-nine employees are significant and bigger than those in the entire sample, but smaller than those found for small firms with fewer than ten employees. Formality for those earning less than ten minimum wages in medium-sized firms increased between 11 to 13 percentage points, but there is no effect among self-employed workers in medium-sized firms except for the pension contributions definition of formality.

By contrast, the probability of making health and pension contributions among workers earning less than ten minimum wages in firms with fifty or more employees increased by only 1.3 percentage points after the reform, which is a much smaller effect than the one found in the full sample. The effects are thus bigger among those in smaller and medium-sized firms than for those in bigger firms. This makes sense given that bigger firms were more likely to have to pay the CREE and smaller and medium-sized firms are more likely to have qualified for exemptions for employees closer to the minimum wage and for self-employed hiring others.

As a check that these results capture the effects of the reform and not some other factors affecting workers after the reform, we performed regressions with placebos. In our placebo, we changed the threshold of 10 MW (as specified by Law 1607) to 20 MW to calculate the dummy variable for employee wages. In these regressions, we excluded all workers with fewer than 10 MW. Table 7 shows these results with clustered standard errors. We found that there was no effect on formality for people with fewer than 20 MW. In many cases, the coefficients become negative, and they are always insignificant.[26]

Finally, table 8 shows similar effects to those presented in tables 4 and 5, but controlling for effects on groups affected by the First Employment Law. In particular, we included indicators for individuals younger than

26. Another placebo could involve examining the impact for those below five minimum wages or some other threshold below the ten minimum wages threshold. The problem with this approach, however, is that those earning less than five minimum wages were indeed affected by the reform, so it does not offer a true placebo.

TABLE 7. Placebo Effects of Less than Twenty Minimum Wages on Formality, Household Surveys[a]

Interaction term	*Written contract (1)*	*Health contribution (2)*	*Pension contribution (3)*	*Health and pension contribution (4)*	*Workers' compensation (5)*
A. Full sample (1,404 observations)					
Less than 20 minimum wages × Reform	−0.001 (0.008)	−0.013 (0.009)	−0.013 (0.009)	−0.009 (0.011)	−0.008 (0.018)
Self-employed with more than 3 workers × Reform	−0.005 (0.005)	0.017 (0.013)	0.030 (0.038)	0.018 (0.013)	−0.017 (0.020)
B. Women (401 observations)					
Less than 20 minimum wages × Reform	−0.000 (0.000)	0.004 (0.004)	−0.020 (0.024)	0.000 (0.001)	0.030 (0.026)
Self-employed with more than 3 workers × Reform	0.000 (0.000)	0.020 (0.023)	−0.113 (0.073)	0.004 (0.004)	−0.181** (0.071)
C. Men (1,003 observations)					
Less than 20 minimum wages × Reform	0.009* (0.004)	−0.003 (0.004)	−0.003 (0.020)	0.003 (0.005)	−0.000 (0.009)
Self-employed with more than 3 workers × Reform	0.004 (0.021)	0.019 (0.019)	0.035 (0.057)	0.022 (0.018)	0.007 (0.006)

* Statistically significant at 10 percent.
** Statistically significant at 5 percent.
*** Statistically significant at 1 percent.

a. The table reports coefficients and clustered standard errors by department in parentheses of linear probability models of different measures of formality on the interaction terms of the post-reform dummy with indicators of whether the worker earns less than twenty minimum wages or the worker is self-employed and hires more than three employees. The formality measures include: a Written Contract dummy; an indicator of whether the employer or employee pay Health and Pension Contributions; an indicator of whether the employee is covered by Workers' Compensation. To estimate the share of workers paid less than 20 MW, wages (deflated to their real value at 2013 prices) were divided by the Colombian minimum wage of 589,500 pesos in 2013 pesos. Sample contains observations with more than 10 MW. All regressions control for age, age squared, years of education, education squared, a male dummy, dummies for marital status, the number of MW the individual earns, the worker's type, firm size, the interaction between firm size and worker type and fixed effects for industry and year.

twenty-nine years of age, women older than forty, and individuals earning less than 1.5 times the minimum wage and we interacted them with a post-2011 indicator, since the First Employment Law was enacted in December 2010. These results show that the effects of the interaction between the reform and employees with less than ten minimum wages are still positive and significant and similar in magnitude even when we control for the First Employment Law. In this case, the probability of having a written contract and health or pension contributions increases by about 6.4 to 7 percentage points, respectively, for those earning less than ten minimum wages. The effects for the self-employed with more than three employees also remain positive and significant and of similar magnitude to those we found without controlling for the First Employment Law. The effects for women older than forty years of age and for those who earn less than 1.5 times the minimum wage after 2011 are neither statistically nor economically significant. On the other hand, the First Employment Law

TABLE 8. Effects of Payroll Tax Reform and First Employment Reform on Formality, Household Surveys[a]

Interaction term	*Written contract* (1)	*Health contribution* (2)	*Pension contribution* (3)	*Health and pension contribution* (4)	*Workers' compensation* (5)
Less than 10 minimum wages × Reform	0.064***	0.063***	0.061***	0.070***	0.054**
	(0.010)	(0.018)	(0.016)	(0.015)	(0.026)
Self-employed with more than 3 workers × Reform	0.011*	0.019***	0.020***	0.016***	0.020***
	(0.006)	(0.003)	(0.002)	(0.003)	(0.002)
Less than 29 years old × 2010	0.006**	0.008*	0.023***	0.012**	0.014***
	(0.003)	(0.004)	(0.006)	(0.005)	(0.003)
Women older than 40 years old × 2010	−0.017**	−0.010	−0.004	−0.010	−0.008
	(0.007)	(0.008)	(0.009)	(0.008)	(0.010)
Less than 1.5 minimum wages × 2010	0.000***	0.000	−0.000***	0.000	−0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Times real minimum wage	0.001***	0.001	0.001**	0.001**	0.002*
	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)
Observations	353,886	353,886	353,886	353,886	353,886

* Statistically significant at 10 percent.
** Statistically significant at 5 percent.
*** Statistically significant at 1 percent.

a. The table reports coefficients and clustered standard errors by department in parentheses of linear probability models of different measures of formality on the interaction terms of the post-reform dummy with indicators of whether the worker earns less than ten minimum wages or the worker is self-employed and hires more than three employees. The formality measures include: a Written Contract dummy; an indicator of whether the employer or employee pay Health and Pension Contributions; an indicator of whether the employee is covered by Workers' Compensation. To estimate the share of workers paid less than 10 MW, wages (deflated to their real value at 2013 prices) were divided by the Colombian minimum wage of 589,500 pesos in 2013 pesos. All regressions control for age, age squared, years of education, education squared, a male dummy, dummies for marital status, the number of MW the individual earns, the worker's type, firm size, the interaction between firm size and worker type and fixed effects for industry and year.

does seem to have a positive, though small, impact on younger workers under twenty-nine years of age.

In conclusion, people earning less than ten minimum wages benefited the most from the reform in terms of having a higher likelihood of holding a formal sector job, and the effects are greater for women and for workers in small firms.[27]

27. The announcement of the tax reform in 2012 and its enactment in 2013 may have motivated firms and workers to agree to report earnings of around ten minimum wages to reduce the payroll tax burden. If this were the case, there would be bunching around the threshold. We ran a regression to check if workers were more likely to report earnings around ten minimum wages around the time of the reform. Appendix table A4 shows the probability of reporting wages between 8.0 and 12.0 minimum wages, 8.5 and 11.5 minimum wages, and between 9.0 and 11.0 minimum wages. Column 1 shows a negative though very small impact of the reform on the likelihood of reporting wages between 8.0 and 12.0 minimum wages. Columns 2 and 3 narrow this window by looking at reported wages closer to ten minimum wages. We find significant, but barely detectable, effects of one-tenth of one percent on the likelihood of reporting wages between 8.5 and 11.5 and between 9.0 and 11.0 minimum wages which for practical purposes we could denominate negligible.

Results from Social Security Records

We estimated the following model to calculate the impact of the reform on transitions from unemployment, inactivity, and informal employment into registered employment:

$$P(F_{it}) = b\mathbf{X}_{it} + l_s + f_r + \tau_t + \mu_m + \delta_0 \text{Less 10 MW}_{it} + \delta_1 \text{Post}_t \times \text{Less 10 MW}_{it} + \delta_2 \text{Post}_t \times \text{Self-employed More 3 Employees}_{it} + u_{it},$$

where $P(F_{it})$ is the probability of transitioning from unemployment or informal employment into the formal sector. Less 10 MW_{it} and Self-employed More 3 Employees are indicators for groups exempted from the payroll tax, that is, those earning less than ten minimum wages and self-employed workers with two or more employees. $Post_t$ is an indicator for whether the company is observed after 2013. $\mathbf{X}_{it}$ includes the economic activity and size of the firm. The PILA database does not contain data on age, education, or any other individual characteristic. The geographic and sectoral effects are captured by l_s and f_r, respectively, and the year and month effects are captured by τ_t and μ_m. All of the regressions estimate clustered standard errors at the individual level.

Table 9 shows the effects on transitions into registered jobs for the full sample and by firm-size. Columns 1 and 2 show the coefficients for the interaction terms in regressions using the full sample. Columns 3 and 4 show the estimates for firms with fewer than three employees; columns 5 and 6 show the estimates for firms between three and ten employees; columns 7 and 8 show the estimates for firms between ten and fifty employees; and columns 9 and 10 show the estimates for firms with more than fifty employees. The overall results in column 1 show an increase in the probability of transitioning into formal sector employment of 3.5 percentage points among employees with less than ten minimum wages and of 16.3 percentage points among self-employed workers employing more than two employees. The specification in column 2 allows for differential effects for those earning less than two minimum wages, those earning between two and five minimum wages and those earning between five and ten minimum wages. As expected, these results show that the impact is greatest on those earning close to the minimum wage and smaller for those with higher wages. The probability of transitioning into formal employment increases by 5.1 percentage points for those earning less than two minimum wages, by 2 percentage points for those earning between two and five minimum wages and by 1 percentage point for those earning between five and ten minimum wages. During the 1990s, the higher payroll taxes could not be passed on as lower wages for workers for

TABLE 9. Effects of Payroll Tax Reform on Transitions to Registered Employment by Firm Size, Social Security Records[a]

	Full sample		*Firms < 3 employees*		*Firms 4–10 employees*		*Firms 11–50 employees*		*Firms > 50 employees*	
Interaction term	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*
Less than 10 MW ×	0.035***		0.394***		0.297***		−0.102***		−0.058***	
Reform	(0.001)		(0.006)		(0.007)		(0.003)		(0.001)	
Self-empl. w/ more than	0.163***	0.168***			0.142***	0.117***	0.059***	0.060***	0.075***	0.074***
3 workers × Reform	(0.001)	(0.001)			(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
0–2 minimum wages ×		0.051***		0.457***		0.228***		−0.106***		−0.053***
Reform		(0.001)		(0.008)		(0.007)		(0.003)		(0.001)
3–5 minimum wages ×		0.020***		0.393***		0.363***		−0.102***		−0.073***
Reform		(0.001)		(0.007)		(0.006)		(0.003)		(0.001)
6–10 minimum wages ×		0.010***		0.267***		0.255***		−0.091***		−0.052***
Reform		(0.001)		(0.005)		(0.006)		(0.003)		(0.001)
Reported wages/	0.001***	0.001***	0.023***	0.026***	0.017***	0.014***	−0.005***	−0.005***	−0.004***	−0.004***
Minimum wages	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Reform	−0.038***	−0.051***	−0.367***	−0.423***	−0.341***	−0.299***	0.098***	0.102***	0.061***	0.059***
	(0.001)	(0.001)	(0.006)	(0.007)	(0.006)	(0.006)	(0.003)	(0.003)	(0.001)	(0.001)
Observations	78,200,257		16,125,810		4,717,052		10,005,116		47,352,279	

* Statistically significant at 10 percent.
** Statistically significant at 5 percent.
*** Statistically significant at 1 percent.

a. The table reports coefficients and clustered standard errors by individual in parentheses of linear probability models of the transition to registered employment. All regressions control for the ratio of reported wages (deflated real values at 2015 prices) to the Colombian minimum wage in 2015 which was 644,350 pesos. All specifications control for industry, state, year and month fixed effects.

whom the minimum wage was binding and they could not remain or become formally employed.[28] Therefore, it is likely that a reduction in payroll taxes due to the 2012 reform had the greatest impact in terms of formal employment for this group of workers.

Columns 2–10 of table 9 show the effects on entry into registered jobs for firms of different sizes. Columns 3 and 5 show that the likelihood of transitioning into registered employment increases by 39.4 and 29.7 percentage points for those in firms with fewer than four employees and in firms with four to ten employees who earn less than ten minimum wages after the reform. Also, columns 4 and 6 show that the effects are bigger for those earning less than two minimum wages, somewhat smaller for those earning between two and five minimum wages and even smaller, though still positive and significant, for those earning between five and ten minimum wages. The effects are negative for those in larger firms. Likewise, the likelihood of transitioning into registered employment increases by 11.7, 6.0 and 7.5 percentage points for self-employed workers with four to ten employees, with ten to fifty employees and with more than fifty employees, respectively.

Results from the Manufacturing Survey

We estimated the following model to calculate the impact of the reform on the level and composition of employment using the monthly manufacturing sample:

$$E_{jst} = \alpha K_{jst} + l_s + f_r + \Psi_t + \delta_0 \text{Less 10 MW}_{jst-1} + \delta_1 \text{Post}_t \times \text{Less 10 MW}_{jst-1} + v_{jst},$$

where E_{jst} is employment in establishment j for permanent production and nonproduction employees, as well as the percentage of permanent production and nonproduction employees. Less 10 MW_{jst-1} is a dummy variable that equals one if the establishment pays average wages that are less than ten minimum wages before the reform. $Post_t$ is an indicator for whether employment at the company occurs after May 2013. The geographic, sectoral, and temporal effects are captured by l_s, f_r, and Ψ_t. K_{jst} represents installed capital. All standard errors are clustered by state.

The coefficients of interest are those for the interaction between the variable for less than ten minimum wages and the variable for after 2013 for

28. Kugler and Kugler (2009).

TABLE 10. Effects of the Payroll Tax Reform on Manufacturing Employment, Monthly Manufacturing Sample[a]

Interaction term	*Number of permanent nonproduction employees* (1)	*Number of permanent production employees* (2)	*Ratio of permanent nonproduction employees* (3)	*Ratio of permanent production employees* (4)	*Regular hours for all permanent employees* (5)	*Extraordinary hours for all permanent employees* (6)
A. Full sample (98,953 observations)						
Average wages less than 10 MW × Reform	46.164***	253.904***	0.104**	−0.073	−278.551*	−37.942
	(12.299)	(36.251)	(0.041)	(0.113)	(146.293)	(27.730)
Average wages/Minimum wages	4.696***	17.510***	0.004	−0.012*	1.020	0.097
	(0.913)	(4.765)	(0.004)	(0.007)	(0.806)	(0.178)
B. Less than 4 employees (5,169 observations)						
Average wages less than 10 MW × Reform	2.363**	5.961***	0.858***	0.294	−2,545.175***	−29.745**
	(0.897)	(1.177)	(0.199)	(0.202)	(95.998)	(12.110)
Average wages/Minimum wages	0.157***	0.633***	0.110***	0.041*	33.558***	3.138***
	(0.053)	(0.107)	(0.028)	(0.023)	(8.607)	(1.079)
C. More than 4 and less than 10 employees (7,844 observations)						
Average wages less than 10 MW × Reform	3.077***	9.482***	0.555***	0.439**	−1,830.071*	−31.833
	(0.932)	(2.152)	(0.198)	(0.188)	(942.582)	(27.470)
Average wages/Minimum wages	0.283***	0.817***	0.048***	0.022*	10.135***	0.830**
	(0.078)	(0.187)	(0.015)	(0.012)	(3.687)	(0.344)
D. More than 10 and less than 50 employees (21,205 observations)						
Average wages less than 10 MW × Reform	4.839***	17.002***	0.020	0.171	−437.734	−75.621
	(1.708)	(4.961)	(0.103)	(0.172)	(308.641)	(69.687)
Average wages/Minimum wages	0.363***	0.714	−0.000	0.025*	−0.255	0.221
	(0.102)	(0.452)	(0.006)	(0.014)	(2.564)	(0.488)
E. More than 50 employees (64,777 observations)						
Average wages less than 10 MW × Reform	35.356***	168.972***	0.030	0.006	−88.831	−16.047
	(11.132)	(54.994)	(0.029)	(0.136)	(66.200)	(11.642)
Average wages/Minimum wages	3.180***	10.364**	−0.007*	−0.013*	−0.772	−0.230
	(1.129)	(4.831)	(0.004)	(0.007)	(1.406)	(0.270)

* Statistically significant at 10 percent.
** Statistically significant at 5 percent.
*** Statistically significant at 1 percent.
a. The table reports the coefficients and robust standard error in parentheses by firm size. The regressions include controls for average (deflated in real 2015 values) divided by the minimum wage of 2015 (644.350 Colombian pesos). All specifications control for industry, state, year and month fixed effects.

the different types of workers. Panel A in table 10 shows the results for the entire sample, while panels B, C, D, and E show the results for establishments with up to three employees, four to ten employees, eleven to fifty employees, and more than fifty employees, respectively. Columns 1 and 2 in table 10 report the impacts on the number of permanent nonproduction and production employees, columns 3 and 4 reports impacts on the percent of nonpermanent and permanent production workers. For establishments that pay on average less than ten minimum wages, we observed an increase in the number of permanent workers and employees after 2013. In particular, columns 1 and 2 in panel A show that there is an increase of 46.2 permanent nonproduction employees and of 254 permanent nonproduction employees in establishments that pay less than ten minimum wages after the reform. This by itself suggests increased job creation in the manufacturing sector. In addition, columns 3 and 4 of panel A show an increase of 10 percent in the share of permanent nonproduction employees, though no effect on the share of permanent production employees.

Columns 5 and 6 in table 10 also show the effects on regular and overtime hours for all permanent workers. The results in column 5 show substitutions in working hours for permanent employees. There is a reduction of 279 regular hours or a reduction of 1.5 percent in regular hours for this group of workers, though no effect for overtime hours.

Panels B–E in table 10 show effects by establishment size. The results show that even though the effects regarding additional permanent workers are naturally smaller in smaller establishments, the effects are clearly larger for smaller companies when we look at the shares of permanent workers. Panels B and C show that the percentage of permanent nonproduction employees increases by 85.8 and 55.5 percent, respectively, in establishments with fewer than four employees and in companies with four to ten employees and that pay less than ten minimum wages on average. Likewise, for small companies that pay less than ten minimum wages on average, there is an increase in the percentage of permanent production workers. Also, there is a reduction in the regular and overtime working hours of permanent employees in establishments with less than four employees and a reduction in regular hours in establishments with four to ten employees. By contrast, panels D and E show that while there is a positive effect on the number of permanent nonproduction and production employees, there are no effects on the shares of permanent nonproduction and production employees or on regular and overtime permanent hours among bigger establishments with ten to fifty employees and with fifty or more employees.

Thus, consistent with the data using the household surveys and the social security records, we find bigger effects on smaller employers. This is likely because the smaller employers are more likely to face higher labor costs due to their inability to pass these costs to their employees, whose wages tend to be lower. Also, the equity income tax (CREE) introduced by the 2012 tax reform likely had a larger impact on larger employers.

As with the household surveys, we carried out regressions with a placebo group using the MMS data. Table 11 shows the results of this placebo using as a threshold twenty minimum wages on average at the establishment level. The results show no significant effects in the regressions that use twenty minimum wages as a threshold.

Conclusions

The results of estimations using data from household surveys, the social security records, and the monthly manufacturing sample are consistent with an increase in the creation of formal employment in response to the tax reform that eliminated payroll contributions for training, family services, and health benefits.

In the case of regressions using data from the household surveys and the social security records, there is strong evidence indicating a greater propensity toward formality among the two groups who experienced payroll tax reductions due to the reform, that is, those earning less than ten minimum wages and self-employed with more than two employees.

The analysis with the data from the household survey (GEIH) and the data from the social security records (PILA) show similar effects on formal employment with contributions to pension funds. The household survey results show an impact of 6.9 percentage points on the likelihood of being employed in jobs with contributions to pension funds for those with less than ten minimum wages. The social security data shows an increase of 3.5 in the likelihood of transitioning to employment registered in a pension fund. The results from the two databases also show positive effects on formal employment among self-employed workers with more than three employees. The household survey estimations also show an increase of 1.6 percentage point in the likelihood of being employed in a job with contributions to both health and pension plans for self-employed workers with more than three employees. Likewise, the social security data results show an increase of 16.3 percentage points in the likelihood of transitioning into a job registered with pension contributions.

TABLE 11. Placebo Effects of Less than Twenty Minimum Wages on Manufacturing Employment, Monthly Manufacturing Sample[a]

Interaction term	*Number of permanent nonproduction employees* (1)	*Number of permanent production employees* (2)	*Ratio of permanent nonproduction employees* (3)	*Ratio of permanent production employees* (4)	*Regular hours for all permanent employees* (5)	*Extraordinary hours for all permanent employees* (6)
Average wages less than 20 MW × Reform	10.877	7.833	−0.065	0.171**	−174.418***	−15.042**
	(9.613)	(4.998)	(0.071)	(0.064)	(57.207)	(5.406)
Average wages/Minimum wages	−3.560***	−0.043	−0.007**	−0.006***	−2.783	−0.239
	(1.216)	(0.188)	(0.003)	(0.002)	(1.609)	(0.141)
Observations	4,358	4,358	4,358	4,358	4,358	4358

* Statistically significant at 10 percent.
** Statistically significant at 5 percent.
*** Statistically significant at 1 percent.
a. The table reports the coefficients and robust standard error in parentheses by firm size. The regressions include controls for average (deflated in real 2015 values) divided by the minimum wage of 2015 (644.350 Colombian pesos). All specifications control for industry, department, year and month fixed effects.

Moreover, the results using the household survey and social security record data show that small firms are most likely to respond to the reform by creating formal jobs. The results using the social security records are also stronger for those who earn lower salaries closer to the minimum wage. We also included placebo regressions to verify that the results were not driven by the reform and not by other factors. We do a placebo test including interactions with less than twenty minimum wages instead of ten minimum wages, and the results show no effects. The fact that the placebo group was not affected, and that the groups most likely to be affected are indeed the ones for which we find greater effects, confirms that the results are likely driven by the reform.

The manufacturing sample results confirm these findings. They show an increase in the number and proportion of permanent production and nonproduction employees after the reform among establishments that pay less than ten minimum wages on average. The tax reform also caused a substitution in the regular hours worked by permanent workers, as would be expected since the costs of hiring permanent workers decreased. As with the individual-level results, establishment-level results show that the tax reform had greater impact among companies with fewer than ten employees.

These effects are larger in comparison to the reform from the mid-1990s in Colombia. Kugler and Kugler[29] find a much smaller effect—a 10 percent increase in payroll taxes reduced employment by about 5 percent. The results from the MMS, which are closest to those used by Kugler and Kugler, show that a decrease of 13.5 percent in payroll taxes introduced by the reform increased the share of permanent nonproduction workers by 46 percent.

At the same time, the effects are substantial compared to other reforms carried out in Colombia affecting both the supply and demand of labor. On the demand side, the deductions introduced by the First Employment Law for new hires from specific groups do not appear to be as effective as the exemptions introduced by the tax reform. On the supply side, the Youth in Action program (or Jóvenes en Acción), which provided vocational training and internships to young individuals, increased formal employment among men and women by 6 and 7 percentage points, respectively.[30] In this case, the cost per employee was US$770. In comparison, the tax reform probably generated fewer costs, since the funds lost due to the tax exemptions were recovered through the equity income tax. On the other hand, Kugler and

29. Kugler and Kugler (2009).
30. Attanasio and others (2011).

others[31] find that the effects of the Youth in Action program were permanent. It is too early to know if the effects of the tax reform are long-term, but it is possible that entering the formal sector can generate positive hysteresis and increase the probability of remaining in the formal sector.

Appendix: Supplemental tables and figures

TABLE A1. Effects of Payroll Tax Reform on Formality for those with Less than Ten Minimum Wages, Household Surveys[a]

Interaction term	*Written contract (1)*	*Health contribution (2)*	*Pension contribution (3)*	*Health and pension contribution (4)*	*Workers' compensation (5)*
A. Full sample (353,886 observations)					
Less than 10 minimum wages × Reform	0.060***	0.063***	0.069***	0.069***	0.058**
	(0.009)	(0.017)	(0.018)	(0.014)	(0.025)
B. Women (168,589 observations)					
Less than 10 minimum wages × Reform	0.123***	0.096***	0.105***	0.105***	0.087*
	(0.008)	(0.033)	(0.033)	(0.030)	(0.047)
C. Men (185,297 observations)					
Less than 10 minimum wages × Reform	0.030***	0.041***	0.048***	0.045***	0.039**
	(0.010)	(0.012)	(0.012)	(0.010)	(0.018)

* Statistically significant at 10 percent.
** Statistically significant at 5 percent.
*** Statistically significant at 1 percent.

a. The table reports coefficients and clustered standard errors by state (in parentheses) of linear probability models of different measures of formality on the interaction terms of the post-reform dummy with indicators of whether the worker earns less than ten minimum wages or the worker is self-employed and hires more than three employees. The formality measures include: a Written Contract dummy; an indicator of whether the employer or employee pay Health and Pension Contributions; an indicator of whether the employee is covered by Workers' Compensation. To estimate the share of workers paid less than 10 MW, wages (deflated to their real value at 2013 prices) were divided by the Colombian minimum wage of 589,500 pesos in 2013 pesos. All regressions control for age, age squared, years of education, education squared, a female dummy, dummies for marital status, the number of MW the individual earns, the worker's type, firm size, the interaction between firm size and worker type and fixed effects for industry and year. Sample of all workers with income and industry.

31. Kugler and others (2015).

TABLE A2. Effect of Payroll Tax Reform on Formality for Self-Employed with More than Three Workers, Household Surveys[a]

Interaction term	*Written contract (1)*	*Health contribution (2)*	*Pension contribution (3)*	*Health and pension contribution (4)*	*Workers' compensation (5)*
A. Full sample (67,167 observations)					
Self-employed with more than 3 workers × Reform	0.144*** (0.015)	0.166*** (0.012)	0.152*** (0.006)	0.163*** (0.009)	0.146*** (0.007)
B. Women (26,230 observations)					
Self-employed with more than 3 workers × Reform	0.168*** (0.026)	0.172*** (0.037)	0.136*** (0.022)	0.178*** (0.033)	0.122*** (0.021)
C. Men (40,937 observations)					
Self-employed with more than 3 workers × Reform	0.127*** (0.013)	0.158*** (0.009)	0.160*** (0.006)	0.150*** (0.013)	0.159*** (0.007)

* Statistically significant at 10 percent.

** Statistically significant at 5 percent.

*** Statistically significant at 1 percent.

a. The table reports coefficients and clustered standard errors by state (in parentheses) of linear probability models of different measures of formality on the interaction terms of the post-reform dummy with indicators of whether the worker earns less than ten minimum wages or the worker is self-employed and hires more than three employees. The formality measures include: a Written Contract dummy; an indicator of whether the employer or employee pay Health and Pension Contributions; an indicator of whether the employee is covered by Workers' Compensation. To estimate the share of workers paid less than 10 MW, wages (deflated to their real value at 2013 prices) were divided by the Colombian Minimum wage of 589,500 pesos in 2013 pesos. All regressions control for age, age squared, years of education, education squared, a female dummy, dummies for marital status, the number of MW the individual earns, the worker's type, firm size, the interaction between firm size and worker type and fixed effects for industry and year. Sample of all Self-Employed with income and industry.

TABLE A3. Effects of the Payroll Tax Reform on Formality: Exclusion of 10 Percent around One Minimum Wage, Household Surveys[a]

Interaction term	Written contract (1)	Health contribution (2)	Pension contribution (3)	Health and pension contribution (4)	Workers' compensation (5)
A. Full sample (330,330 observations)					
Less than 10 minimum wages × Reform	0.061*** (0.008)	0.062*** (0.016)	0.069*** (0.017)	0.067*** (0.014)	0.058** (0.025)
Self-employed with more than 3 workers × Reform	0.009 (0.007)	0.016*** (0.003)	0.017*** (0.003)	0.013*** (0.003)	0.018*** (0.003)
B. Women (159,604 observations)					
Less than 10 minimum wages × Reform	0.124*** (0.007)	0.095*** (0.032)	0.106*** (0.033)	0.104*** (0.029)	0.087* (0.046)
Self-employed with more than 3 workers × Reform	0.016*** (0.004)	0.017*** (0.003)	0.005 (0.006)	0.015*** (0.003)	0.015*** (0.005)
C. Men (170,726 observations)					
Less than 10 minimum wages × Reform	0.030*** (0.009)	0.039*** (0.012)	0.045*** (0.013)	0.044*** (0.009)	0.037* (0.018)
Self-employed with more than 3 workers × Reform	0.006 (0.009)	0.017*** (0.004)	0.025*** (0.004)	0.014*** (0.005)	0.021*** (0.003)

* Statistically significant at 10 percent.
** Statistically significant at 5 percent.
*** Statistically significant at 1 percent.

a. The table reports coefficient and clustered standard errors by state (in parentheses) of linear probability models of different measures of formality on the interaction terms of the post-reform dummy with indicators of whether the worker earns less than ten minimum wages or the worker is self-employed and hires more than three employees. The formality measures include: a Written Contract dummy; an indicator of whether the employer or employee pays Health and Pension Contributions; an indicator of whether the employee is covered by Workers' Compensation. To estimate the share of workers paid less than 10 MW, wages (deflated to their real value at 2013 prices) were divided by the Colombian minimum wage of 589,500 pesos in 2013 pesos. All regressions control for age, age squared, years of education, education squared, a female dummy, dummies for marital status, the number of MW the individual earns, the worker's type, firm size, the interaction between firm size and worker type and fixed effects for industry and year. Sample excludes population with 5 percent above and below 1 MW.

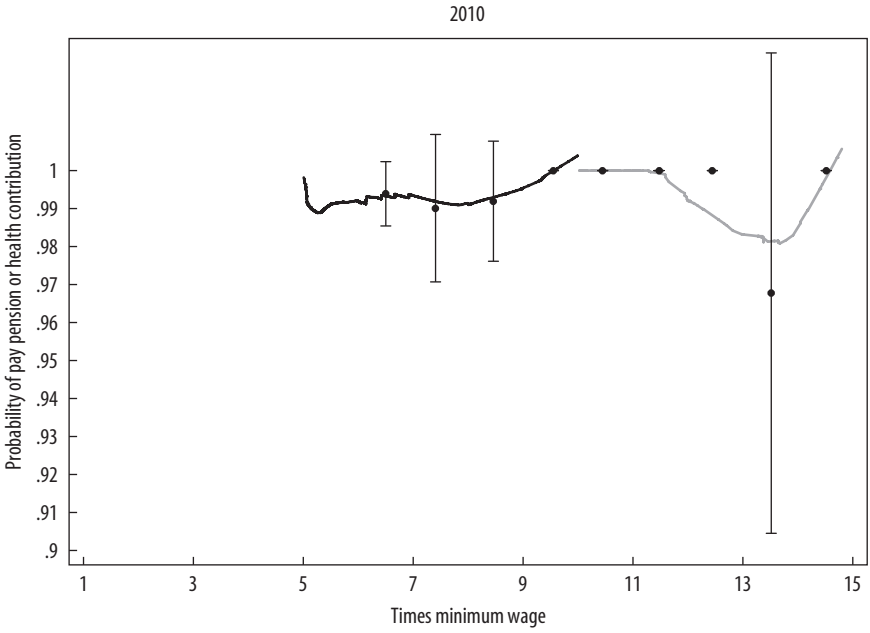
TABLE A4. Bunching Effects[a]

	From 8 to 12 MW (1)	*From 8.5 to 11.5 MW* (2)	*From 9 to 11 MW* (3)
Reform	–0.001***	0.001***	0.001***
	0	0	0
Observations	5,030,925	3,195,775	2,116,038
R-squared	0.032	0.018	0.022

* Statistically significant at 10 percent.
** Statistically significant at 5 percent.
*** Statistically significant at 1 percent.

a. Robust standard errors are in parentheses.

FIGURE A1. Probability of Contributing to Pension or Health Fund[a]



a. This figure reports the probability of contributing to health coverage or a pension fund in 2010 by the multiples of the minimum wages paid.

References

Attansio, Orazio, Adriana Kugler, and Costas Meghir. 2016. "Subsidizing Vocational Training for Disadvantaged Youth in Colombia: Evidence from a Randomized Trial." *American Economic Journal—Applied Economics* 3: 188–220.

Bell, Linda. 1997. "The Impact of Minimum Wages in Colombia." *Journal of Labor Economics* 15(3): S102–35.

Gordon, Robert. 1972. "Wage-Price Controls and the Shifting Phillips Curve." *Brookings Papers on Economic Activity* (2): 385–421.

Gruber, Jonathan. 1994. "The Incidence of Mandated Maternity Benefits." *American Economic Review* 84(3): 622–41.

———. 1997. "The Incidence of Payroll Taxation: Evidence from Chile." *Journal of Labor Economics* 15(3): S72–S101.

Gruber, Jonathan, and Alan Krueger. 1991. "The Incidence of Mandated Employer-Provided Insurance: Lessons from Workers' Compensation Insurance." In *Tax Policy and the Economy,* edited by David Bradford, pp. 111–44. MIT Press.

Hamermesh, Daniel. 1996. *Labor Demand*. Princeton University Press.

Kaestner, Robert. 1996. "The Effect of Government-Mandated Benefits on Youth Employment." *Industrial and Labor Relations Review* 50(1): 122–42.

Kugler, Adriana. 1999. "The Impact of Firing Costs on Turnover and Unemployment: Evidence from the Colombian Labour Market Reform." *International Tax and Public Finance* 6(3): 389–410.

———. 2004. "The Effect of Job Security Provision Regulations on Labor Market Flexibility: Evidence from the Colombian Labor Market Reform." In *Law and Employment: Lessons from Latin America and the Caribbean,* edited by James Heckman and Carmen Pagés, pp. 183–228. University of Chicago Press.

———. 2005. "Wage-Shifting Effects of Severance Payments Savings Accounts in Colombia." *Journal of Public Economics* 89, nos. 2–3: 487–500.

———. 2011. "Is There an Anti-Labor Bias of Taxes? A Survey of the Evidence from Latin America and around the World." Research Department Publication 4746. Washington: Inter-American Development Bank.

Kugler, Adriana, and Maurice Kugler. 2009. "Labor Market Effects of Payroll Taxes in Developing Countries: Evidence from Colombia." *Economic Development and Cultural Change* 57(2): 335–58.

Kugler, Adriana, and others. 2015. "The Long-Term Direct and Spillovers Effects of Job Training: Experimental Evidence from Colombia," Working Paper 21607. Cambridge, Mass.: National Bureau of Economic Research.

Maloney, William. 1999. "Does Informality Imply Segmentation in Urban Labor Markets? Evidence from Sectoral Transitions in Mexico." *World Bank Economic Review* 13(2): 275–302.

———. 2004. "Informality Revisited." *World Development* 32(7): 1159–78.

Maloney, William, and Mariano Bosch. 2006. "Gross Worker Flows in the Presence of Informal Markets: The Mexican Experience, 1987–2002." Research Working Paper 3883. Washington: World Bank.

Maloney, William, Edwin Goni, and Mariano Bosch. 2007. "The Determinants of Rising Informality in Brazil: Evidence from Gross Worker Flows." Research Working Paper 4375. Washington: World Bank.

Maloney, William, and Jairo Núnez. 2004. "Minimum Wages in Latin America." In *Law and Employment: Lessons from Latin America and the Caribbean*, edited by James Heckman and Carmen Pages, pp. 109–30. University of Chicago Press.

OECD (Organization for Economic Cooperation and Development). 2015. Taxing Wages. Paris.

Saez, Emmanuel, David Seim, and Benjamin Schoefer. 2017. "Firm Behaviora and Payroll Taxes: Evidence from a Young Worker's Tax Cut in Sweden." Mimeo, University of California at Berkeley.

Vroman, Wayne. 1974. "Employer Payroll Taxes and Money Wage Behavior." *Applied Economics* 6(3): 189–204.