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María Florencia Pinto, Yulia Valdivia Rivera y Hernan Winkler

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Does the Enforcement of Labor Regulations Reduce Informality? The Case of Peru *

María Florencia Pinto† Yulia Valdivia Rivera‡ Hernan Winkler§

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Abstract

This article examines the effects of strengthened labor regulation enforcement on labor market outcomes in Peru from 2010 to 2019. In 2013, the Peruvian government established a national labor inspection agency, which was progressively rolled out nationwide. This reform led to a substantial increase in the frequency and severity of fines imposed on formal firms. Despite this heightened enforcement, our analysis using extended two-way fixed effects models finds no significant effects on overall employment levels. Moreover, there is no evidence of changes along either the *intensive* margin—informal employment within formal firms—or the *extensive* margin—the share of employment in informal firms. These findings suggest that increased enforcement of labor regulations did not lead to measurable shifts in labor informality or employment outcomes during this period.

JEL Classification: H26, J3, O23, O17
Keywords: labor informality, enforcement, regulation, inspections, fines.

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†CEDLAS - IIE - Universidad Nacional de La Plata; mflorenciapinto@econo.unlp.edu.ar
‡University of Chicago, Harris School of Public Policy; yvaldiviarivera@uchicago.edu
§World Bank; hwinkler@worldbank.org

1 Introduction

Labor informality is widespread in the developing world. Despite some progress during the last three decades, informality still accounts for more than 70 percent of total employment and one-third of total output in developing economies (Ohnsorge and Yu, 2022). While informality is often a symptom of an underdeveloped economy, it can also prevent people from moving out of poverty.

Addressing labor informality remains a critical challenge for developing nations. As the informal sector operates outside the legal and regulatory framework, informal workers are often excluded from social insurance, job-related benefits such as paid-time-off and sick leave, and other publicly-provided services (Loayza, 2018). Furthermore, informality challenges the collection of contributions and taxes, reducing the fiscal capacity of governments. Finally, informality is often more prevalent among the poor and vulnerable, and it could prevent them from improving their living conditions.

In response to these challenges, governments around the developing world have often relied on strengthening the enforcement of labor regulations to increase the formalization of firms and workers (Jessen and Kluve, 2021). This policy increases the relative cost of hiring informal workers, as firms face a higher risk of being detected and penalized. Therefore, stricter enforcement is expected to reduce informality. However, in practice, the final impact will depend on other factors. For example, the effectiveness of enforcement depends on the capacity of governments to supervise firms, which could be challenging in developing countries where informality is pervasive and compliance with regulations is extremely low (Almeida and Carneiro, 2012). At the same time, stricter labor inspections could have unintended consequences similar to those of other labor regulations, where the increased cost of labor may lower firms' growth, increase their exit rates, and reduce formal employment (see, for example, Bossavie et al. (2019); Kahn (2007); Betcherman (2015)).

In this article, we study the effect of increasing the enforcement of labor inspections on labor market outcomes in Peru, a country with one of the highest levels of labor informality worldwide.[1] Estimating such an effect is often challenged by the fact that inspections are not randomly assigned. For example, sectors or districts where intrinsic violations of the labor law are more prevalent could be more likely to be targeted by inspections, inducing an upward bias in the estimation. At the same time, non-compliance detection may be higher in areas with better technology or capacity to conduct labor inspections, which is likely correlated with labor outcomes, thereby adding bias to the point estimates. To account for this potential non-random assignment of labor inspections, we exploit the creation and geographic roll-out of SUNAFIL, the National Labor Inspection Office, as a source of exogenous variation in the level of public enforcement. SUNAFIL is in charge of promoting, supervising, and verifying compliance with labor regulations throughout

[1] According to the ILO's Statistics on the informal economy (https://ilostat.ilo.org/topics/informality/, accessed on July 25 2025), among 92 economies with 2019 data, Peru ranked in the 24th position in terms of labor informality.

Peru.

We find that the opening of SUNAFIL's regional offices dramatically increased the enforcement of labor regulations, measured by the number and size of fines issued per 1,000 workers in the formal sector. We then estimate impacts using a Two-Way Fixed Effects (TWFE) model, which suggests that opening a SUNAFIL regional office did not affect total employment or employment in the formal sector. An essential contribution of this article is to measure the effects of enforcement on both the *extensive* and *intensive* margins of informality. The former is the share of employment concentrated in informal or unregistered firms. The latter is the share of informal jobs within the universe of formal or registered firms. This is relevant because enforcement measures are typically directed towards the latter group, even though informality is more concentrated among unregistered or informal businesses. The standard TWFE model suggests that the policy reduced informality along both margins, but the impacts were modest. However, while TWFE models are widely used in empirical research, recent literature has shown that they can produce biased results when the treatment is introduced at different times across units and if treatment effects are heterogeneous (de Chaisemartin and D'Haultfœuille (2020); Sun and Abraham (2021); Goodman-Bacon (2021); Callaway and Sant'Anna (2021); Borusyak et al. (2024)). Therefore, to address these concerns, we complement the baseline analysis by estimating the extended two-way fixed effects (ETWFE) estimator proposed by Wooldridge (2021). The analysis reveals no statistically significant effects of the policy on total employment or labor informality, whether at the extensive or intensive margin.

This article contributes to a large body of literature investigating the impacts of labor regulations. The conclusions from empirical studies are far from conclusive. Almeida and Carneiro (2012) explore the effects of labor inspections on labor market outcomes in Brazil, and find that a rise in inspections led to an increase in the share of the population in formal employment, an increase in non-employment, and a reduction of wages in the formal sector. Likewise, De Andrade et al. (2016) conducted a field experiment in Belo Horizonte, Brazil, to assess the relative effectiveness of policies that make it easier and cheaper for informal businesses to formalize versus policies that raise the costs of remaining informal by increasing the enforcement of existing regulations. The authors find that inspections are more effective than incentives, i.e., firms do not choose formality unless forced to do so. The authors interpret this finding as a sign of the low private benefits of formality to firms. Also, for the case of Brazil, Meghir et al. (2015) find that enforcement allowed the allocation of workers toward higher-productivity jobs. Other studies, however, find that enforcement has unintended impacts on labor market outcomes or no impacts at all. For instance, Bhorat et al. (2012) explore an increase in government enforcement in South Africa and find that it did not affect minimum wage compliance, whereas Almeida and Poole (2017) show that, after a trade shock, plants facing stricter labor-law enforcement experience a slowdown in job creation and productivity. Accordingly, Almeida and Poole (2017) find that the positive effects of a trade shock increase

employment and output, and reduce informality in Brazil; however, firms in areas that experience stricter enforcement of labor regulations experience weaker positive impacts.

Building on this international evidence, research specific to Peru has also examined enforcement effectiveness. Viollaz (2018b) studies the effects of enforcement on compliance with four labor standards (pension system enrollment, minimum wage, maximum weekly working hours, and written employment contract) in Peru from 2008 to 2013. She exploits labor regulations and penalties variation according to firm size and studies whether firms adjust by downsizing to benefit from lower fines and less stringent regulations. The empirical findings indicate that enforcement efforts have little effect on the degree of compliance or the size of firms. In sum, the empirical evidence on labor enforcement effectiveness remains inconclusive, with studies documenting positive, null, and negative effects depending on context and methodology. This heterogeneity in findings highlights the importance of rigorous identification strategies and comprehensive outcome measurement when evaluating enforcement interventions.

The remainder of the article is organized as follows. Section 2 describes the labor inspection process in Peru and the creation of SUNAFIL. Section 3 presents the data sources used in the analysis, and Section 4 describes the empirical analysis used in the article. Section 5 discusses the main results, and Section 6 concludes.

2 Background

2.1 Labor informality in Peru and the creation of SUNAFIL

Peru has experienced a constant and significant decline in labor informality since 2007, primarily due to rapid formal job creation in a context of strong output growth over the last two decades. However, this downward trend slowed down in 2016, and informality rates grew again, even before the COVID-19 pandemic. The incidence of this phenomenon remains high: in 2019, labor informality reached 73 percent of total employment, a rate that increased to almost 77 percent in 2021, the highest level in 11 years (see Figure A1, Panel a). In terms of output, the informal sector produces only around 19 percent of total output, reflecting its lower productivity compared to the formal sector (INEI, 2019).

In 2013, Law 29981 created the National Labor Inspection Administration (SUNAFIL, the acronym for *Superintendencia Nacional de Fiscalización Laboral*), whose primary purpose is to verify the compliance of labor market and social security regulations in the private sector.[2] Before the creation of SUNAFIL, labor inspections were conducted only by the Ministry of Labor and by regional offices distributed throughout the country. Even though the *de jure* regulation based on the labor law was universal, there was high heterogeneity in effective enforcement across the territory, not only due to regional differences in technical capacity (human resources and equipment) for conducting inspections

[2]Strictly speaking, it verifies compliance with labor regulations both in the private and public sector, as long as the labor relationship takes place under the private labor regime (SUNAFIL, 2022).

but also because of significant disparities in the criteria applied when an infraction was detected. Thus, a firm operating in two regions and violating the same labor standard faced different inspection risks and could receive completely different penalties.

These regional disparities in enforcement led to the creation of SUNAFIL, a central authority in the labor inspection system, attached to the Ministry of Labor, whose objective was to consolidate all labor inspections throughout the country and standardize the criteria applied when dealing with labor law infractions. SUNAFIL is responsible for promoting, supervising, and verifying that employers comply with labor obligations nationwide. The labor inspections conducted by SUNAFIL, as it generally happens in other countries as well, are focused on firms in the formal sector only, i.e., firms that are registered with the tax authority (SUNAT – *Superintendencia Nacional de Aduanas y Administración Tributaria*).[3] In addition, SUNAFIL targets small and large firms, while micro firms (that is firms with no more than five employees) continue to be under the orbit of the regional inspection agencies.[4] This is a crucial point since labor inspections miss a large share of labor informality, given that the informal sector employs most informal workers.

Informality can take place under two different margins. On one hand, firms can decide whether to register with the tax authorities and comply with taxes and labor regulations. If they do, they become formal; if they do not, firms remain informal and small, not to be detected by tax authorities. This is known as the *extensive margin* of informality, which differentiates the formal and informal sectors of the economy. On the other hand, there is an *intensive margin* of informality that takes place within the formal sector of the economy. Registered firms can be partially informal across different dimensions: they can maintain part of their workforce unregistered, pay part of the salary of registered workers off the books, or fail to comply with other labor regulations such as those related to working days, holidays, and leave, etc. (Ulyssea, 2018; Perry et al., 2007). The intensive margin of informality accounts for a large share of total informal employment in Latin American countries: In Brazil and Mexico, 40 and 44 percent of informal workers are employed by formal firms, respectively (Ulyssea, 2018). In the case of Peru, about 23 percent of informal workers are employed in the formal sector (INEI, 2020).

SUNAFIL began to operate in practice in 2014, gradually opening offices in each Peruvian region. Figure 1 below displays the creation of regional offices by year. The Headquarters (Lima) and a few regional offices initiated their inspection operations in 2014. Other regional offices were launched later, between 2015 and 2019. There are five regions that by 2019 had not yet established a SUNAFIL labor inspection office.[5] This

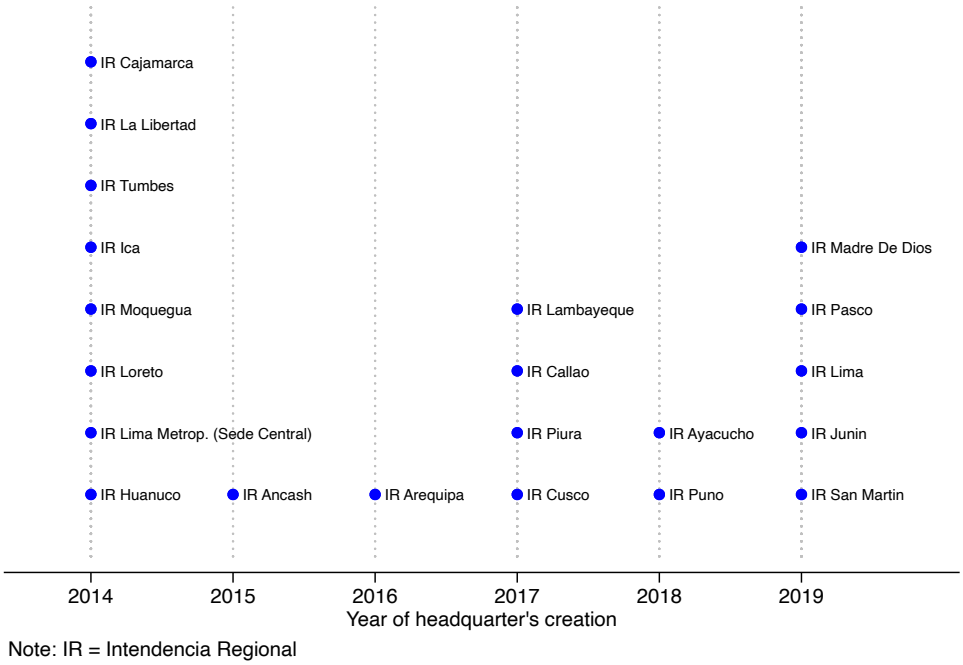
[3] SUNAFIL also conducts information campaigns and provides guidance regarding labor market regulations.

[4] In 2018, Law N° 30814 established that for eight years, SUNAFIL would temporarily supervise microenterprises, a competence that until then only regional governments had. However, it was only in June 2021 that a Ministerial Resolution (N° 100-2021-TR) allowed the creation of commissions to transfer powers from regional governments to SUNAFIL. In practice, only three regions have fully completed this process to date.

[5] Those regions are Amazonia, Apurímac, Huancavelica, Tacna, and Ucayali, where SUNAFIL opened

gradual rollout induced significant variation in the level of enforcement for firms located in different geographical areas and over time, which we exploit in this article.

Figure 1: Year of creation of SUNAFIL regional offices



Note: The number of fines refers to the number of inspections that resulted in the issuance of a fine. Data about workers in the formal sector is from ENAHO and refers to individuals working in firms registered with the tax authority (SUNAT), regardless of the worker's own (in)formality condition.

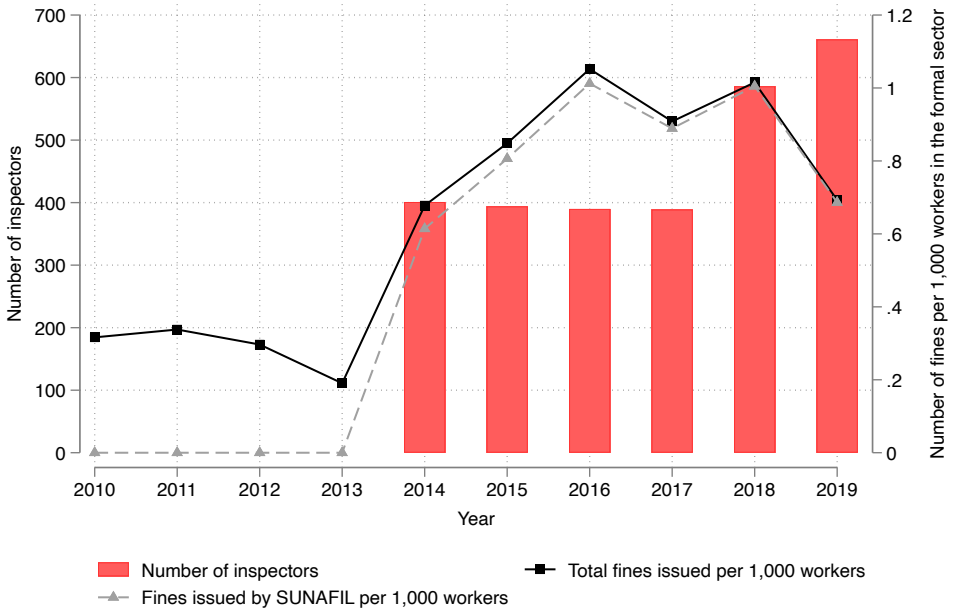
2.2 The labor inspection process

The enforcement process starts with the inspection itself, which can be triggered either by an employee's complaint about the employer not complying with some regulation, or by one of SUNAFIL's intelligence operations. About 80 percent of inspections in 2014 corresponds to the first case.[6] During the inspection, the SUNAFIL agent issues an inspection order and verifies labor obligations' (non-) compliance. In cases where the inspector does not find any labor law violation, the procedure ends. Otherwise, the inspector urges the firm to comply with the regulation over a certain period. If the firm meets the inspector's requirements and regularizes its status, the procedure is terminated and no fine is issued. On the contrary, if the firm fails to comply with an infraction—which may be classified as minor, serious, or very serious depending on the labor standard violated—SUNAFIL proposes the fee amount based on the seriousness of the infraction and the number of employees affected. This initiates the administrative procedure, as a result of which SUNAFIL's sanctioning body issues the penalty resolution

its first regional office in the late 2020s.

[6] According to information reported in the Annual Labor Inspection Plan (SUNAFIL, 2022).

Figure 2: Number of SUNAFIL inspectors and fines issued per 1,000 workers in the formal sector by year



Note: The number of fines refers to the number of inspections that resulted in the issuance of a fine. Data about workers in the formal sector is from ENAHO and refers to individuals working in firms registered with the tax authority (SUNAT), regardless of the worker's own (in)formality condition.

(*resolución sancionadora*), which includes the amount of the fine to be paid by the firm, giving closure to the process.[7]

The creation of SUNAFIL's regional offices led to an increase in the number of labor inspectors and, consequently, in the number of inspections conducted and fines issued. Labor inspectors were assigned to a given SUNAFIL regional office and inspected firms in that region.[8] Figure 2 presents the evolution in the number of SUNAFIL inspectors and fines, both the total number and those issued by SUNAFIL only. The left y-axis measures the number of inspectors per year: in 2014, the year of creation of SUNAFIL, there were 325 inspections in the labor inspection system, assigned to the first seven regional offices (see Figure 1); there were about 400 labor inspectors in the country until 2017, and the number increased since then, reaching 650 inspectors in 2019.

While we do not have information on the number of inspectors before 2014, we do know the number of labor inspections that resulted in fines, which is our preferred enforcement measure and is arguably closely correlated with the number of available inspectors. In

[7]During the administrative procedure, the employer is given the right to present a defense (gather the requested information, present additional evidence, etc.), and an examining body conducts additional revisions. Also, there might be additional instances where the employer can ask for reconsideration, for instance, if additional evidence was not presented in the first place.

[8]There is a very small fraction of cases in which labor inspections were conducted on firms from a given inspection agency from another region. In our data, only 2 percent of fines are issued by an inspection agency from a different region, most of which correspond to inspections conducted by the Metropolitan Lima inspection agency.

Figure 2, the black line (measured in the right y-axis) plots the number of fines issued per 1,000 workers in the formal sector.[9] Until 2013, the average number of violations detected was low: about 0.2 fines for every 1,000 workers, which were the result of inspections carried out by regional labor inspection agencies.[10] However, a clear break in this trend appears in 2014, with the creation of SUNAFIL: the number of fines issued starts to increase steeply, reaching 0.7 fines per 1,000 workers in the formal sector in 2014 to about one fine per worker during 2016-2018. This corresponds to a 400 percent increase in fines per 1,000 workers. The dashed grey line measures the number of fines issued by SUNAFIL and shows that most of the increase in fines over the period is due to an increase in fines issued by SUNAFIL.

Given that SUNAFIL's offices were gradually rolled out across Peruvian regions, the increase in enforcement was not homogeneous throughout the country. Figure 3 gives an idea of this geographic variation. Each shaded area corresponds to a different district (the smallest territorial unit), and the grey boundaries represent the 25 regions.[11] In 2014, the first year of SUNAFIL's operation (panel a), there were very few districts where inspections that resulted in fines were conducted. One was Metropolitan Lima, home of the headquarters office, which initiated about 84 percent of the 2,800 inspections conducted that year. In addition, the purple dots represent the location of a SUNAFIL regional office and reveal that, overall, the level of enforcement of labor regulations was higher in districts located in regions with a SUNAFIL office. Likewise, panels b and c report the number of inspections that detected violations and the location of SUNAFIL offices in 2017 and 2019. The pattern is clear: there was considerable heterogeneity in the level of enforcement across the territory. In particular, districts in a region with an operating SUNAFIL agency were significantly more likely to be inspected and penalized.[12]

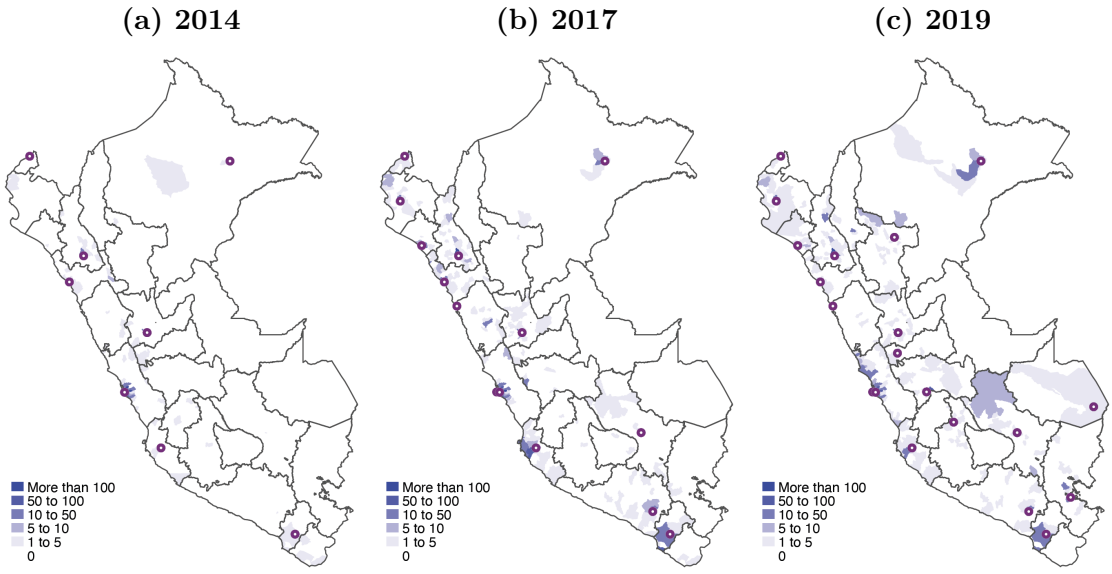
[9] This information refers to the number of fines issued after the detection of a labor law violation, but it does not necessarily reflect fines collected.

[10] Moreover, as pointed out by Díaz et al. (2018), most labor inspectors were concentrated in the regions of Lima and Callao at the time.

[11] There are about 1,800 districts, each of them belonging to one of 196 provinces in 24 *departamentos* and the Constitutional Province of Callao. For conciseness, we refer to those 25 areas as regions.

[12] This can be expected since inspectors go from the regional office to the location of each firm either by car or public transportation (Viollaz, 2018a). Some SUNAFIL offices have only one vehicle, which further restricts the displacement of inspectors throughout the territory. Further, there is also little availability of human, logistical, and financial resources for the various functions that SUNAFIL oversees (SUNAFIL, 2019).

Figure 3: Number of fines issued by SUNAFIL by district



Note: The shaded areas correspond to different districts, the grey boundaries represent regions, and the purple dots represent the location of the corresponding SUNAFIL office in the region. There were 2872, 3925, and 3063 initiated inspections that resulted in fines in 2014, 2017, and 2019, respectively.

In sum, the gradual roll-out of SUNAFIL agencies across different regions induced considerable disparities in the likelihood that a firm was inspected depending on its location. In particular, firms in a region with no inspection agency faced a much lower likelihood of inspection and penalization.

3 Data

We use several sources of data. First, we use data on all labor inspection orders that resulted in administrative penalties for 2010-2020. These data refer to penalties issued by the labor inspection system, including SUNAFIL dependencies and other regional offices.[13] For every penalty issued, the data includes information about the inspection order that initiated the process and the administrative penalty issued at the end: their year and place of issuance (region, province, and district), as well as the inspection agency that carried out the process.[14] In addition, we also know the seriousness of the penalty (minor, serious, or very serious, which varies according to the breached obligation and the number of employees affected), the amount of the fine, and the sector of economic activity of the inspected firm. We restrict our period of analysis to years up to 2019 since the arrival of the Covid-19 pandemic at the beginning of 2020 affected not only the level

[13] Some regional offices under the orbit of the Ministry of Labor that were still operational.

[14] In the vast majority of cases, labor inspections in a given region are conducted by the inspection agency from that region. However, in our data, there are 2 percent of cases where the inspection is conducted by an agency from a different region; most of these cases correspond to inspections initiated by the Metropolitan Lima inspection agency.

of economic activity but also the intensity and modality of labor inspections.[15]

Table 1: Summary statistics of penalty resolutions

	2010-2013	2014-2019
Total number of penalties	4,535	22,208
Number of penalties issued by SUNAFIL	0	21,447
Number of districts that received penalties	185	1,385
% of minor penalties	3.40%	2.30%
% of serious penalties	21.40%	6.60%
% of very serious penalties	75.30%	91.10%
Average amount of minor penalties	104	783
Average amount of serious penalties	6,356	13,282
Average amount of very serious penalties	5,738	35,381
Average penalty amount	11,377	42,894
Average length of process (months)	23.5	20.3
Number of penalties per 1,000 workers in formal sector	0.058	0.438

Note: The penalties are measured in S./ of 2019.

We observe a total of 4,500 penalties issued before the creation of SUNAFIL (until 2013), and about 22,000 after (2014-2019), most of these resulting from inspections conducted by SUNAFIL (see Table 1). The number of districts that received penalties for violating labor standards increased from 185 before 2014 to almost 1,400 afterward. Moreover, the share of penalties considered "very serious" increased from 75 to 91 percent. Table 1 also presents the average penalty amount, depending on the seriousness of the infraction: for the period 2014-2019, the average amount for minor penalties is almost 783 soles, while for severe infractions (which account for more than 90 percent of issued infractions) the average fine is 35,381 soles. This is economically significant: it represents at least 5.5 percent of microenterprises' sales.[16] The length of the inspection process upon the detection of an infraction (i.e., from the issuance of the inspection order until the issuance of a penalty resolution) was reduced, on average, by three months after 2014, revealing an effort on the part of SUNAFIL to speed up the process and reduce burdensome and lengthy procedures. The average number of fines issued increased: for every 1,000 workers in the formal sector, the number of fines went from 0.058 before the creation of SUNAFIL to 0.438 afterward. In addition, we have data on the exact launch date of each SUNAFIL regional office and the exact physical address, which we matched to our dataset of penalties.[17]

[15] Due to social distancing measures imposed during the pandemic, labor inspections were conducted online, and prioritized for certain types of violations, such as non-compliance with health and sanitary measures, over others such as labor obligations.

[16] Under the law, firms with sales of about 700,000 soles or less are microenterprises

[17] We exclude from our analysis the five agencies created after 2019: Amazonas, Apurímac, Huancavelica, Tacna, and Ucayali.

Table 2: Summary statistics of outcome and control variables

	2010-2013	2014-2019
Outcome variables:		
Employment rate	70.6	69.6
Participation of formal sector (% of total employment)	29.4	28.2
Informality rate (% of total employment)	75.3	73.1
Informality rate in formal sector	31.8	27.5
Additional control variables:		
Paved roads (% of total roads in the region)	19.1	20.4
Government expenditure executed (%)	68.0	65.2
Regional GDP	24.0	29.2
Share of agriculture in regional GDP (%)	10.6	10.1
Share of manufacture in regional GDP (%)	12.8	11.4
Share of services in regional GDP (%)	19.5	20.3

Note: Gross Domestic Product (GDP) is measured in constant 2007 thousands of soles.

Second, we use data at the individual level from the *Encuesta Nacional de Hogares* (ENAHO), the main National Household Survey to measure individual- and household-level socioeconomic outcomes in Peru, from 2010 to 2019. ENAHO contains information about individuals' reported employment status, including workers' informality condition, as well as their earnings, hours of work, and economic sector of activity.[18] Workers report whether the firm (or person) that employs them is registered with the Tax Authority (SUNAT), either as a legal or an individual entity (with an associated taxpayer number), allowing us to distinguish between workers in the formal and the informal sector of the economy.[19] This last piece of information is of particular interest to us, since it allows us to identify workers employed in the formal sector of the economy, which is the one targeted by labor inspections.[20] Our main measures of labor outcomes are employment, employment in the formal sector (i.e., registered with the SUNAT), informality status, and informality status within the formal sector (i.e. informal workers employed by a firm registered with SUNAT).[21] Further, the ENAHO reports information about the *district*

[18]The INEI defines informal employment as those jobs that meet the following conditions: i) employers and self-employed workers whose productive unit belongs to the informal sector, ii) wage earners without social security financed by their employer, and iii) unpaid family workers, independently of the formal or informal nature of the productive unit where they work.

[19]Interestingly, being registered with SUNAT does not necessarily imply compliance with the tax legislation, since some firms registered with the tax authority do not file taxes (Díaz et al., 2018).

[20]Workers also report whether the firm maintains accounting records. Interestingly, 2.6 percent of workers reporting that their firms are registered with SUNAT also report that they do not keep accounting records, which may be due to reporting errors. Our results, however, are robust to using this alternative variable to define the formal sector.

[21]Figure A.4 in the Appendix presents a diagram showing the different components of employment, which helps understand the various outcomes analyzed. Thus, "employed" is a dummy variable equal to one if the individual is employed and zero otherwise, while "employment in the formal sector" is equal to one only if the individual is employed in the formal sector (box 3 in the diagram) and zero if employed in the informal sector (box 6). "Informal" is a dummy variable that equals one for informal workers

(an administrative unit similar to a municipality) of residence of each household, which is critical to our analysis. The sample of interest is restricted to individuals aged 15 or older. Table 2 presents basic descriptive statistics of the outcomes measured with ENAHO for our sample. The table shows a slight decline in the prevalence of labor informality, from about 75 percent in 2010-2013 to 73 percent in 2014-2019. Within the formal sector, the informality rate decreased as well, from 32 to 28 percent on average, even though the participation of the formal sector in total employment decreased slightly.

Third, we use administrative data on district and regional-level characteristics. As a measure of institutional quality at the district level, we use the execution of public investment in projects as a percentage of the budget from the Ministry of Economy (MEF). Further, we use information on regional development indicators, including the gross added value and the share of GDP accounted for by the agriculture, manufacturing, and service sectors at the regional level from the Instituto Nacional de Estadística e Informática (INEI). We also use the Ministry of Transport and Communications' information on the percentage of paved regional roads to measure accessibility.

In the following section, we present two empirical strategies to estimate the impact of an increased enforcement of labor regulations on labor informality. The first, widely used in the literature, is based on standard Two-Way Fixed Effects (TWFE) models. The second, more recent and robust, uses an extended estimator that avoids the usual biases in studies with a staggered treatment adoption, as in our study. This comparison allows us to evaluate to what extent the empirical results depend on the underlying assumptions or not.

4 Empirical analysis

This article seeks to evaluate the causal effect of higher enforcement of labor regulations on the degree of compliance with the labor law, measured by the incidence of labor informality. The main difficulty in such an estimation is that labor inspections and fines are not randomly allocated. Instead, it is likely that sectors or districts where intrinsic violations of the labor law are more prevalent are more often inspected and penalized, inducing an upward bias in the estimation of the effect of labor law enforcement on the informality rate. On the other hand, the number of violations detected and fines issued may be higher in areas with better technology or capacity to conduct labor inspections, which is also very likely correlated with labor outcomes.

To identify the impact of interest, we exploit the fact that SUNAFIL was created as a central labor inspection authority in 2014, but its different regional offices started operations at various points in time, as shown previously in Figure 2. This induced an arguably exogenous variation in the level of enforcement for firms located in different

(boxes 5 and 6 in the diagram) and zero for formal workers (box 4), and "informality in the formal sector" considers, for the universe of workers in the formal sector (boxes 4 and 5), whether the worker is informal (box 5) or formal (box 4).

regions of the country at different times. For instance, while a firm located in the Ica region that violated the labor law experienced an increase in the risk of being detected in 2014 (the year in which the Ica Regional Office was inaugurated), a similar firm in the Cusco region did not experience a change in the probability of being detected until 2017, when the Cusco Regional Office started to operate.

4.1 Baseline specification: TWFE model

Our baseline specification follows a standard TWFE approach. Specifically, we estimate the following specification:

$$y_{i,d,r,t} = \beta D_{r,t} + \lambda_d + \lambda_t + \theta \cdot X_{i,d,r,t} + \epsilon_{i,d,r,t} \tag{1}$$

where $y_{i,d,,r,t}$ represents the outcome of interest for individual i, district d, region r, at time t. Our main treatment variable is $D_{r,t}$, a binary variable equal to one if a SUNAFIL agency is operational in region r and year t. We include year fixed effects λ_t that capture any shocks over time that might affect labor market outcomes both in regions with and without a SUNAFIL agency. In addition, to address the possibility that wealthier areas may have better inspection capacity, we include district fixed effects λ_d that capture any time-invariant heterogeneity between districts.

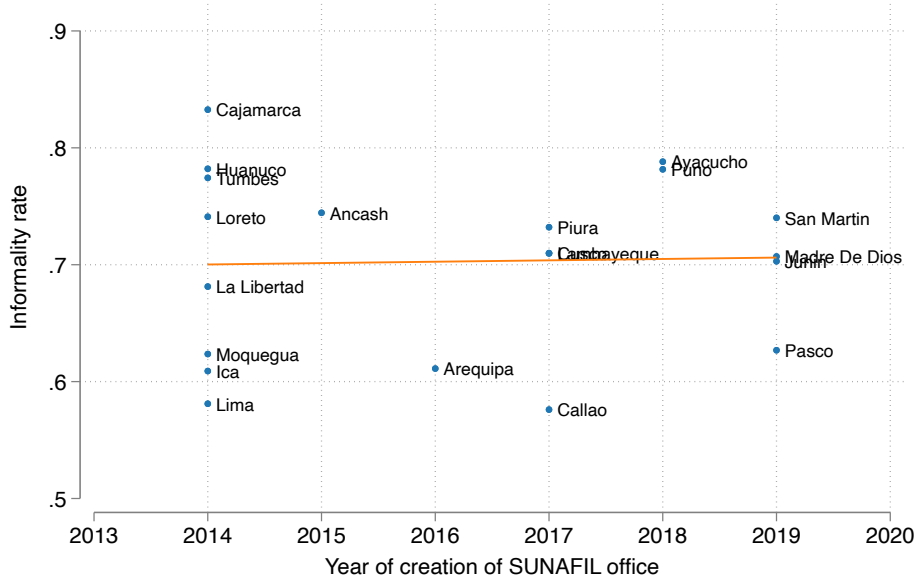
We also include time-varying control variables $X_{i,d,r,t}$. Specifically, we control for each individual's age and age squared, a set of dummy variables corresponding to educational levels, and a dummy variable indicating urban or rural location. Given that enforcement may be stricter in districts with better institutions or governance, which are potentially correlated with labor market outcomes, we control for the percentage of government expenditure executed per year, as a proxy for districts' institutional quality. We control for regional GDP, as well as the participation of agriculture, manufacturing, and services in regional GDP, to proxy for their level of development. We control for the percentage of paved roads in the region, given that inspectors need to travel from the inspection agency to the firm's location and that inspections are more likely in regions with a better road network.

Under the assumptions of parallel trends in the absence of treatment, the main coefficient of interest β, captures the average treatment effect of SUNAFIL presence. This requires that, absent the intervention, regions with and without a SUNAFIL office would have followed similar trends in labor market outcomes. Further, for our estimates to be interpreted as causal, we also assume no anticipation, i.e., that the eventual opening of a SUNAFIL regional office did not affect labor market outcomes before implementation. A quick inspection of labor informality levels across regions suggests that SUNAFIL's rollout correlated with pre-existing informality levels (see Figure 4). Further, to formally assess the assumption of common trends, we test for differential pre-trends in informality with an event study model.[22]

[22]For this, we take the event date as the year of each regional SUNAFIL office opening, and estimate

If pre-existing trends in labor market outcomes are not adequately accounted for, they would bias our estimates by attributing to SUNAFIL effects driven by unrelated factors. Figure A.1 in the Appendix presents the results. It shows estimates that are not statistically different from zero before the opening of a regional SUNAFIL agency for any of the outcomes analyzed. This suggests that the timing of SUNAFIL agencies' opening is not correlated with the evolution of labor market outcomes, and provides support to the primary identification assumption of the TWFE estimates.

Figure 4: Year of creation of the SUNAFIL office and labor informality by region



Source: author's elaboration based on data from SUNAFIL and ENAHO.

4.2 Extended TWFE

While TWFE are widely used in empirical research, recent literature has shown that they can produce biased results when the treatment is introduced at different times across units and if treatment effects are heterogeneous (de Chaisemartin and D'Haultfœuille (2020); Sun and Abraham (2021); Goodman-Bacon (2021); Callaway and Sant'Anna (2021); Borusyak et al. (2024)). As shown in Goodman-Bacon (2021), the treatment effect estimate obtained from a TWFE model is a weighted average of all possible 2 × 2

the following standard event study specification:

$$y_{i,d,r,t} = \sum_{j=-5}^{5} \gamma_j \mathbb{1}\{Years\_since\_agency_{r,t} = j\} + \lambda_d + \lambda_t + \epsilon_{i,d,r,t}$$

where the indicator function $\mathbb{1}$ equals one if an inspection agency opened j periods away in region r and period t (j equals zero for the first year under treatment, i.e., the year that SUNAFIL opened in that region, and takes negative –positive– values for years before –after– the event). The λ_d and λ_t represent district and year fixed effects as before. The main coefficients of interest are the γ_j's that measure the effect of an increase in labor law enforcement for each of the j years before and after the event of the SUNAFIL agency opening. Therefore, γ_j's are typically interpreted as measuring the effect of being treated at different exposure lengths.

difference-in-differences comparisons between groups of units treated at different points in time, including comparisons between earlier and later treated units. If treatment effects are homogeneous across treated groups and across time, the TWFE estimator is consistent for the average treatment effect on the treated (ATT). Conversely, when treatment effects are heterogeneous over time, these weights can be negative or non-convex, potentially biasing the overall estimate. As a result, the TWFE estimator does not necessarily recover the ATT, and may even produce misleading or incorrectly signed estimates.

Given the staggered roll-out and the possibility that treatment effects vary over time, relying only on TWFE can be problematic. Therefore, to address these concerns, we complement the baseline analysis and adopt the extended two-way fixed effects (ETWFE) estimator proposed by Wooldridge (2021). This approach exploits the staggered timing of SUNAFIL regional office openings, comparing treated units to appropriate control groups– either never-treated or not-yet-treated units– in each period. Let regions be indexed by r, years by $t = 2010, \ldots, T = 2019$, and q denote the year of treatment for a given region. Our parameter of interest is the ATT for each cohort $k \in \{q, \ldots, T\}$, in the post-treatment periods $t \geq k$.[23]

The benchmark ETWFE specification is:

$$\mathrm{Y}_{irt} = \eta + \sum_{k=q}^{T} \sum_{s=k}^{T} \tau_{ks} \left(w_{rt} \cdot d_{rk} \cdot fs_t \right) + \sum_{k=q}^{T} \lambda_k d_{irk} + \sum_{s=2}^{T} \theta_s fs_t + u_{irt}, \tag{2}$$

where $Y_{irt}(k)$ is the observed labor market outcome of individual i living in region r in year t, w_{rt} is an indicator taking the value 1 if region r is treated in year t, d_{rk} is an indicator taking the value 1 if region r belongs to treatment cohort k, fs_t are year fixed effects (i.e. $fs_t = 1$ if $s = t$ and 0 otherwise), and u_{irt} is the error term. This specification fully interacts cohort and year indicators to estimate cohort-specific dynamic treatment effects.

The parameters τ_{ks} capture the average treatment effect for cohort k in year s. In Section 5, we report both the average of the different group-time average treatment effect estimates, i.e. $\overline{\widehat{\tau}} = \frac{1}{(T-q+1)(T-q+2)/2} \sum_{k=q}^{T} \sum_{s=k}^{T} \widehat{\tau}_{ks}$, as well as the dynamic effects by length of exposure.

5 Main results

5.1 Effect on measures of enforcement

Before examining the effect on labor market outcomes, we discuss whether the opening of a SUNAFIL office in the region triggered an increase in the enforcement of labor

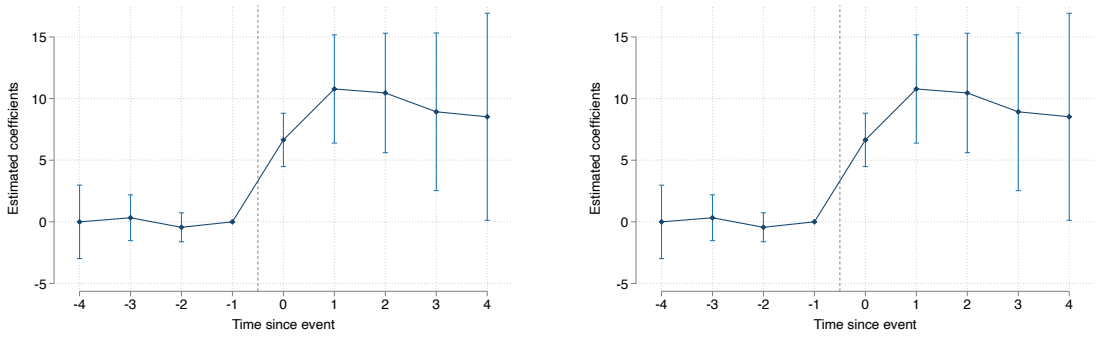
[23] Let $Y_{irt}(k)$ denote the potential labor market outcome that an individual i living in region r would experience in year t if it were to receive the treatment in year k, and $Y_{irt}(\infty)$ the potential outcome if she had never being treated. The ATT for cohort k in period t is denoted by $\tau_{kt} \equiv E\left[Y_{irt}(k) - Y_{irt}(\infty) | d_{irk} = 1\right], \quad k = q, \ldots, T; \quad t = k, \ldots, T.$

regulations. Figure 5a displays the estimated coefficients from Equation 1 on the log of the number of fines issued per 1,000 workers in the formal sector for different years relative to the year of each regional office opening. The trend in the number of fines issued changed dramatically after the opening of a SUNAFIL office in the region. Relative to the last period before the event, the number of fines per 1,000 workers increased by more than 600 percent in the first year that SUNAFIL was in place, and increased further the following years, with all coefficients significant at least at the 95% level (see Table A.2 in the Appendix). Likewise, Figure 5b plots the log of the total monetary amount of fines issued per 1,000 workers in the formal sector (measured in soles of 2019), and presents the same steep increase: in those regions where a SUNAFIL office opened, the total amount of fines issued increased by 700 percent the first year of SUNAFIL's operations, and more than 900 percent on average during the four years after the opening. In addition, none of the estimated coefficients are significant for periods before $j = 0$, suggesting that existing pre-trends do not drive the observed increase in these enforcement measures. Overall, these figures show that opening a SUNAFIL office in the region implied a significant increase in the enforcement of labor regulations, measured by the number and size of fines issued. Next, we use the timing of this event to measure its effect on labor market outcomes.

Figure 5: Impact of the opening of the SUNAFIL offices on penalties issuance

(a) Log of number of fines per 1,000 workers in the formal sector

(b) Log of total amount of fines per 1,000 workers in the formal sector



Note: The dots and bars represent the coefficients and 95 percent confidence intervals based on standard errors clustered at the regional level. The full regression output is shown in Table A.2 in the Appendix.

5.2 Effect on labor market outcomes

This section presents the main findings of the article, emphasizing how the estimated effects vary depending on the empirical strategy used. We begin by reporting the results from a standard TWFE model, the baseline approach in Table 3. Column 1 presents the β estimates from the baseline TWFE specification (equation 1) with only district and year fixed effects. Column 2 adds individual and household controls, and Column 3 further includes regional characteristics such as public investment execution, road infrastructure,

regional GDP, and sectoral composition.

Table 3: TWFE estimates of the impact of the opening of a SUNAFIL office on employment and informality

	(1)	(2)	(3)
Employment	-0.004	-0.005	-0.004
	(0.003)	(0.003)	(0.003)
Employment, formal sector	0.008	0.006	0.005
	(0.005)	(0.004)	(0.004)
Informality	-0.016**	-0.014**	-0.014**
	(0.007)	(0.007)	(0.006)
Informality, formal sector	-0.018**	-0.015*	-0.018**
	(0.008)	(0.008)	(0.008)
Control variables:			
Individual and household-level controls	No	Yes	Yes
Public investment execution	No	No	Yes
Percentage of paved roads	No	No	Yes
Regional GDP	No	No	Yes
% of regional GDP in agriculture, manufacture, and service	No	No	Yes

Note: All regressions also include district and year fixed effects. The estimations are population-weighted, and the standard errors are clustered at the regional level. *** p<.01, ** p<.05, * p<.1 .

The estimates suggest that opening a SUNAFIL regional office does not affect the number of jobs, total employment, or employment in the formal sector, as the coefficients are small and never statistically different from zero.

Regarding informality, the estimates suggest that opening a SUNAFIL office leads to a statistically significant reduction in labor informality. Specifically, the informality rate declines by 1.4 percentage points, a magnitude that remains robust to including controls. Yet, the effect represents a modest 2.5 percent reduction relative to the national average of 73 percent between 2014 and 2019. In addition, we analyze the impact on informality within the formal sector (i.e., workers employed by a registered firm but whose employment conditions do not comply with formal labor regulations), given that registered firms are the target of SUNAFIL inspectors and face a higher inspection probability. The decrease is slightly higher: on average, the informality rate within the formal sector decreases by 1.8 percentage points.

These findings could be interpreted as evidence that the presence of SUNAFIL has a negligible effect on compliance with labor regulations, as reflected in the decline in informality within the universe of registered firms, and the absence of impacts on employment. However, as discussed in Section 4, TWFE models may produce biased estimates in staggered treatment settings like ours, which motivates the use of alternative methodologies, more robust to treatment effect heterogeneity.

To address the methodological limitations of the TWFE model, we next implement the ETWFE estimator, which accounts for treatment effect heterogeneity and avoids the problem of negative weighting across treatment cohorts. Table 4 presents the aggregate ATT estimates from Equation 2. Column 1 reports results using never-treated regions as the comparison group, while Column 2 uses not-yet-treated regions.[24] The results show no statistically significant effect of the opening of a regional SUNAFIL agency on total employment or employment in the formal sector of the economy, in line with the findings of the TWFE model, which suggests that the SUNAFIL roll-out does not lead to unintended job losses. Furthermore, we find no statistically significant effects of SUNAFIL's presence on overall informality or informality within the formal sector. These null results hold regardless of whether the comparison group consists of never-treated or not-yet-treated regions.

Table 4: Extended TWFE estimates of the impact of the opening of a SUNAFIL office on employment and informality

	(1)	(2)
Employment	0.004	0.001
	(0.007)	(0.004)
Employment, formal sector	0.002	0.008
	(0.006)	(0.005)
Informality	0.001	-0.002
	(0.006)	(0.004)
Informality, formal sector	-0.004	-0.002
	(0.012)	(0.016)
Comparison group	Never treated	Not yet treated

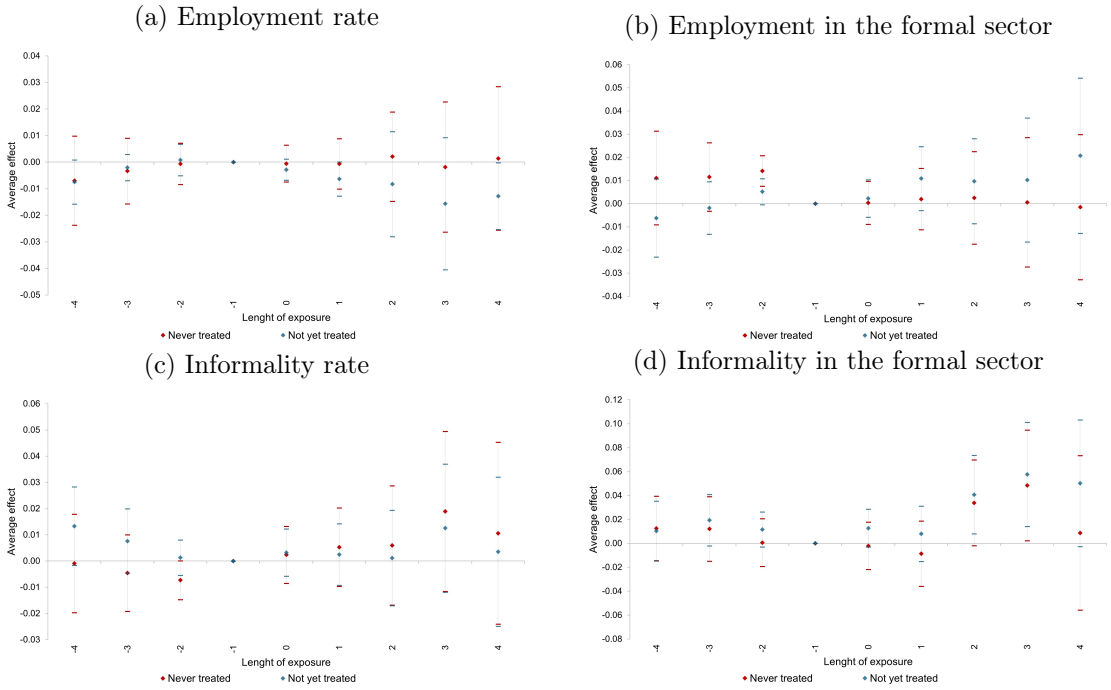
Note: All regressions also include cohort and year fixed effects. The estimations are population-weighted, and the standard errors are clustered at the regional level. *** p<.01, ** p<.05, * p<.1.

In addition, Figure 6 presents the dynamic treatment effects from the ETWFE specification in Equation 2, using never-treated (red) and not-yet-treated (blue) regions as comparison groups. Reassuringly, no evidence of differential pre-trends for any of the outcomes analyzed supports the validity of the parallel trends assumption. In the post-treatment periods, we do not observe any statistically significant effects on informality or employment outcomes at any horizon.

These findings suggest that the reductions in informality observed under the TWFE model are not robust, and may reflect biases introduced by how TWFE aggregates 2×2

[24] While never-treated regions are often considered the cleanest control group -minimizing potential contamination across units- not yet treated regions may offer a more relevant counterfactual, as they are on a similar treatment trajectory, therefore exhibit more comparable pre-trends with treated units.

Figure 6: Impact of the opening of a SUNAFIL office on employment and informality, ETWFE without covariates



Note: The dots and bars represent the coefficients and 95 percent confidence intervals based on standard errors clustered at the regional level.

comparisons in staggered treatment designs, as discussed in Goodman-Bacon (2021). When accounting for those biases, our results indicate that a SUNAFIL office did not lead to changes in labor market outcomes, regardless of the length of exposure to treatment.

5.3 Robustness checks

SUNAFIL inspectors might face financial constraints when traveling throughout the territory to conduct inspections. Given these restrictions regarding physical and human capital and accessibility challenges in some areas– for instance, due to dense jungle terrain or heavy rainfall– it is possible that SUNAFIL's inspections are not reaching the entire country. If this were the case, we might expect the estimated effects to be downward biased. To test this hypothesis, Table 5 reports the results of the ETWFE estimation but excluding from the sample the districts where no inspection order or fine has been recorded during our period of study. These findings confirm the absence of effect of SUNAFIL's rollout, both overall and within the formal sector. We observe a marginally significant positive impact on formal employment when using never-treated regions as the comparison group. Still, it disappears when not-yet-treated units are used as the comparison group.

Table 5: Robustness to the exclusion of districts never inspected, ETWFE

Comparison group	Employment	Employment, formal sector	Informality	Informality, formal sector
Never treated	-0.003	0.012*	-0.005	0.002
	(0.006)	(0.007)	(0.009)	(0.015)
Not yet treated	0.001	0.008	-0.002	-0.002
	(0.004)	(0.005)	(0.004)	(0.016)

Note: The estimations are population-weighted, and the standard errors are clustered at the regional level. *** p<.01, ** p<.05, * p<.1

6 Conclusion

This article studies the impact of increasing the enforcement of labor inspections on labor market outcomes in Peru for 2010-2019. We exploit the decentralization of SUNAFIL–the National Labor Inspection Office–as a source of variation in the level of public enforcement and take advantage of its gradual rollout in Peruvian regions. This decentralization was aimed at consolidating all labor inspections and standardizing the criteria applied when dealing with labor law infractions. Our findings point out a large and significant increase in the number and size of fines in response to the roll-out of the SUNAFIL's regional offices. However, we do not find any impacts on total employment or informality.

Several factors may explain the absence of measurable effects from SUNAFIL's enforcement efforts on labor informality. As is often the case in developing countries with high levels of informality, the capacity of inspection work is limited by the lack of inspectors, insufficient infrastructure, equipment, and vehicle units. At the same time, there are factors related to the institutional framework, with most inspections usually being reactive rather than preventive. Finally, it can also be argued that even with an ideal enforcement capacity and institutional framework, there is an upper bound to the potential impacts of enforcement on informality given the low levels of productivity that often characterize informal jobs. Forcing the formalization of such jobs could lead to unintended consequences such as job destruction or employment precarization (see, for example, Almeida et al. (2022), and Bossavie et al. (2019) for the case of minimum wages).

Our article contributes to the literature that studies the effectiveness of labor enforcement regulations through a large-scale intervention. Evaluating labor inspections as instruments to reduce informality *vis-à-vis* other policies is essential, especially considering the cost of such intervention. Other policies to reduce informality include information campaigns (De Andrade et al., 2016), tax reductions and bureaucracy simplification policies (Monteiro and Assunção, 2012), reductions in payroll taxes (Bernal and Eslava, 2017), or simplification of labor registration procedures (Ronconi and Colina, 2011).

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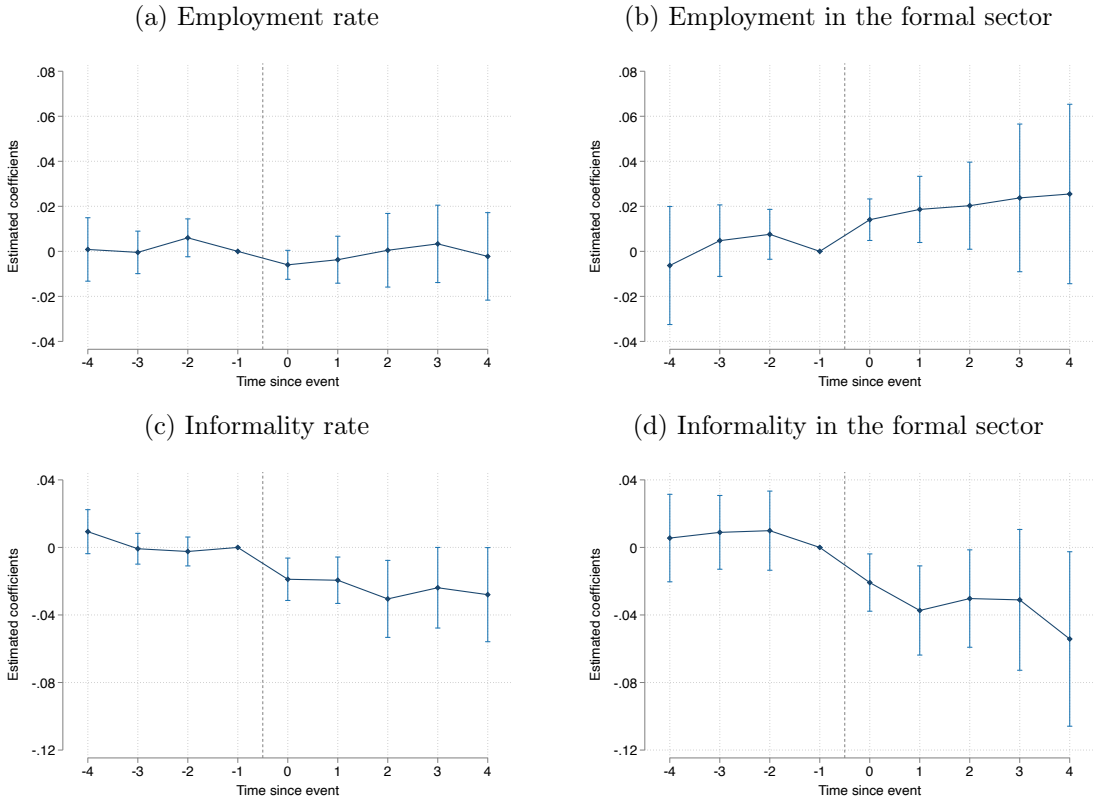
A Tables and figures

Figure A.1: Impact of the opening of a SUNAFIL office on employment and informality



Note: The dots and bars represent the coefficients and 95 percent confidence intervals based on standard errors clustered at the regional level. The full regression output is in the Appendix in Table A.1.

Table A.1: Impact of the opening of a SUNAFIL office on employment and informality

Dependent variable:	Employment			Employment in formal sector			Informality			Informality in formal sector		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Four years prior	0.001	0.002	-0.005	-0.006	-0.007	-0.002	0.009	0.013**	0.008	0.006	0.014	0.019
	(0.007)	(0.007)	(0.007)	(0.013)	(0.011)	(0.010)	(0.006)	(0.005)	(0.006)	(0.012)	(0.012)	(0.013)
Three years prior	-0.000	-0.000	-0.005	0.005	0.002	0.005**	-0.001	0.004	0.001	0.009	0.013	0.017*
	(0.005)	(0.005)	(0.005)	(0.008)	(0.007)	(0.007)	(0.004)	(0.004)	(0.005)	(0.011)	(0.010)	(0.009)
Two years prior	0.006	0.006	0.003	0.008	0.007	0.009***	-0.002	-0.001	-0.003	0.010	0.013	0.015
	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.011)	(0.011)	(0.011)
One year prior	-	-	-	-	-	-	-	-	-	-	-	-
Implementation	-0.006*	-0.007**	-0.006*	0.014***	0.011**	0.010**	-0.019***	-0.016***	-0.015***	-0.021**	-0.020**	-0.021**
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.006)	(0.005)	(0.005)	(0.008)	(0.008)	(0.008)
One year after	-0.004	-0.006	-0.002	0.019**	0.018***	0.016**	-0.019***	-0.020***	-0.017***	-0.037***	-0.037***	-0.040***
	(0.005)	(0.005)	(0.005)	(0.007)	(0.006)	(0.006)	(0.007)	(0.006)	(0.005)	(0.013)	(0.012)	(0.011)
Two years after	0.000	-0.002	0.005	0.020**	0.020**	0.015*	-0.030**	-0.033***	-0.028***	-0.030**	-0.032**	-0.037***
	(0.008)	(0.008)	(0.008)	(0.009)	(0.007)	(0.008)	(0.011)	(0.010)	(0.008)	(0.014)	(0.013)	(0.012)
Three years after	0.003	-0.000	0.009	0.024	0.023*	0.017	-0.024**	-0.028***	-0.021*	-0.031	-0.035*	-0.042*
	(0.008)	(0.009)	(0.009)	(0.016)	(0.014)	(0.014)	(0.012)	(0.010)	(0.010)	(0.020)	(0.019)	(0.021)
Four years after	-0.002	-0.005	0.008	0.025	0.027	0.018	-0.028**	-0.034***	-0.025**	-0.054**	-0.058**	-0.067**
	(0.009)	(0.010)	(0.010)	(0.019)	(0.017)	(0.017)	(0.013)	(0.012)	(0.012)	(0.025)	(0.023)	(0.027)
Control variables:												
Individual and household-level controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Public investment execution	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Percentage of paved roads	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Regional GDP	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
% of regional GDP in agriculture, manufacture, and services	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Observations	829,131	829,034	829,034	567,838	567,779	567,779	594,820	594,757	594,757	137,416	137,396	137,396

Note: All regressions also include district and year fixed effects. The coefficients correspond to different leads and lags of SUNAFIL office openings in the region. In particular, each variable takes a value of 1 if the individual lives in a region four years before the opening of a SUNAFIL office in that region, two years prior, the year of opening, one year after, two years after, three years after, and four years after. The estimations are population-weighted, and the standard errors are clustered at the regional level. *** p<.01, ** p<.05, * p<.1

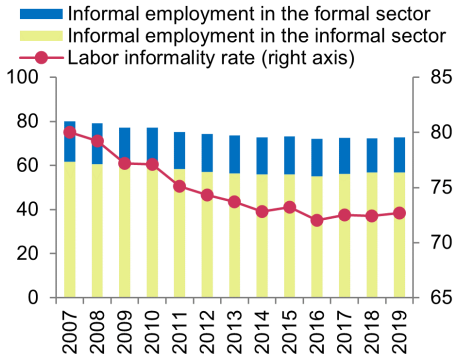
Table A.2: Impact of the opening of SUNAFIL regional offices on enforcement

Dependent variable:	Log (fines per 1,000 workers in formal sector)	Log (fine amount per 1,000) workers in formal sector)
Four years prior	-0.00397	-0.693
	(1.443)	(1.941)
Three years prior	0.329	-0.921
	(0.900)	(1.222)
Two years prior	-0.445	-1.461*
	(0.568)	(0.794)
One year prior	-	-
Implementation	6.650***	7.791***
	(1.048)	(1.638)
One year after	10.78***	12.82***
	(2.130)	(2.809)
Two years after	10.46***	10.51***
	(2.347)	(2.922)
Three years after	8.929***	7.996*
	(3.099)	(3.943)
Four years after	8.524**	10.40**
	(4.071)	(4.980)
Observations	828,273	830,089
District and year FE	Yes	Yes

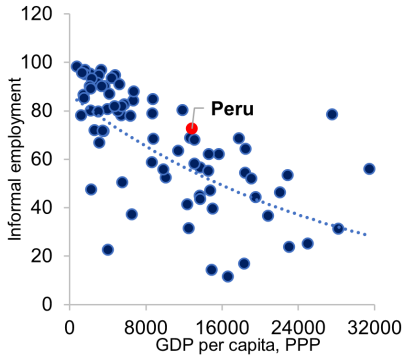
Note: All regressions include district and year fixed effects. The coefficients correspond to different leads and lags of SUNAFIL office openings in the region. In particular, each variable takes a value of 1 if the individual lives in a region four years before the opening of a SUNAFIL office in that region, two years prior, the year of opening, one year after, two years after, three years after, and four years after. Standard errors clustered at the regional level. *** p<.01, ** p<.05, * p<.1

Figure A.2: Labor informality in Peru

(a) Labor informality, 2007-2019 (% of total employment)



(b) Labor informality and GDP per capita (% of total employment, constant 2017 international $)



Source: Own elaboration based on data from ENAHO (Panel a) and ILO, World Bank (Panel b).

Note: Both figures measure informality as a percentage of total employment. GDP per capita (PPP) in Panel b is measured in constant 2017 international dollars.

Figure A.4: Components of employment