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Multiple Violations of Labor Market Regulations: Patterns in the Peruvian Labor Market and the Impact of Enforcement

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Abstract

This paper quantifies labor law violations and how the enforcement efforts impact on the compliance level by considering the possibility of different labor regulations being violated simultaneously. The findings for the Peruvian labor markets over the period 2004-2013 indicate that: (i) multiple violations of labor regulations are an important feature of Peruvian labor markets; (ii) young workers, workers with low level of education, indigenous workers, workers in micro firms and workers employed in the agricultural sector have higher chances of being deprived of several labor benefits simultaneously; (iii) the enforcement of labor regulations, captured through the number of labor inspections at the region level, is effective in detecting and penalizing extreme situations of multiple violations of the labor law, but the evidence also suggests that firms adjust only partially as an attempt to reduce the amount of a potential fine if discovered, and that laid off workers during the adjustment process moved to the informal sector where firms are not inspected. These findings are useful from a policy perspective indicating that there is space to improve firms' incentives when facing an increase in the enforcement effort.

JEL codes: J81, J83, J88

Keywords: Multiple violations, Labor market regulations, Enforcement, Peru

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1. Introduction

Compliance with labor market rules in developing countries is generally low despite their extensive regulations (Ronconi, 2010). Last available household surveys for Latin American countries reveal that, on average, 40.6% of wage employees were deprived of a written labor contract, 42.2% didn't receive the contributions to the pension system, while 37.4% didn't have health insurance coverage associated to their job (SEDLAC, 2017). Imperfect enforcement of the labor law and weak institutions have been pointed out as potential explanations for the low level of compliance in developing countries (Loayza et al., 2005; Basu et al., 2010). Having unreasonably stringent labor regulations and taxes in general have also been found to be an important determinant of the compliance level in the developing world (de Soto, 1989; Loayza, 1996; de Paula and Scheinkman, 2006).

The effects of the enforcement of labor market regulations on the compliance level and other labor outcome variables have also been covered extensively by the literature. Empirical studies have found that higher enforcement of the labor law increases the compliance with labor market regulations (Ronconi, 2010; Almeida and Carneiro, 2012; Almeida et al., 2013) or does not generate any effect (Bhorat et al., 2012; Viollaz, 2018), increases the compliance among men and reduces the compliance among women (Viollaz, 2018), reduces firms' size and possibly productivity (Almeida and Carneiro, 2009), decreases job creation and increases job destruction (Almeida and Poole, 2013), reduces the provision of non-mandated benefits (Almeida et al., 2013), and generates wage adjustments -mainly reductions of formal wages at the top of the wage distribution and increases of informal wages (Almeida and Carneiro, 2012; Almeida et al., 2013).

All these papers have analyzed violations (or compliance) of only one labor regulation (Bhorat et al., 2012; Almeida and Carneiro, 2012) or violations of different regulations one at a time (Ronconi, 2010; Almeida et al., 2013; Viollaz, 2018; Viollaz, 2018). No work has been done on multiple violations of the labor law. A situation of multiple violations of labor regulations takes place when a worker is simultaneously deprived of more than one of the labor benefits he is entitled to.

Two main questions are the focus of this paper. First, how the pattern of multiple violations varies over time and with worker, employment, and region characteristics. Second, how the enforcement of labor market regulations impacts the pattern of multiple violations. To answer

these questions, I explore microdata from Peruvian national household surveys for the period 2004-2013 where workers report their own working conditions. Wage employees are entitled to several labor benefits in Peru. However, the compliance with labor market regulations is low, i.e., around 78% of workers were deprived of at least one of the labor benefits captured by the household survey in the analyzed period. Compliance with labor market regulations is monitored by a labor inspection system which is decentralized at the region level. I use information on the number of inspections carried out in each region of the country to construct an enforcement measure that I relate econometrically with the number of labor violations workers suffer. Previous evidence for Peru has shown that there was no impact of the degree of enforcement on the compliance level with labor regulations analyzed individually during 2008-2013 (Viollaz, 2018).

The mechanisms I analyze in this paper are the following. Firms decide whether to violate any labor regulation, and in that case, how many of them to violate, considering *simultaneously* the expected gains from evading any labor benefits established by law (labor costs savings mainly) which are specific of each benefit, and the expected costs (monetary fine in case of being detected by labor inspectors and difficulties to access to new markets) which varies with the labor benefit as well. Firms' decide the optimal number of labor regulations to evade considering all these factors (expected gains associated to the evasion of each labor rule and the expected costs) given the technology, level of capital, market conditions, and the degree of enforcement of labor market regulations. The simultaneous nature of this decision is an important factor not considered by previous studies which are focused on the impact of the enforcement effort on the compliance with only one labor regulation or with different regulations analyzed separately. When enforcement increases, firms that were evading some labor rules may find it optimal to start complying with all or with some of them depending on the factors mentions above, i.e., technology, market conditions, etc. I expect this adjustment to impact on the pattern of multiple violations, for instance, reducing the probability of suffering the violation of many labor rules and, consequently, increasing the probability of suffering the violation of only few or none of them. Firms can use other margins of adjustment as well, such as the layoff of workers who can then find a job in the informal sector of the economy which is not inspected.

This paper contributes to different strands of literature related to the non-compliance with labor market regulations and the enforcement of the labor law. First, this paper contributes to the

empirical literature quantifying labor law violations. As mentioned before, previous literature has been focused on the analysis of the violation of one labor regulation or different labor regulations considered one at a time. This paper considers the possibility of different labor laws being violated simultaneously. Second, this paper adds to the literature by analyzing the impact of the enforcement of labor regulations on the compliance with labor rules. Again, the literature here has been focused on the analysis of how changes in enforcement affect the compliance with one specific labor regulation or with different regulations considered separately. This paper contributes by analyzing how the pattern of multiple violations changes when the enforcement effort changes.

The findings can provide insights for labor inspection and labor regulation design. The estimation of the effect of enforcement on the pattern of multiple violations can be informative about the incentives generated by different penalties associated to different labor violations. The lack of effect when analyzing how the compliance with individual labor regulations changes when the degree of enforcement varies may be hiding a more complicated pattern of adjustment. Non-compliant firms may start complying with some of the rules they were evading as a way to reduce the amount of the fine in case of being detected. In the final situation, the compliance level would be partial, but it could result in an improvement in terms of the number of benefits workers receive.

2. Labor Market Regulations and Labor Inspection System in Peru

2.1 Labor Protection

In Peru, workers' rights are established in the Political Constitution and protected by the labor inspection system led by the Ministerio de Trabajo y Promoción del Empleo (Labor Ministry or MTPE). Wage employees who are registered in the Planilla –the formal register of labor relationships, are entitled to several benefits. These benefits include a monthly wage equal or above the minimum wage; a maximum of 8 working hours a day and 48 hours a week; contributions to the health insurance and the pension system;¹ a break of no less than 45 minutes a day; a minimum of 24 hours of rest time during the week; a paid maternity leave of 90 days and a paternity leave of four days; paid vacation time; family allowances; surcharge for night

¹ Contributions to the pension system are completely paid by workers in Peru while employers have the obligation of enrolling employees into the system and deducting the contributions from the monthly wage.

shifts, compensation for length of service; and severance pay. All labor relationships must be established through a written contract.

2.2 Labor Inspection System

The labor inspection system in Peru has the objectives of monitoring the compliance with labor market and social security regulations in the private sector, give technical support and guidance on labor issues, and penalized the violations of the rules.

There is a central authority, the National Labor Inspection Office (DNIT in Spanish), one regional inspection agency in each of the 25 regions in the country (agency of high rank), and some zonal inspection agencies (agencies of low rank). The labor inspection functions of the regional agencies extend to each region's territory.

Every year, the DNIT jointly to the regional governments plan the inspection activities, while regional inspection agencies carry out the labor inspections in each region territory. The planning of the inspection functions has been eased since the implementation of the electronic payroll system in 2008 (Rani, et al., 2013; Díaz, 2014; ILO, 2015). Similarly to other developing countries, labor inspections are focused on formal firms in Peru –those enrolled in the tax register. Informal firms receive orientation interventions regarding labor market regulations.

The resources of the labor inspection system in Peru are scarce (Weil, 2008). In 2009 the system had 406 labor inspectors for the entire country, only 6 of the 25 regions had a supervisor, and most labor inspectors were concentrated in the regions of Lima and Callao (Díaz, 2014; Julca Babarzy, 2013; Requejo Alemán, 2013). Human resources and equipment to carry out the inspections are provided by the Labor Ministry (MTPE in Spanish) and regional governments. If transport to arrive to the firms to be inspected are lacking, the MTPE and regional governments refund any transport expenses. However, the evidence indicates that transport expenses are reimbursed long after the labor inspections are carried out, or they are never covered (Requejo Alemán, 2013).

The violations of labor regulations are classified according to their severity –there are minor, serious and very serious violations. When a labor inspector detects a situation of non-compliance with labor regulations, the employer receives a proposal to solve the irregularity in certain period of time in exchange for a reduction in the penalty. The amount of the monetary fine depends on

the severity of the violation and on the number of workers affected. The total value of the monetary penalization has a maximum that has been established in 30 tax units.²

2.3 Measure of Enforcement of Labor Market Regulations

In this paper, I follow Viollaz (2018) and define the enforcement of labor market regulations as the number of labor inspections per hundred salaried workers employed in the private sector in each region and year, excluding domestic workers.³ Data on the number of labor inspections comes from the Ministerio de Trabajo y Promoción del Empleo.

Figure 1 presents the number of inspections per hundred salaried workers during 2004-2013 (Panel a) and the variation in the measure of enforcement across regions and over time (Panel b). The pattern of the enforcement of labor market regulations during the analyzed period was erratic (Panel a). There was an important reduction between 2004 and 2007, when the number of inspections per hundred workers fell from 2.5 to 0.9, a subsequent recovery, and a new declining trend from 2009 to 2013. The number of inspections per hundred salaried workers also shows an important variation across region and over time (Panel b). This is the variation I exploit in the econometric analysis. Between 2004 and 2005, the degree of enforcement decreased in most regions, and the rate of reduction was different across them. Regions with a higher level of enforcement to begin with exhibited the largest reductions, resulting in a change in the distribution of the enforcement effort across regions. In the other three sub-periods depicted in Figure 1 (2007-08, 2009-10, 2012-13), the annual changes in the enforcement measure were smaller but mixed, i.e., the enforcement effort increased in some regions while declined in some others.

The variability of the enforcement measure across regions is in line with expectations. First, labor inspections are led and carried out by regional agencies with jurisdiction in each region. The decentralization of the inspection activities jointly to the flexibility and discretion of labor inspectors in the Peruvian system (Piore and Schrank, 2008), may result in regional agencies pursuing different objectives and even to corruption practices. In fact, the low level of remuneration received by labor inspectors in Peru is considered a determinant of corruption

² The tax units are units of reference used for tax purposes. For instance, the tax unit was set at 3700 nuevos soles in December 2013 (1329 USD).

³ Domestic workers are not entitled to a minimum wages and their activity is not subject to labor inspections (Díaz, 2014).

(Requejo Aleman, 2013). Second, labor inspection resources, i.e. number of labor inspectors and means of transportation, are unevenly distributed across regions (Díaz, 2014; Julca Babarzy, 2013; Requejo Alemán, 2013).

3. Patterns of violations of labor market regulation

3.1 Sample and Variables Definition

I use information from the Peruvian household survey (ENAHO) where workers report their own working conditions. The analyzed period extends from 2004 (some labor benefits were not captured by the ENAHO before 2004) to 2013 (some changes to the labor inspection system were introduced in 2013 and became operative in 2014).⁴ Information on labor benefits includes enrolment into the pension system and having a labor contract. Surveys also collect information on the number of hours of work during the last week and labor earnings that I compare with the legislated maximum of weekly hours of work and with the minimum wage respectively. The sample comprises wage employees from the private sector aged 15 to 65 (the legislated retirement age) and excludes domestic workers who are not entitled to a minimum wage and are not subject to labor inspections (Díaz, 2014). To compare the monthly labor income with the minimum wage, I consider the national minimum wage that was in place in the previous month each worker was interviewed; this data comes from the Ministerio de Trabajo y Promoción del Empleo. For workers in the agricultural and livestock sectors and for workers in the mining sector I use their specific minimum wages.⁵ For individuals working less than 4 hours a day, the minimum wage is proportional to the number of hours worked according to the Peruvian legislation. I include this adjustment in the calculations.

With this information I construct indicator variables for whether a wage employee is suffering a violation of each labor benefit considered separately, and for whether a wage employee is suffering multiple violations of labor regulations. The measures of individual violations and of multiple violations are defined as follows. Let v_i^j be an indicator variable for

⁴ A central authority of the labor inspection system was created in 2013, the Superintendencia Nacional de Fiscalización Laboral or SUNAFIL. The SUNAFIL started operating in April 2014 and centralizes most inspection activities. This change in the distribution of labor inspection functions prevents from using year 2014 in the econometric analysis in Section 4, where I rely in the regional and time variation of the enforcement effort.

⁵ The minimum wage in the mining sector is 25% higher than the national minimum wage (Order 030-89-TR). For workers employed in the agricultural and livestock sectors, the minimum wage is set in a daily base and grows at the same pace than the national minimum wage (Law 27360). I calculate the monthly minimum wage assuming full time workers, i.e., I multiple daily minimum wage * 5 days of work per week * 4.33 weeks in a month.

whether individual i is deprived of labor benefit j , where j could be enrolment into the pension system, having a labor contract, earning a wage equal or above the minimum wage, and working no more than the maximum weekly hours:

$$v_i^j = \begin{cases} 1 & \text{if labor benefit}_i^j = 0 \\ 0 & \text{if labor benefit}_i^j = 1 \end{cases} \quad (1)$$

V^j is the measure of violation of labor benefit j and is defined as the average value of v_i^j for the sample of wage employees:

$$V^j = \sum_{i=1}^N \frac{v_i^j}{N} \quad (2)$$

\mathbb{V}^k is the indicator of multiple violations of labor regulations and is defined as the average of an indicator variable for whether each individual i is deprived of k labor benefits, with $k = 1, 2, 3, 4$:

$$\mathbb{V}^k = \sum_{i=1}^N \frac{I_i^k}{N} \quad (3)$$

where

$$I_i^k = \begin{cases} 1 & \text{if } \sum_{j=1}^J v_i^j = k \\ 0 & \text{if } \sum_{j=1}^J v_i^j \neq k \end{cases}$$

3.2 Patterns of Individual Violations of Labor Regulations

In this sub-section, I describe the patterns of individual violations of labor market regulations distinguishing by worker characteristics, employment characteristics, and regions.

Table 1 shows that on average, 38% of wage employees covered by the minimum wage earned below that level between 2004 and 2013 (column a). The level of minimum wage violation fell substantially over the period, from 42% in 2004 to 34% in 2013. The reducing trend was interrupted in 2011 and 2012, but resumed after that. The increase in the level of minimum wage violation coincided with a large rise in the real minimum wage and in the Kaitz index (ratio between the minimum wage and average labor income). The minimum wage

shortfall (column b) was 15%, while it reached 41% for those earning below the minimum wage level (column c).⁶

The percentage of wage employees working more than the legal maximum of weekly hours was 34% on average. This share followed a declining trend over time, falling from 35% in 2004 to 30% in 2013. The violation of the enrolment into the pension system was as high as 55% on average. However, the non-compliance with this regulation fell substantially from 61% in 2004 to 48% in 2013. Finally, the share of workers without a labor contract was 52% on average, and decreased from 57% in 2004 to 47% in 2013.

Panel A of Table 2 presents the results when the sample is broken down according to worker characteristics. Young workers (workers aged 14-17 and 18-24) are more likely to suffer from violations of labor regulations than their adult counterparts (workers aged 25-55 and 56-65). This result is in accordance to previous evidence for Peru and other Latin American countries (Cruces et al., 2017). Young workers usually begin their labor market career in positions where they do not have access to labor benefits, but it has been argued that they can potentially obtain training and experience for better jobs in the future that they could not get right out of school (Bosch and Maloney, 2010). This is true for the minimum wage, the enrolment into the pension system and labor contract regulations, and also for the minimum wage shortfall. For the maximum of weekly hours of work, results indicate that the non-compliance level is higher for workers aged 18-24 and 25-55. There is no clear pattern of violation of labor market regulations by sex. The non-compliance with the minimum wage regulation is larger among women, as is also the shortfall among workers earning below the minimum. The opposite occurs with the maximum hours of work per week and labor contract regulations, i.e. the non-compliance level is larger among men. The share of workers not enrolled into the pension system is roughly the same among men and women. Workers with higher levels of education are less likely to suffer from violations of labor market regulations. That is true for the minimum wage, pension and labor contract regulations, and also for the minimum wage shortfall. The non-compliance for workers with a superior level of education is less than half the value for workers with primary education. The only exception to this pattern is the maximum of weekly hours of work. The distinction by race shows that

⁶ The minimum wage shortfall is defined as the difference between the minimum wage and the earned monthly wage as a percentage of the minimum wage for people earning below the minimum, and takes the value zero for people earning equal or above the minimum.

indigenous workers suffer from higher levels of labor standard violations compared to non-indigenous workers for all labor regulations considered.

Panel B of Table 2 presents the results obtained when workers are grouped according to employment characteristics. The levels of violation of the minimum wage, pension and labor contract regulations decrease with the size of the firm where workers are employed. This is in line with expectations as large firms are more visible and can be subject to labor inspections with a higher probability than small firms. On the contrary, the pattern of non-compliance with the maximum hours of work regulation shows higher levels of violation for larger firms, although the discrepancies with firms of medium and small size are small. The distinction by economic sectors shows that more than half of agricultural workers face violations of minimum wage, pension or labor contract regulations, and a minimum wage shortfall of 51%. The non-compliance with the hours of work regulation is the lowest for them compared to workers from other economic sectors. Services workers are the less affected compared to other sectors. Around one third of them earns below the minimum wage, works more than the maximum of weekly hours, is not enrolled into the pension system or does not have a labor contract. Labor standard violations for manufacturing and construction workers are in between the levels registered by agricultural and services workers.

Labor standards violations also differ by region. Figure 2 shows that minimum wage violations range from a minimum of 23% in Callao to a maximum of 59% in Amazonas. There is also large heterogeneity in the minimum wage gap by region. Ica is the region with the lowest level of violation of the enrolment into the pension system with a non-compliance rate of 30%. At the other end of the scale, the share of not enrolled workers is as high as 74% in Amazonas. For the labor contract regulation, Callao is again the region with the best performance, with 38% of its workers without a labor contract. The maximum level of non-compliance with the labor contract regulation is 67% in Amazonas. Finally, the lowest violation to the hours of work regulation is found in Cajamarca where the non-compliance rate is 17%, while the maximum is in Madre de Dios with a non-compliance rate of 39%. Besides the regions located at the extremes of the violation space (Callao and Amazonas mainly), other regions with low levels of non-compliance with labor laws are Lima, Ica and Moquegua. These regions, jointly to Callao, belong to the urban coast area of the country. Among the regions with high non-compliance levels, Apurimac and San Martin share with Amazonas the highest positions in the ranking of

violations of labor regulations. These regions belong mainly to the jungle area, both rural and urban, and to the rural mountain area of the country.

3.3 Patterns of Multiple Violations of Labor Regulations

The statistics presented in the previous sub-section showed a general pattern of low compliance with the labor law in Peru between 2004 and 2013. The four labor regulations considered were violated for at least one third of the workers in the sample when they were analyzed separately. The next questions refer to the pattern of multiple violations of labor regulations in Peru. What was the share of workers for whom the four labor regulations considered were violated? What was the share of workers receiving only one, two or three of the labor benefits? What was the share receiving all of them?

Table 3 shows the distribution of workers according to the number of violations of labor regulations they suffered. During the period 2004-2013, around 71% of workers in the sample were deprived of one, two or three out of four labor benefits covered in the survey. Specifically, 29% of workers bore three violations of labor regulations, 20% suffered the violation of two of the four labor regulations, and 22% suffered the violation of one labor law over the period. The remaining workers are mainly in the zero violations category, 22%, while 7% did not receive any of the four labor benefits (four violations).

The pattern of multiple violations changed over time. The shares of workers suffering the violation of three or four labor regulations fell between 2004 and 2013, while the shares being deprived of none, one or two labor benefits increased. Figure 3 presents the variations over time. The largest changes were the reduction in the share of workers reporting three violations (drop of 10 percentage points) and the increase in the share with zero violations of the labor law (rise of 7 percentage points).

The pattern of multiple violations of the labor law differs according to worker characteristics. Table 4 presents the results in Panel A. There is a negative relation between age and the number of labor regulations being violated as expected. The shares of young workers (aged 14-17 or 18-24) deprived of three or four labor rights are larger than the shares of adult workers (aged 25-55 or 56-65) in a similar situation. For instance, 66% of workers aged 14-17 suffered the non-compliance with three labor regulation, while that figure was 23% for workers aged 25-55. There is no clear pattern of multiple violations by gender. The shares of women without any violations

of the labor laws and with four violations are larger than the shares of men. For one, two, and three violations, the shares of men surpass the shares of women. There is a negative relation between the number of violation and the level of education. For instance, the share of workers with high level of education suffering zero violations is 40% while the share suffering four violations is 2%. The corresponding figures for workers with low level of education are 5% and 11% respectively. Indigenous workers are more deprived from labor benefits than non-indigenous workers. The shares of indigenous workers suffering two, three or four violations of labor regulations are larger compared to the shares of non-indigenous workers. At the other end of the scale, the shares of workers with zero or one violation of the labor laws are larger for non-indigenous workers compared to indigenous workers.

Panel B of Table 4 presents the pattern of multiple violations by employment characteristics. Following the evidence in previous sub-section, the pattern tends to improve with the size of the firms where workers are employed. The shares of workers with zero or one violation of the labor laws are larger for workers in large firms compared to small firms, and for workers in small size firms compared to workers in micro firms. On the contrary, the shares of workers suffering three or four violations of the labor laws decrease with the size of the firm. Workers from agriculture and construction sectors suffer more violations of the labor law compared to workers from services and manufacturing: 78% of agricultural workers and 69% of construction workers are deprived from two, three or four labor benefits. These figures are 57% and 46% for manufacturing and services workers respectively.

Figure 4 shows the regional variation in the number of violations of labor regulations. The share of workers suffering four violations of the labor law is small in general, and hardly surpasses 10% (11% in Lambayeque). There is a large variability in the share of workers deprived of three out of four labor benefits. Ica is the region with the smallest share (17%), while Amazonas has the maximum value, with half of its workers suffering three violations of the labor law. The share of workers with two violations of labor market regulations ranges from a minimum of 12% in Huancavélica to a maximum of 23% in Madre de Dios. Finally, Amazonas and San Martín –regions that belong to the jungle area of the country- have the smallest shares of workers with one and zero violations of the labor rules respectively (11% and 15%). Ica and Moquegua are at the other end of the scale with the largest shares of workers with one and zero violation of labor rules (31% and 32%).

All in all, the pattern of multiple violations of labor regulations shows that most workers receive some of the labor benefits considered, i.e. the share of workers suffering four violations is small, but very few of them receive all of them, i.e. the share of workers with zero violations is also very small. This result reveals that firms do not restrict their choices to comply with all the regulations or to not comply with any of them. Some potential factors affecting this decision is the way the labor inspection system works, imposing different monetary fines depending on the severity of the violation detected and assigning a cap to the total penalty a non-compliant firm pays. Next section analyses these potential factors in more detail.

4. Impact of Enforcement of Labor Regulations on the Pattern of Multiple Violations

4.1 Theoretical Discussion

In a context of imperfect enforcement, as is the case of Peru, a profit maximizing firm can decide to comply with all labor market regulations (perfect compliance), to comply with only some of them (partial compliance), or to evade all the labor rules (non-compliance). There is a benefit for evading labor regulations (labor costs savings), but there are also some costs (the monetary fine a firm has to pay if discovered not complying with the labor rules and the potential difficulties to access to new markets or to improve technology). Evasion of labor regulations can also be explained by lack of information (Schrank, 2013). Although unintended, non-compliant firms due to lack of knowledge/information are also obtaining a benefit in the form of reduced labor costs.

A pattern of partial compliance can be explained by the different net benefit associated to the evasion of each labor rule. Each labor benefit implies a different labor cost for a firm, and the fine in case of being discovered depends on the severity of the violation in Peru, which differs according to the labor regulation considered and on the number of workers affected. For instance, the non-compliance with the minimum wage regulation is a very serious violation, while the non-compliance with the enrolment into the pension system is considered a serious violation. Additionally, there is a maximum to the total fine a firm pays in Peru. I expect a firm to decide the optimal mix of labor regulation to evade and the number of workers affected as a function of the specific labor cost being saved and on the potential monetary fine given the technology, level of capital, market conditions, and the degree of enforcement of labor market

regulations. The optimal decision may be to violate all labor regulations, to violate only some of them, or not to violate any labor rule.

An increase in the enforcement effort may have an impact on this decision because it implies an increase in the expected costs of evading the labor rules –due to a higher probability of being discovered and fined (deterrence effect). Thus, an increase in compliance is expected when the degree of enforcement increases. Considering an initial situation of partial compliance or non-compliance, the deterrence effect may imply a reduction in the probability of suffering any violation and a final situation of perfect compliance. However, the characteristics of the inspection system in Peru, where the monetary fine for not complying with the labor rules depends on the labor rights being violated and the number of workers affected, may generate incentives to adjust only partially (fine reduction effect). An increase in enforcement may generate a reduction in the probability of suffering a large number of violations to the labor rules, and an increase in the probability of suffering the violation of only some of them.⁷ For instance, a firm violating the minimum wage regulation and other labor rights can adjust and start paying above the minimum to avoid being penalized for a very serious violation. In the final situation, the compliance is partial, but there was an improvement in terms of the number of labor rights being violated.

There are some secondary effects associated to a stricter level of enforcement. The increased compliance due to the higher probability of detection translates into higher labor costs for a firm. Firms may lay off workers as an adjustment mechanism. A possible associated effect is that workers who lose their jobs may offer their hours of work in the informal sector of the economy, where firms are not inspected (movement into the informal sector effect). The movement into the informal sector will depend on workers' valuation of the benefits being enforced and may lead to a growth in the share of workers not covered by labor benefits.

Summing up, several forces are at play when analyzing the impacts of a stricter level of enforcement. First, the deterrence effect can generate an increase in the compliance with all or some of the labor rules being violated. Second, because fines depend on the severity of the violation and on the number of workers affected, the increased compliance may be only partial, implying a reduction in the probability of suffering the violation of several labor benefits and an increase in the probability of suffering the violations of only some of them. Third, laid off

⁷ Similarly, a firm can adjust by reducing the number of workers affected by the violation.

workers may find a job in the informal sector of the economy, increasing the non-compliance with the labor rules. For all these reasons, the impact of an increase in enforcement may differ with the number of violations considered. In the next sub-section, I will estimate the effect of a change in an enforcement measure on the probability of suffering multiple violations of labor regulations. The results will show the net effect of all these forces and I will be able to identify which one dominates. In an additional exercise, I will try to disentangle the movement into the informal sector effect from the fine reduction effects.

4.2 Econometric Strategy

This sub-section estimates the causal impact of enforcement of labor regulation on the patterns of multiple violations described previously. To this end, a set of four probit regression models are estimated where the dependent variables are indicators of the number of labor regulations being violated. The regression equations take the following form:

$$\Pr(Y_{irt}^j = 1 | X = x_{irt}) = \Phi(x_{irt}\beta) \quad j = 1,2,3,4 \quad (4)$$

The dependent variable Y_{irt}^j takes the value 1 if person i located in region r in year t suffers the violation of j labor regulations, with j taking the value 1 to 4 (the number of regulations covered by the Peruvian ENAHO), and 0 otherwise. X is a vector of explanatory variables, β are the parameters to be estimated, and $\Phi(\cdot)$ is the standard normal cumulative distribution function. The vector of explanatory variables includes the enforcement measure presented in section 2.3, a set of individual, employment and region characteristics. Specifically, the measure of enforcement is defined as the logarithm of the number of labor inspections per hundred salaried workers in region r and year t . The set of individual characteristics includes sex, indicator variables for age groups, indicator variables for level of education, years of tenure, and indicator variables for whether or not the person is indigenous or lives in an urban area. The employment characteristics considered are the size of the firm where each worker is employed, indicator variables for sector of activity, an indicator variable for whether the firm uses the accounting books required by the tax authority (proxy for the formality status of the firm), and the Kaitz index calculated for each economic sector and year. The region characteristics are the unemployment rate, the fiscal result as a share of total fiscal incomes, the logarithm of the per capita household income, and the logarithm of the number of orientation orders in each region

and year. The model also includes region and year fixed effects. Standard errors are clustered at the region level.

The enforcement measure may be endogenous in this setting for at least two reasons. First, the compliance with labor market regulations can have an impact on the level of enforcement, i.e. low compliance levels may lead authorities to increase the enforcement effort. Second, the enforcement measure can be correlated with unobserved institutional and development time-varying variables at the region level, which are not captured by region fixed effects. To deal with these potential sources of endogeneity I instrument the enforcement variable with a measure of the arrival cost of labor inspectors to the firms, as in Viollaz (2018). The instrument is based on the way the Peruvian labor inspection system works. Labor inspectors travel by car from the regional agency to the firms to be inspected in some location of the same region. The extension of the region road network and the traffic in the network contain information on the arrival costs. On the one hand, a wider road network should be associated to a higher geographic dispersion of firms, increasing the cost of arrival. On the other hand, a larger number of vehicles in the road network should increase the arrival cost as well. Let RN_{rt} be the extension of the region road network (national plus regional roads) in kilometers divided by the region territory, T_{rt} be the number of per capita crossing vehicles in the road network in region r and year t . The arrival cost is defined as the logarithm of the number of per capita crossing vehicles per kilometer of the ratio territory–region road network:

$$Z_{rt} = \log(RN_{rt} * T_{rt}). \quad (5)$$

A possible threat to this instrumental variable strategy is that the extension of the road network and the traffic may be capturing the development level of each region, violating the exclusion restriction of the instrument. I expect to be capturing the development level with the region fixed effects and regional regressors with variation over time (unemployment rate, fiscal result as a share of total fiscal incomes, and the logarithm of the per capita household income).⁸

I present the results of the first stage in Table 5 for different specifications. Column (1) controls for individual characteristics, region and year fixed effects. Column (2) adds employment characteristics, while Column (3) includes region characteristics. The arrival cost measure is negative and highly significant in all specifications. Furthermore, estimates are quite

⁸ Regional inspection agencies are based in the main cities of each region (e.g. capital city) where a large share of firms is expected to be located. A measure of the geographic dispersion of firms would improve the instrument as an arrival cost measure. However, I do not expect the lack of this information to affect the validity of the instrument.

stable across models and indicate that for each 1% of increase in the arrival cost measure, the enforcement effort declines in around 0.16%-0.18%. To put these values in context, the average annual change in the arrival cost measure was 6.9%, meaning a reduction in the enforcement level of 1.10%-1.24%.

4.3 Estimation results

Table 6 provides the estimated average marginal effects from probit models (4) when controlling for the measure of enforcement of labor regulations, individual, employment and region characteristics. Table A1 in the Appendix presents the results for the probit models without instrumenting the enforcement measure.

The effect of the enforcement measure –the logarithm of the number of labor inspection orders per hundred workers, on the probability of suffering violations of the labor law is not monotonous, changing from positive to negative when the number of violations increases. First, there is a negative impact on the probability of suffering four violations of labor regulations (significant at 1% level). Specifically, a 10% increase in the enforcement effort leads to an average reduction of 0.5 percentage points in the probability of being deprived of four labor rights. This is in accordance to expectations; when the enforcement effort increases, non-compliant firms perceive a higher chance of being detected and fined. A complementary explanation is in the educating role of labor inspections. Firms may evade labor regulations because of lack of information and labor inspectors can fill this gap (Schrank, 2013). Second, there is a positive impact of an increase in the degree of enforcement on the probability of suffering one or three violations of labor regulations (significant at 10% level) –average increases of 0.7 and 0.3 percentage points for each 10% of increase in the enforcement measure. Two different forces may be at play here. On the one hand, firms may choose to comply with some of the labor rules they were evading, but not with all of them (fine reduction effect). This strategy, where the final compliance levels is partial, can be explained as an attempt to reduce the amount of the potential fine in case of being caught by labor inspectors and by the financial difficulty of complying with all the rules. On the other hand, workers who were laid off in the adjustment process may offer their hours of work in the informal sector of the economy, increasing the share of workers suffering one or three violations of labor regulations (moving to the informal sector effect). The following sub-section intends to disentangle these two forces.

4.4 Additional Results

I obtained additional results by estimating previous models for firms using and not using the accounting books required by the tax authority separately. I will be using this information as a proxy for firms' formality status. With these estimations I will try to separate the part of previous findings that is explained by the fine reduction effect from the part explained by the movement into the informal sector effect.

Results are presented in Table 7 for formal firms (Panel A) and informal firms (Panel B). Estimates show that the previous reduction in the probability of suffering four violations of labor regulations as a result of an increase in enforcement is only present for formal firms. The reason is simple. The deterrence effect of labor inspections only applies to formal firms which are the subject of inspections. The increase in the probability of suffering three violations of labor regulations is found in informal firms only. The impact on formal firms is in fact negative, although not significant. This finding indicates that the movement into the informal sector effect is dominating over the fine reduction effect. Some workers are moving into the informal sector, probably after being laid off from a formal position. There is a reduction in the probability of suffering two violations for workers in informal firms. This result cannot be interpreted as a deterrence effect of labor inspections (informal firms are not subject to inspections and fines in the Peruvian system), but could be explained by the guidance/information role of labor inspectors in informal firms. Finally, there is an increase in the probability of suffering one violation of labor regulations in formal firms which is close to be significant at 10% level. This increase can be explained by the fine reduction effect, i.e., an increase in the enforcement effort leads to a reduction in the probability of suffering four violations of labor regulations in formal firms and a simultaneous increase in the chances of suffering only one. Firms start complying with some of the rules they were evading, but the final level of compliance is partial.

5. Conclusions

This paper has made two important contributions to the empirical literature quantifying labor law violations and how the enforcement of the labor law can have an impact on the compliance level by considering the possibility of different labor regulations being violated simultaneously.

First, descriptive results over the period 2004-2013 revealed that multiple violations of labor regulations are an important feature of Peruvian labor markets. More than half of wage

employees were deprived of two or more labor benefit during the analyzed period, and while most workers receive some of the labor benefits covered by household surveys (the share of workers suffering four violations was small), very few receive all of them (the share of workers with zero violations was also very small). The patterns of multiple violations by worker and employment characteristics showed that young workers, workers with low level of education and indigenous workers have higher chances of being deprived of several labor benefits simultaneously –three or four. Similar results were found for workers in micro firms and workers employed in the agricultural sector.

Second, previous evidence has shown that enforcement of labor market regulation is not effective in Peru when analyzing the compliance with different labor benefits one at a time. This paper found that the enforcement effort has an impact on the pattern of multiple violations of labor regulations. On the one hand, the labor inspection system is effective in detecting and penalizing situations of multiple violations of the labor law, i.e., the probability of being deprived of four labor benefits falls when enforcement increases. This effect is explained by the deterrence effect of labor inspections in formal firms. On the other hand, the impact on the probability of suffering one or three violations of the labor law is positive, suggesting that firms adjust only partially as an attempt to reduce the amount of a potential fine if discovered, and that laid off workers during the adjustment process moved to the informal sector where firms are not inspected.

These findings are useful from a policy perspective. They indicate that the inspection system has been successful in identifying extreme situations of non-compliance with labor rules, i.e., there is a reduction in the probability of suffering four violations. However, there is still space to improve firms' incentives when facing an increase in the enforcement effort, i.e., the combination of different penalties depending on the labor regulation being violated and the cap to the total monetary fine. Despite the perceived increase in the probability of being discovered by labor authorities, the evidence has shown that firms stick to partial compliance.

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Tables

Table 1: Violations of labor market regulations

| | Minimum wage | | | Minimum wage | Kaitz index | Hours of work | Pensions | Labor contract |
|---------|---------------|---------------|-------------|--------------|-------------|---------------|----------|----------------|
| | Violation (a) | Shortfall (b) | (c)=(b)/(a) | | | | | |
| 2004 | 42.42 | 18.50 | 43.60 | 464.02 | 0.70 | 35.33 | 60.99 | 56.89 |
| 2005 | 44.43 | 19.80 | 44.55 | 458.16 | 0.70 | 35.78 | 63.74 | 57.59 |
| 2006 | 42.49 | 19.23 | 45.25 | 490.54 | 0.70 | 35.33 | 59.97 | 55.70 |
| 2007 | 40.42 | 17.01 | 42.08 | 481.30 | 0.66 | 34.36 | 56.14 | 53.65 |
| 2008 | 38.93 | 15.30 | 39.29 | 488.87 | 0.67 | 35.43 | 55.56 | 51.85 |
| 2009 | 33.53 | 13.56 | 40.44 | 486.85 | 0.62 | 33.71 | 52.65 | 51.00 |
| 2010 | 31.32 | 12.51 | 39.93 | 478.68 | 0.61 | 33.32 | 52.22 | 52.79 |
| 2011 | 34.38 | 12.46 | 36.24 | 519.05 | 0.66 | 32.26 | 49.71 | 49.71 |
| 2012 | 35.90 | 13.35 | 37.18 | 579.75 | 0.69 | 30.49 | 48.02 | 47.35 |
| 2013 | 33.79 | 12.55 | 37.15 | 587.09 | 0.68 | 29.64 | 47.80 | 47.34 |
| Average | 37.76 | 15.43 | 40.57 | 503.43 | 0.67 | 33.56 | 54.68 | 52.39 |

Source: Own elaboration based on Encuesta Nacional de Hogares.

Notes: Minimum wage in local currency unit of 2005. Kaitz index defined as the ratio between monthly minimum wage and average monthly labor earnings.

Table 2: Violations of labor market regulations by worker and firm characteristics
Average 2004-2013

| | Minimum wage | | | Hours of work | Pensions | Labor contract |
|---------------------------|---------------|---------------|-------------|---------------|----------|----------------|
| | Violation (a) | Shortfall (b) | (c)=(b)/(a) | | | |
| Panel A | | | | | | |
| <i>Group of age</i> | | | | | | |
| [14,17] | 76.17 | 42.54 | 0.56 | 25.66 | 99.62 | 97.06 |
| [18,24] | 50.40 | 20.74 | 0.41 | 34.21 | 77.37 | 68.15 |
| [25,55] | 29.59 | 10.75 | 0.36 | 34.13 | 43.80 | 43.23 |
| [56,65] | 32.95 | 13.61 | 0.41 | 26.05 | 32.05 | 42.62 |
| <i>Gender</i> | | | | | | |
| Women | 44.51 | 18.62 | 0.42 | 26.24 | 53.13 | 46.38 |
| Men | 32.71 | 12.75 | 0.39 | 37.06 | 53.76 | 54.55 |
| <i>Level of education</i> | | | | | | |
| Primary | 62.76 | 30.31 | 0.48 | 29.43 | 81.32 | 84.91 |
| Secondary | 41.59 | 16.61 | 0.40 | 41.03 | 65.60 | 66.61 |
| Superior | 23.42 | 7.83 | 0.33 | 26.37 | 31.73 | 24.95 |
| <i>Race</i> | | | | | | |
| Non-indigenous | 35.29 | 13.59 | 0.39 | 32.06 | 49.13 | 47.69 |
| Indigenous | 43.57 | 19.60 | 0.45 | 32.67 | 62.81 | 60.96 |
| Panel B | | | | | | |
| <i>Size of firm</i> | | | | | | |
| [1,10] | 55.87 | 25.39 | 0.45 | 34.31 | 83.67 | 89.23 |
| [11,100] | 29.17 | 9.50 | 0.33 | 36.90 | 50.17 | 44.16 |
| [101, +) | 15.16 | 3.33 | 0.22 | 42.33 | 18.46 | 11.67 |
| <i>Economic sector</i> | | | | | | |
| Agriculture | 61.30 | 31.23 | 0.51 | 22.93 | 74.54 | 77.40 |
| Manufacturing | 32.22 | 11.27 | 0.35 | 45.24 | 53.50 | 53.37 |
| Construction | 27.79 | 11.50 | 0.41 | 32.58 | 63.05 | 74.34 |
| Services | 32.86 | 11.78 | 0.36 | 32.91 | 46.17 | 40.36 |

Source: Own elaboration based on Encuesta Nacional de Hogares.

Table 3: Multiple violations of labor market regulations

| | Zero violations | One violation | Two violations | Three violations | Four violations |
|----------------|--------------------|------------------|-------------------|---------------------|--------------------|
| 2004 | 19.39 | 18.32 | 18.62 | 34.47 | 9.19 |
| 2005 | 16.79 | 19.28 | 19.12 | 35.20 | 9.60 |
| 2006 | 19.06 | 19.90 | 18.08 | 34.42 | 8.54 |
| 2007 | 20.82 | 21.18 | 18.88 | 30.86 | 8.26 |
| 2008 | 21.01 | 22.13 | 18.66 | 30.45 | 7.74 |
| 2009 | 23.86 | 21.99 | 19.97 | 27.70 | 6.48 |
| 2010 | 22.69 | 23.11 | 21.48 | 27.31 | 5.42 |
| 2011 | 23.06 | 24.71 | 20.88 | 25.84 | 5.51 |
| 2012 | 25.33 | 23.84 | 20.29 | 24.78 | 5.76 |
| 2013 | 26.15 | 23.45 | 21.10 | 24.22 | 5.07 |
| Average | 21.82 | 21.79 | 19.71 | 29.52 | 7.16 |

Source: Own elaboration based on Encuesta Nacional de Hogares.

Table 4: Multiple violations of labor market regulations by worker and firm characteristics
Average 2004-2013

| | Zero violations | One violation | Two violations | Three violations | Four violations |
|---------------------------|--------------------|------------------|-------------------|---------------------|--------------------|
| Panel A | | | | | |
| <i>Group of age</i> | | | | | |
| [14,17] | 0.07 | 1.17 | 15.75 | 66.21 | 16.81 |
| [18,24] | 8.69 | 15.20 | 24.70 | 40.15 | 11.26 |
| [25,55] | 27.70 | 26.07 | 18.80 | 22.63 | 4.81 |
| [56,65] | 33.98 | 25.11 | 17.80 | 19.49 | 3.62 |
| <i>Gender</i> | | | | | |
| Women | 26.97 | 20.27 | 16.76 | 27.49 | 8.51 |
| Men | 19.81 | 23.36 | 21.64 | 29.32 | 5.87 |
| <i>Level of education</i> | | | | | |
| Primary | 4.57 | 9.51 | 20.20 | 54.40 | 11.33 |
| Secondary | 10.97 | 18.97 | 23.77 | 36.79 | 9.49 |
| Superior | 40.12 | 29.93 | 15.81 | 11.60 | 2.53 |
| <i>Race</i> | | | | | |
| Non-indigenous | 24.75 | 23.92 | 19.60 | 25.84 | 5.89 |
| Indigenous | 17.71 | 17.77 | 20.15 | 35.51 | 8.85 |
| Panel B | | | | | |
| <i>Size of firm</i> | | | | | |
| [1,10] | 2.84 | 8.12 | 25.11 | 51.00 | 12.93 |
| [11,100] | 21.32 | 28.04 | 23.83 | 22.53 | 4.27 |
| [101, +) | 38.05 | 43.31 | 12.49 | 5.26 | 0.88 |
| <i>Economic sector</i> | | | | | |
| Agriculture | 9.08 | 12.41 | 18.05 | 54.16 | 6.29 |
| Manufacturing | 17.92 | 24.68 | 20.95 | 28.02 | 8.42 |
| Construction | 10.47 | 20.75 | 32.97 | 32.17 | 3.64 |
| Services | 29.16 | 24.58 | 18.05 | 21.17 | 7.03 |

Source: Own elaboration based on Encuesta Nacional de Hogares.

Table 5: Enforcement of labor market regulations and arrival cost of labor inspectors

| Dependent variable: | Enforcement measure | | |
|----------------------------|-----------------------|-----------------------|-----------------------|
| log(RN*T) | -0.155 (0.0504)*** | -0.155 (0.0502)*** | -0.169 (0.0497)*** |
| Region and Year FE | Yes | Yes | Yes |
| Individual characteristics | Yes | Yes | Yes |
| Employment characteristics | No | Yes | Yes |
| Region characteristics | No | No | Yes |
| Observations | 83,322 | 83,322 | 83,322 |
| R-squared | 0.794 | 0.795 | 0.800 |

Source: Own elaboration based on Encuesta Nacional de Hogares and Ministerio de Trabajo y Promoción del Empleo.

Notes: OLS estimations. RN: sum of national and regional roads/region territory. T: per capita crossing vehicles. Robust standard errors clustered at the region level between parentheses. *** significant at 1%, ** significant at 5%, * significant at 10%.

Table 6: Average marginal effects of a probit model for the probability of suffering one, two, three or four violations of labor regulations. Instrumental variables estimation

| | IV Probit | | | |
|-------------------------------------|-------------------|-------------------|-------------------|---------------------|
| | One violation | Two violations | Three violations | Four violations |
| <i>Enforcement measure</i> | | | | |
| Log of #inspections per 100 workers | 0.067 (0.036)* | -0.037 (0.061) | 0.029 (0.017)* | -0.050 (0.025)** |
| Individual characteristics | Yes | Yes | Yes | Yes |
| Employment characteristics | Yes | Yes | Yes | Yes |
| Region characteristics | Yes | Yes | Yes | Yes |
| Observations | 83,322 | 83,322 | 83,322 | 83,322 |
| Predicted probability | 0.206 | 0.225 | 0.329 | 0.078 |

Source: Own elaboration based on Encuesta Nacional de Hogares and Ministerio de Trabajo y Promoción del Empleo.

Notes: Robust standard errors clustered at the region level between parentheses. Enforcement measure instrumented by a measure of the arrival cost of labor inspectors. *** significant at 1%, ** significant at 5%, * significant at 10%.

Table 7: Average marginal effects of a probit model for the probability of suffering one, two, three or four violations of labor regulations. Formal and informal firms. Instrumental variables estimation

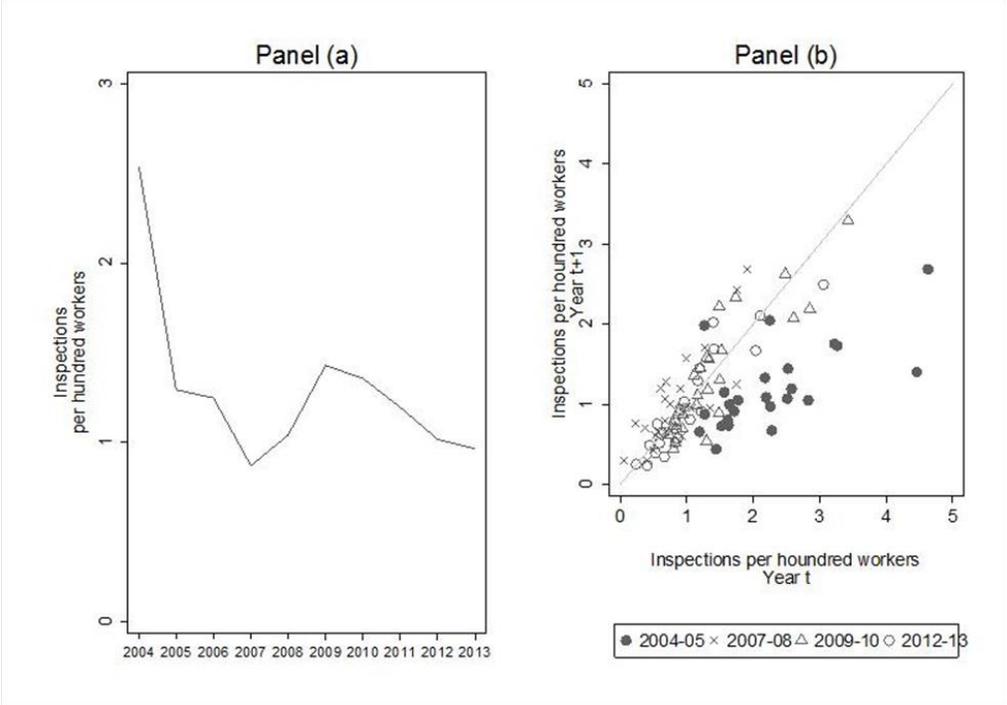
| Dependent variable: | Log of #inspections per 100 workers | Number of labor regulations being violated | | | |
|-------------------------------------|---|--|--------------------|---------------------|----------------------|
| | | One violation | Two violations | Three violations | Four violations |
| A) Formal firms: | | | | | |
| <i>First stage result</i> | | | | | |
| log(RN*T) | -0.192 (0.0595)*** | | | | |
| <i>Second stage result</i> | | | | | |
| Log of #inspections per 100 workers | | 0.103 (0.063) | 0.043 (0.101) | -0.026 (0.038) | -0.048 (0.018)*** |
| Observations | 42,257 | 42,257 | 42,257 | 42,257 | 42,257 |
| R-squared | 0.815 | | | | |
| Predicted probability | | 0.317 | 0.200 | 0.166 | 0.044 |
| B) Informal firms: | | | | | |
| <i>First stage result</i> | | | | | |
| log(RN*T) | -0.152 [0.0433]*** | | | | |
| <i>Second stage result</i> | | | | | |
| Log of #inspections per 100 workers | | 0.019 0.021 | -0.098 (0.056)* | 0.076 (0.044)* | -0.023 0.043 |
| Observations | 41,065 | 41,065 | 41,065 | 41,065 | 41,065 |
| R-squared | 0.791 | | | | |
| Predicted probability | | 0.061 | 0.260 | 0.546 | 0.122 |

Source: Own elaboration based on Encuesta Nacional de Hogares and Ministerio de Trabajo y Promoción del Empleo.

Notes: Robust standard errors clustered at the region level between parentheses. Enforcement measure instrumented by a measure of the arrival cost of labor inspectors. *** significant at 1%, ** significant at 5%, * significant at 10%.

Figures

Figure 1: Pattern of enforcement of labor market regulations over time and across regions



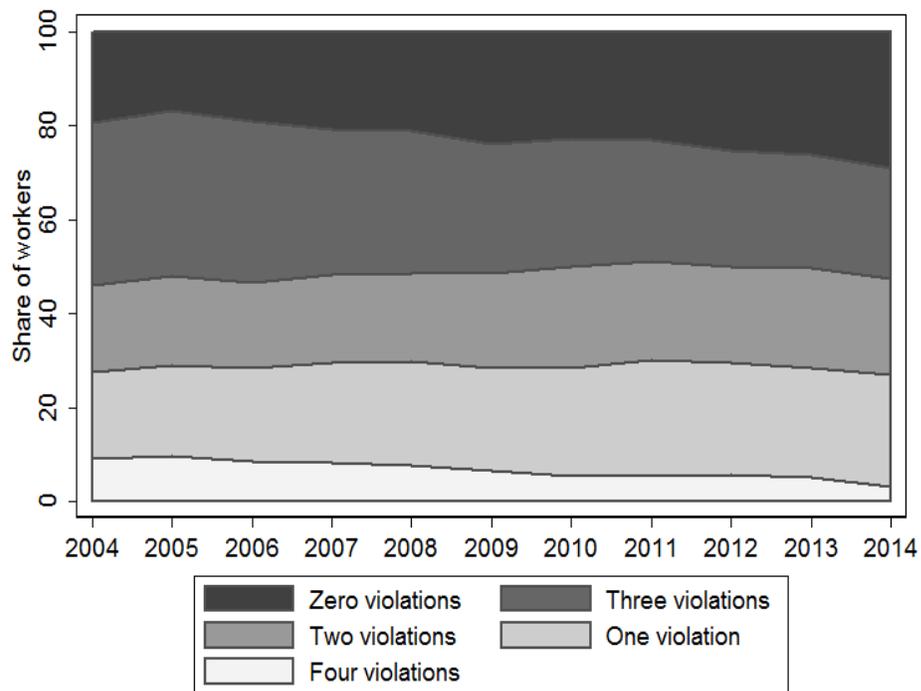
Source: Own elaboration based on Ministerio de Trabajo y Promoción del Empleo.

Figure 2: Violations of labor market regulations by region
Average 2004-2013. In percentages.



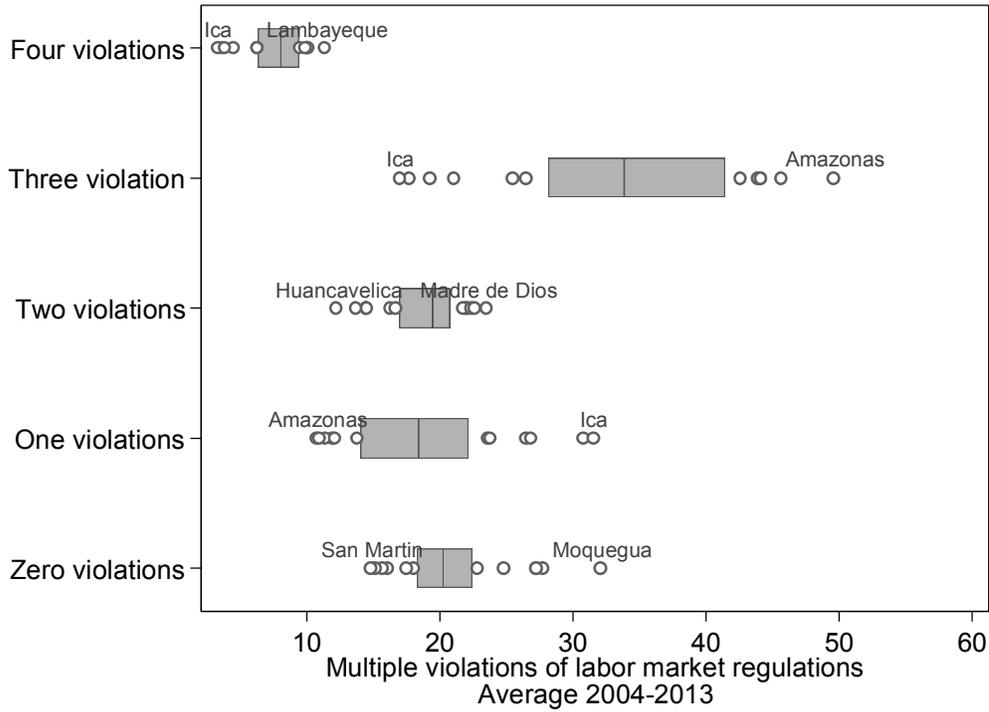
Source: Own elaboration based on Encuesta Nacional de Hogares.

Figure 3: Multiple violations of labor market regulations over time
Average 2004-2013. In percentages.



Source: Own elaboration based on Encuesta Nacional de Hogares.

Figure 4: Multiple violations of labor market regulations by region
Average 2004-2013. In percentages.



Source: Own elaboration based on Encuesta Nacional de Hogares.

Appendix

Table A1: Average marginal effects of a probit model for the probability of suffering one, two, three or four violations of labor regulations.

| | Probit | | | |
|-------------------------------------|------------------|-------------------|--------------------|------------------|
| | One violation | Two violations | Three violations | Four violations |
| <i>Enforcement measure</i> | | | | |
| Log of #inspections per 100 workers | 0.005 (0.007) | -0.006 (0.008) | 0.019 (0.009)** | 0.000 (0.005) |
| Individual characteristics | Yes | Yes | Yes | Yes |
| Employment characteristics | Yes | Yes | Yes | Yes |
| Region characteristics | Yes | Yes | Yes | Yes |
| Observations | 83,322 | 83,322 | 83,322 | 83,322 |
| Predicted probability | 0.206 | 0.225 | 0.329 | 0.077 |

Source: Own elaboration based on Encuesta Nacional de Hogares and Ministerio de Trabajo y Promoción del Empleo.

Notes: Robust standard errors clustered at the region level between parentheses. *** significant at 1%, ** significant at 5%, * significant at 10%.