

LARGE FIRMS AND THE INTENSIVE MARGIN OF LABOR INFORMALITY EVIDENCE FROM AN ENFORCEMENT INTERVENTION IN PERU

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Large Firms and the Intensive Margin of Labor Informality

Evidence from an Enforcement Intervention in Peru

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Abstract:

In developing countries, informal labor is not only employed by illegal or unregistered firms but also by legal firms that hire workers informally, known as the intensive margin of labor informality. Reducing this type of work may have ambiguous effects on formal employment, depending on factors such as firm size and productivity. In collaboration with Peru's labor inspection authority, we conducted a randomized mailing experiment targeting large firms with a high propensity for employing workers informally. The authority sent letters with either deterrence messages detailing fines for non-compliance or social norms messages highlighting the positive impacts of formality. We analyzed the impact of this intervention on formal employment levels over the following two years using monthly administrative data. The treated firms (particularly those in the deterrence treatment arm) and larger firms increased their formal employment levels. However, these increases followed a seasonal pattern coinciding with the high labor demand during the tourist season, suggesting that prior to the intervention, firms were employing temporary workers informally. The higher perceived cost of non-compliance led them to formalize some of these workers. The informal hiring of seasonal workers by these firms appears to have been motivated by basic tax evasion, and the absence of a negative effect on firm-level formal employment indicates that the firms were exploiting rents from low enforcement of regulations.

JEL Classifications: C93, D91, H55, J46, O17

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1. Introduction

While most informal labor (i.e., non-registered workers with no associated payroll taxes nor social security contributions) in developing countries is employed by illegal or unregistered firms, a recent literature has highlighted the importance of the intensive margin of labor informality – when legally registered firms that employ some workers formally also hire other employees informally or off the books – as an integral part of the phenomenon (Ulyssea, 2018, 2020; Bobba et al., 2021; Samaniego and Fernandez Bujanda, 2024). Although not the largest component of the informal sector, this margin represents the portion that most enforcement agencies can effectively audit. Theoretically, the impact of these enforcement efforts is ambiguous. On one hand, such efforts might reduce informality in the short term by formalizing illegal workers. However, in the long term, they could (a) decrease the level of formality within these firms as they adjust to the perceived increase in enforcement and (b) discourage other firms from expanding into the extensive margin. Some empirical work suggests that enforcing this margin leads to lower employment (Samaniego and Fernandez Bujanda, 2024; Brotherhood et al., 2023). The overall impact of these measures is thus an empirical question. We aim to address it by means of a randomized information provision experiment in the context of the labor inspection authority in Peru.

In Latin America, a large mass of the informal workforce is self-employed, or consists of small informal firms that only employ family members or have no workers (Perry et al., 2007; Ulyssea et al., 2023). There is also a large mass of salaried workers in fully informal small firms, which are not registered with the tax authorities nor pay social security contributions for their employees, which Ulyssea (2018, 2020) labels as the extensive margin of informality. The intensive margin of informality, documented by Perry et al. (2007) among others and formalized by Ulyssea (2018, 2020), refers to the group of informal employees working in firms that are registered with the tax authorities, pay taxes regularly and employed some workers formally. In Peru, the case analyzed in this paper, labor informality is rampant, with about 11 million (76% of total employment) informal workers (IDB, 2020). Among these informal workers, 56.8% are self-employed, 22% are salaried employees in informal firms, and the remaining 21.2% correspond to the intensive margin of informality – informal salaried employees in formal firms. This margin is thus substantial, even if it is lower than in Brazil, at about 40% (Ulyssea, 2018), and in Mexico, at about 56% (Samaniego and Fernandez Bujanda, 2024). Interestingly, this phenomenon is not restricted to small firms only: 29% of informal workers in the intensive margin in Peru are employed in firms with 10 to 100 workers and 15% in firms with more than 100 employees (MTPE, 2018).

These high levels of informality and low compliance with labor regulations obey to a series of different and potentially overlapping factors (see Ulyssea et al., 2023, for a thorough review). The existing literature has highlighted the perverse incentives implied by the design of taxation and social protection systems; excessive labor regulations, which increase labor and compliance costs; low productivity of economic units; low quality of public services; and the lack of monitoring and enforcement of tax and labor regulations (Maloney, 2004; Fields, 2005; Levy, 2008; Pages, 2010; Levy and Cruces, 2021, among others). This study deals with the importance of the latter factor for labor informality in large firms. The high levels of non-compliance with labor regulations in this group in Peru may be attributed, in part, to the limited capacity for labor inspection. Peru has 0.2 labor inspectors for every 10 thousand workers compared to 1.7 in Chile or 0.8 in Uruguay (ILOSTAT, 2018), which have substantially lower levels of labor informality. While other factors are certainly at play, the lack of monitoring and enforcement allows even large firms to employ workers informally with low expected cost of being caught (Bosch, Melguizo and Pagés, 2013).

The recent literature on the intensive margin of informality has found that larger firms employing workers informally may respond to changes in the perceived threat of audits by decreasing their formal employment levels. Ulyssea’s structural models (2018, 2020) predict that enforcement on the intensive margin may be ineffective in reducing labor informality because it increases the cost of being formal in smaller and less productive firms, even if some informal workers are formalized. Samaniego and Fernandez Bujanda (2024) confirm some of these findings. They exploit a very large number of random inspections in Mexico and find that after inspections, some informal employees are formalized, but that in larger firms, there is a fall in formal job creation and an increase in formal job destruction, reducing formal employment growth in the longer run. Brotherhood et al. (2023) also find that audited firms in Brazil experience lower growth and negative effects on employment in the medium run. While increasing the cost of informality through audits would seem to lead to higher formal employment, for instance as found exploiting geographic variation in the enforcement of labor regulation within Brazil (Almeida and Carneiro, 2012), these recent studies find the opposite: audited firms show persistently lower levels of formal employment. This result arises from considering the intensive margin of informality - formal firms employing some informal workers - in addition to the extensive margin of firms operating completely formally or informally.¹ Samaniego and Fernández Bujanda (2024) show that consistent with an increase in labor costs (and with the counterfactual exercise of increasing the cost of hiring informal workers for formal firms in Ulyssea 2018), audits shrink the pool of informal workers within formal firms who could be formalized, a key source of formal employment growth. Audits also raise the marginal cost of formalizing workers, leading to decreased overall hiring and increased separations of both formal and informal workers. While some informal workers are formalized due to audits, this is outweighed by the reduced hiring and increased separations that persistently decrease the stock of formal employment at audited firms.² Cisneros-Acevedo’s (2022) study of Peru is closely related to ours. The analysis shows that greater import competition shifts informality along two margins, reducing extensive informality while raising intensive informality within registered firms, with the intensive margin dominating the overall effect. Previous studies of trade liberalization and informality had not looked at these two margins simultaneously (Cruces, Porto and Viollaz, 2018). We complement this by providing experimental evidence from a large-firm enforcement-salience shock using administrative payroll data: a light-touch increase in perceived detection risk induces seasonal formalization with little extensive-margin response, indicating that the same intensive margin highlighted in the trade-driven setting is also responsive to credible enforcement signals in low-enforcement environments.

These recent advances in the literature highlight the importance of considering the intensive margin of informality and of distinguishing between aggregate, firm-level and individual effects of informality-reducing policies. The overall effects may be ambiguous, depending on the characteristics of the firms, the labor markets and the enforcement environment. For instance, firms with market power in a context of low labor regulation enforcement may have rents from employing workers informally at a lower cost and higher enforcement efforts may result in lower rents rather than lower formal employment levels. The effects may also vary between more and less productive firms. Moreover, firms may not face a reduced stock of informal workers to formalize if their labor demand follows a seasonal pattern.

¹ There are also additional related margins. For instance, Bergolo and Cruces (2014) find that a social security reform in Uruguay that increased the health insurance benefits linked to formal employment led to the formalization of some workers, but that the firms increased under the table payments for these newly formalized workers.

² De Andrade, Bruhn and McKenzie (2016) present a review of the broad range of policies that governments carry out to formalize firms, and Jessen and Kluve (2021) an assessment of their effectiveness.

In partnership with Peru’s labor inspection authority, the National Superintendency of Labor Inspection (SUNAFIL for its acronym in Spanish), we designed a randomized mailing experiment to document the reaction to deterrence measures of large firms with a high propensity to employ workers informally in Peru (as determined by the authority’s classification). The firms’ reaction to these treatments allows us to document the patterns of informality’s intensive margin in Peru. Specifically, the labor inspection authority sent letters with either deterrence (detailing fines for non-compliance with labor regulations) or social norms (highlighting formality’s positive impacts for workers and firms) messages to a set of large and high intensive-margin-informality risk firms. We study the impact of this light touch intervention on subsequent formal employment over the following two years, based on monthly administrative data.

The treated firms in our experimental sample substantially increase their formal employment levels, especially those in the deterrence treatment arm, with an average effect of about 17 percent (20 more formal workers with respect to the control group baseline of 120 formal workers on average). However, these increases followed a clear seasonal pattern coinciding with the high labor demand tourist season, with differences as high as 40 formal workers (a one third increase with respect to the control group). This suggests that before the intervention the firms facing seasonal fluctuations in labor demand were employing temporary workers informally to meet their short-term staffing needs, and that the higher perceived cost of noncompliance made them reduce this practice by formalizing some of these short-term workers. The informal hiring of seasonal workers for these firms seems to have responded to basic tax evasion motives, and the lack of a negative effect on employment at the firm level indicates that the firms were exploiting rents from low enforcement of regulations. These rents seemed to give firms some room for maneuver, adapting to the increased perceived cost of noncompliance without reducing formal employment.

The specific nature of the firms targeted by our intervention may explain the divergence of our results from those of previous studies (Samaniego and Fernandez Bujanda, 2024) and from recent theoretical work in this subject (Ulyssea, 2018, 2020). We focused on large firms with a high risk of engaging in informal employment practices at the intensive margin, and thus our results complement the findings (counterfactual and empirical) on more general firms. Our results highlight that empirical studies could focus on comparing the effects of enforcement measures across different types of firms and sectors to shed light on the potential for divergent outcomes and the factors that drive these differences. Moreover, the existing models could provide a more comprehensive understanding of the complex dynamics of informal employment at both the extensive and intensive margins by incorporating other dimensions of firm and market heterogeneities, such as firms’ market power, the implications of low-enforcement environments, and the seasonal nature of employment demand, among other factors. Finally, we emphasize that the light-touch mailing intervention was designed as an identification device—a minimally intrusive increase in perceived detection risk that allows us to test whether enforcement salience shifts the intensive margin in large firms facing seasonal labor demand. This type of nudges, while useful, are not necessarily substitute for audits, enforcement or broader formalization policy. The persistence of some of the effects beyond the immediate season was not anticipated, as the impact of interventions of this type tends to fade over time (see for instance Bergolo et al., 2023, and the review by Antinyan and Asatryan, 2025), and should be interpreted cautiously: such responses could attenuate as messages diffuse and firms update beliefs over time, and DellaVigna and Linos (2022) document the presence of diminishing returns to nudges. We use the intervention to uncover the mechanism and to benchmark magnitudes, but sustained compliance likely hinges on a mix of light-touch and more involved enforcement tools.

The rest of the document is organized as follows: The second section describes the data, the experimental design, and the empirical specification. The third section presents the results, while the fourth section concludes.

2. Context of the Intervention

The labor market in Peru is characterized by high and persistent levels of labor informality. It fell from around 88% in 2004 to 78% in 2019 (IDB, 2020), due to economic growth and structural change (Chacaltana, 2016). Despite this progress, labor informality in Peru is still widespread, with about 11 million (76%) informal self-employed and salaried workers (IDB, 2020), and this phenomenon is even present in large firms that opt to hire workers informally, especially when facing seasonal staffing needs.

To foster the formalization of the labor market, the Peruvian Government created the SUNAFIL in 2013 with the mandate to enforce labor regulations in formal private firms, that is, firms registered with the tax authority, around 41% of the total number of firms (Novella, Rosas, and Alvarado, 2019).³ Despite major improvements in the labor inspection system since 2013, SUNAFIL still lacks the human and financial resources to properly supervise all formal firms. Peru has 0.2 labor inspectors for every 10 thousand workers compared to 1.7 in Chile or 0.8 in Uruguay (ILOSTAT, 2018). As a result, between 2014 and 2017, only about 20,000 firms were inspected by SUNAFIL, even though the micro-business segment alone amounts to 3.7 million firms (PNCP, 2018). In addition, the process is lengthy with average time of a labor inspection exceeding 500 days.

Peruvian labor law does provide a lawful channel for short-duration hiring through fixed-term modalities, most notably the seasonal contract, yet using these contracts is neither costless nor risk-free. Contracts must be executed in writing stating the seasonal cause, dates, and tasks, and workers must be registered on the electronic payroll administrative platform from day one. Registration immediately triggers employer outlays that accrue even over short spells (health insurance contributions and the proportional accrual of gratifications, CTS-“Compensación por tiempo de servicios”-the severance savings account contributions, and vacation), as well as the associated payroll and reporting requirements. In addition, fixed-term arrangements create legal exposure if the objective cause is not precisely documented or if employment extends beyond the stated period (courts may denaturalize the relationship into an indefinite one, which entails large severance costs), and early termination without cause before the agreed end date can generate compensation obligations. These pecuniary, bureaucratic, and legal risks raise the marginal cost of formalizing very short-term seasonal slots, even for firms that otherwise register the bulk of their workforce. In short, while the law offers a formal channel for short term seasonal employment, the combination of payroll/benefit outlays, paperwork/registration, and lawsuit exposure makes formal short-stint hiring comparatively inconvenient, giving employers strong incentives to avoid it even among employers that already register most of their workforce. The marginal calculus for very short-spell seasonal hires still discourages formalization: high per-hire pecuniary and bureaucratic costs and legal risks that do not vanish just because the firm otherwise largely registers its fixed workforce. When seasonal spikes are brief or uncertain, even high-compliance firms may rationally prefer informal arrangements over putting short-term workers on the payroll.

³ 95% of the formal firms are micro-enterprises.

From the worker’s perspective, many of the “social benefits” that formal employment unlocks accrue gradually and may be realized only with sustained tenure, so the immediate private value of being on-payroll for a few weeks or months can be limited. Faced with brief or uncertain seasonal spikes, firms thus have strong incentives to avoid the fixed costs and litigation risks of formal short-stint hiring, while some workers may not strictly prefer formalization for very short engagements. In this environment of weak and delayed enforcement, it is therefore plausible that small shifts in perceived detection risk could move firms along the intensive margin—formalizing slots that would otherwise be filled off-the-books without altering the extensive margin of employment.

Our intervention was designed to capture some of the underlying forces behind the high levels of labor informality within formal firms in this context of weak enforcement capacity. While the randomization of audits has been applied successfully in other contexts, these are costly and interfere with the running of the auditing agency. For these reasons, as a first step, we opted for a light-touch approach in the form of a mailing experiment with different messages, which would allow us to uncover firms’ reactions to higher perceived probabilities of audits.

3. Data and Experimental Design

3.1 Data and sampling method

The universe for our intervention consists of firms and workers registered with the tax authority (Superintendencia Nacional de Aduanas y de Administración Tributaria-SUNAT), specifically in the electronic payroll system (“Planilla Electrónica”), a centralized electronic system where payroll taxes, social security contributions, and other key payroll reporting takes place. This registry contains all formal firms, covering both public and private entities. Since 2008, employers must register in this database monthly information on their salaried workers, service providers, and outsourced workers. In 2016, there were 1.5 million private firms registered in the electronic payroll.

Using the sample of firms that were inspected in 2016, SUNAFIL carried out an analysis of 1,712 large firms (with more than 50 workers) to develop risk models and increase the effectiveness of its labor inspections. Inspectors detected at least one informal worker (i.e., not registered in the electronic payroll system) in 170 firms. SUNAFIL analyzed the data and identified the main characteristics of firms with informal workers: they were relatively young (they had been operating for less than 30 years), they had less than 2,500 workers and fewer than 100 outsourced workers, paid relatively low levels of taxes, had fewer than 25 establishments, their total profits did not exceed 50% of sales, their fixed assets were less than 1% of the total fixed assets of their corresponding economic sector, and less than 2% of the total fixed assets of the corresponding economic activity. SUNAFIL used these identified characteristics to classify all 1.5 million private firms in the electronic payroll in terms of their propensity to higher workers informally. Of a total of 2,121 firms that fulfilled the criteria, SUNAFIL selected 590 to be inspected, and a random sample of 1,045 firms in the remaining group were selected for this study.

The firms in our experiment are thus not representative of all firms in Peru. First, we only consider formal firms registered with the tax authority, thus excluding fully informal firms. Second, we focus only on large firms with over 50 registered workers. Third, the firms in the experimental sample have a high likelihood of employing informal workers, according to SUNAFIL’s risk criteria. While this strategy does not allow us to make inference about the reaction of all firms (nor all formal firms) in Peru to increased perceived

probabilities of audit, this is still an important group for a series of reasons. On the one hand, with a fixed cost per inspection and large numbers of informal workers in large formal firms, the expected “audit return” for the agency is larger in larger firms. On the other hand, this return will be even larger in firms with a higher propensity to employ informal workers. Finally, government agencies routinely rely on risk scores rather than purely random criteria to select firms for audits. For all these reasons, we argue that the firms in our experimental sample provide valuable information from both research and public-policy perspectives, as they are representative of the type of firms an agency such as SUNAFIL will target in real life.

3.2 Experimental design

In partnership with SUNAFIL we designed a randomized mailing experiment to document the reaction to deterrence measures of large firms with a high propensity to employ workers informally in Peru. To increase the perception that the authority would enforce compliance with firms’ worker registration requirements, SUNAFIL sent letters informing firms that the government was running a formalization process at the national level, and they were invited to review the current situation of their workforce to comply with social security obligations.

Two types of letters were randomly sent: one with a deterrence message and one with a social norms message. The deterrence letter detailed the fines for non-compliance with labor regulations and emphasized that not registering workers (and thus evading payroll taxes and social security contributions) is a serious violation, stressing the punishment (a fine and back-due contributions) in the event of caught non-compliance. The social norms letter highlighted the benefits of formality and its positive impacts for workers and firms. This letter emphasized the importance of protecting workers against health risks and accidents, as well as the possible positive impacts on the productivity of the firm.

As is common in mailing information experiments of this type, the structure of both letters was identical, except for the paragraph with the main treatment message (see Table 1). The letter provides information on the government’s labor formalization efforts, invites firms to review the status of their workers on the electronic payroll, and provides a link to a site with information on how employers can comply with their obligations (see the Online Appendix for facsimiles of each of the two letters). The letters were personalized, addressed to the firm’s legal name, and signed by a SUNAFIL government official.

3.3 Empirical strategy

The firms’ reaction to these treatments, devised to increase the perceived probability of an audit, allows us to document the patterns of informality’s intensive margin in Peru. The use of two different letter types is also a common feature in this type of experiments (Antinyan and Asatryan, 2025) and allows to establish which of the two types of messages is most effective over and above the higher perceived audit probability.

The sample of 1,045 firms was divided randomly into three groups: control, deterrence letter and social norms letter (see Appendix Table A1 for a summary of the experimental design). We study the impact of this light-touch intervention on subsequent formal employment over the following two years, based on monthly administrative data. Our main outcome of interest is the number of formal workers per firm, and

we compute differences in this indicator in the control group and in each of the treatment groups with this high-frequency data.

The non-compliance rate is an important factor to be considered in the evaluation results. The letters were sent through a certified courier firm between October 20 and December 7, 2017. Around 82% of the letters sent were successfully delivered (see Appendix Table A2). This was due to either incorrect address information or inability to find a recipient. Another important element is the attrition rate. As previously mentioned, randomization was carried out based on firms registered in the electronic payroll in 2016. However, a percentage of these firms do not have information on the electronic payroll for the period in which the impact is evaluated. Appendix Table A2 shows that there was a 3.7% reduction in the sample of firms (39 firms that are not on the electronic payroll). There are no statistically significant differences between the control and treatment firms with full information on the electronic payroll – Appendix Table A3 presents the experimental balance in baseline characteristics for firms in the two groups, indicating that there are no statistically nor economically significant differences between the groups. We base our analysis on the 1,006 firms with complete information.

4. Results

The three panels in Figure 1 illustrate the main results. The top panel presents the monthly difference in formal employment for levels from January 2016 to December 2019 (the letters were sent in October 2017) comparing firms in the control group to firms in the pooled treatment group (i.e., all firms that received a treatment letter, irrespective of the specific treatment). The middle panel displays the difference in the same variable between firms receiving the deterrence treatment and those in the control group, while the bottom panel presents the same difference for firms in the social norms and those in the control group. These differences correspond to plain differences in means between the corresponding groups, computed each month, conditional on baseline variables and pre-treatment mean.⁴

The differences in formal employment levels fluctuate around zero and are not statistically significant in the three panels for the pre-treatment period from January 2016 to October 2017. For the deterrence treatment group (middle panel), the difference becomes positive and statistically significant at around 10 workers per firm, an effect of around 8 percent (the baseline pre-treatment employment level was about 120 formal workers per firm) in the first six months after the treatment. This difference becomes smaller and not significant from April to August 2018, and they start to increase again in September 2018, with a peak difference of about 40 formal workers (about a one third higher number of workers) in January 2019 and substantially higher levels from November 2018 to February 2019. The difference falls again to about 10 workers and becomes not statistically significant from April to August 2019, and the difference in formal worker numbers increases again in August 2019, reaching peaks of about 30 workers in October, November and December 2019. The patterns are similar across the three panels, although the post-treatment differences are about twice as large for the deterrence treatment group with respect to the social norms group (bottom panel). For the latter, despite similar trends, only the coefficients for February and March 2019 are statistically significant. The top panel represents an average of the two treatment groups, with statistically significant differences only for the October 2018 to March 2019 and October to December 2019 coefficients.

⁴ We present the same figures without controls in Appendix Figure A2.

We rely first on this detailed month to month variation to illustrate a series of characteristics of our results which would be mostly lost in simple comparisons of averages for the total post-intervention period. First, the three panels in Figure 1 reveal a clear seasonal pattern of the treatment effects. The tourist season in Peru is given by the Southern Hemisphere summer (December 21 to March 21), which corresponds to the long school holidays (and thus local tourism) and to the influx of foreign tourists fleeing the Northern Hemisphere’s winter. The letter treatments had significant effects mostly during the months building to and corresponding to the high labor demand summer period. Second, notably, these seasonal effects were still present in late 2019, two years after the reception of the treatment letters in late 2017.

The analysis of the full post-intervention period can still provide some useful insights. This is presented in the form of difference in differences regressions (basically, a form of controlling for pre-intervention outcomes) in Tables 2 and 3. These estimates include controls by differential trends for baseline variables and the mean of the number of workers in the pre-treatment period.⁵ In Table 2, we present the effect of the pooled treatment, and the results indicate a positive and statistically significant effect on the number of formal workers of about 11 on average for the post-treatment period (after adding differential trends by baseline variables and pre-treatment means – third column in Table 2). Table 3 shows the effects by type of letter, and confirms that only the deterrence letter has a positive and significant effect in the post treatment period, with a difference of 19 formal workers with respect to the control group, compared to only 2 workers with the social norms letter (not statistically significant), as displayed in column 1 of Table 3. This result remains stable after including differential trends by pre-treatment mean of the number of workers.

The analysis of the full post-intervention period masks the seasonal fluctuation of treatment effects but allows for a more detailed heterogeneity analysis that would lack statistical power on a monthly basis given the relatively small number of firms in our experimental sample. Interestingly, the effect of the deterrence letter is led mainly by the impact on large firms. On average, these firms have about 74 additional formal workers after the intervention. The social norms letter also had a slightly greater impact on those firms, although it remains non-significant (column 6 in Table 3). As a benchmark, the deterrence letter increases formal employment by about 74 workers in large firms, about 25% of the pre-treatment mean headcount (304 workers) in that size bin. For system-wide context, SUNAFIL reported for 2024 a total of 130,816 newly registered workers following 24,582 inspections, a yield of about 5.3 formalizations per inspection across all firms and actions (SUNAFIL, 2024). This underscores how targeted enforcement salience at large, high-risk firms can yield much larger per-firm effects.

Three stylized facts emerge from our results. First, as shown for the broader context of tax compliance mailing experiments, deterrence messages are more effective than social norm and other pro-social types of messages (Antinyan and Asatryan, 2025). In our case, we can argue that both treatments increased the perceived probability of an audit, since both letters signal the labor inspection authorities’ knowledge about and focus on the recipient firm, which was likely to be hiring some workers informally, but the deterrence message and its emphasis on fines still seems to induce a stronger response from recipients.

Second, the treatment effects show a clear seasonal pattern, with positive effects on the number of formal workers during the summer months, which have higher labor demand and require temporary workers.

Third, the impact seems to be driven mostly by large firms.

⁵ We present results without controls in Appendix Table A4.

A final empirical analysis we can conduct is whether the mailing campaign implied a net positive effect for the government budget, as this is a low-cost intervention compared to other public policy alternatives such as an in-person inspections. According to SUNAFIL, each completed inspection cost PEN 1,309 (USD 409) in 2018.

The costs of the mailing campaign are comparatively modest, even having relied on certified letters delivered by a private courier firm. The information letters had a unit cost of PEN 30.4 (USD 9.3). The resources invested in preparing the letters, such as the staff time spent preparing the campaign, were not included in this estimation. Another possible cost is reputation: if the letters do not go hand in hand with an effective increase in the likelihood of control, the threat of being inspected loses credibility over time (Pomeranz, Marshall, and Castellon, 2014).

The benefits consider the direct revenue for the public sector associated with the formalization of workers, i.e., the social security contribution payment. Under the assumption that formalized workers earn a minimum wage, we estimate a substantial increase in monthly government revenue resulting from social security contributions. Table 4 reports a peak-month snapshot of fiscal benefits and mailing costs. We compute delivered letters as posted letters $\times$ delivery rate, multiply by the per-delivered-firm treatment effect on formal headcount (Table 3) to obtain total added formal workers in the peak month, and monetize each worker-month at 17.5% (the social security contribution rate) of the 2018 minimum wage (930 PEN), i.e., 162.75 PEN per worker-month. Total mailing cost equals postage per letter $\times$ letters posted. Under this conservative one-month horizon, the pooled mailing (“Both Letters”) yields about 6,526 additional formal workers and 1.062 million PEN in social-security contributions, for a benefit–cost ratio of 50.13; the Deterrence letter in turn yields about 5,044 workers and 0.821 million PEN, for a benefit–cost ratio of 77.6. However, this is a very conservative estimate of the benefits since it leaves out the direct benefits from the perspective of the worker, such as protection against health risks, accidents, and old age, as well as the fulfillment of all labor rights associated with formality (vacation, Christmas bonuses, distribution of profits). Likewise, it does not consider other benefits for society and the economy from increased tax compliance, such as greater legal certainty and higher aggregate productivity.

This experiment’s labor formalization benefits far exceed the mailing campaign’s cost. However, as highlighted by DellaVigna and Linos (2022), there are probably diminishing returns to nudges. To scale up the scope of this enforcement approach while maintaining its effectiveness, two challenges emerge. The first challenge is to reach more firms at a low cost. Information technologies can help systematize electronic notifications to firms by opening permanent and effective communication channels. The second challenge is to ensure that alternative channels, such as letters and notifications, remain effective over time. Therefore, the increased perception of the likelihood of being monitored should be linked to further action by the authorities, such as increased audits, inspections, information campaigns, and comprehensive formalization policies. Otherwise, there is the risk that letters lose credibility as a threat. It is unlikely that an agency such as SUNAFIL can rely solely or primarily on light-touch interventions of this type.

5. Conclusion

This study provided evidence on how large firms in Peru respond in their intensive margin of informality (that is, how these firms hire workers both formally and informally) to an increased perceived probability of audit, varied exogenously through a mailing experiment. We find that our light-touch mailing campaign

led to significant increases in formal employment levels at treated firms over the subsequent two years. The effect was particularly pronounced for firms receiving the deterrence messages and for larger firms overall.

Interestingly, the increases in formal employment followed a clear seasonal pattern coinciding with the high labor demand during the tourist season. This suggests that before the intervention, the firms were employing temporary workers informally to meet short-term staffing needs, likely to evade taxes and regulations. The messaging campaign increased the perceived costs of non-compliance, incentivizing firms to formalize more of these seasonal workers.

The fact that even a light-touch intervention could substantially increase formal employment without negative effects on overall firm-level employment indicates that these large firms were exploiting rents from the lax enforcement environment. The increased compliance costs cut into these rents but still left firms with enough flexibility to maintain employment levels.

These findings have important implications for both research and policy. For research, our results highlight the value of examining heterogeneity in the impacts of enforcement measures across different types of firms and sectors. The effects we document for large, high-informality-risk firms in a low-enforcement environment contrast with some recent studies finding negative employment impacts of increased enforcement in other contexts. Theoretical models could be enriched by incorporating factors like firm market power, weak enforcement, and seasonality of labor demand to capture more of the complex dynamics driving informality at both the extensive and intensive margins.

For policy, this study suggests that in settings with very low enforcement, focusing efforts on large firms engaging in intensive margin informality can lead to substantial increases in formal employment without major disruptions to overall employment levels. The seasonal nature of the effects also points to the potential for dynamic enforcement strategies that target firms during high labor demand periods. Finally, our light-touch intervention seems to have been effective even in the medium run, and provided useful information on the underlying mechanisms. However, we should not go as far as to interpret this as evidence that policymakers may be able to meaningfully impact firm behavior at scale solely relying on nudges whose effects will probably fade over time. These interventions can be thought of as part of more comprehensive (and probably resource-intensive) enforcement efforts.

Overall, while this study provides valuable insights into the dynamics of informality at the intensive margin, it also underscores the need for more empirical research examining the impacts of various enforcement strategies across the highly heterogeneous contexts in which informality persists in developing countries. A nuanced understanding of these varying impacts will be critical for designing policies that can effectively reduce informality while supporting inclusive growth and employment.

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Figures and Tables

Table 1. Letters' treatment message

A. Deterrence Letter	B. Social Norms Letter
“In this sense, it is specified that the current regulations classify as a serious offense the failure to register workers in the payroll and / or not to enroll them in the social security regimes (health and pensions). In order to sanction non-compliance behaviors on the matter, very severe fines are imposed as detailed below: * Microenterprise: up to 1,823 soles * Small business: up to 18,225 soles * Others: up to 91,125 soles ”	“Formalizing the employment situation of dependent workers by registering them on the company's payroll, in EsSalud and the pension system, in addition to protecting the worker against health risks and work accidents, has the advantage of making the company more productive : the formal sector represents 80% of the total national gross value. ”

Source: Authors' intervention materials (English translation of treatment letters). The minimum wage at the time of the intervention (“Remuneración Mínima Vital-RMV”) was 850 PEN (Peruvian Soles) per month. The exchange rate in the last trimester of 2017 was about 3.25 PEN per US dollar.

Table 2. Treatment effects on number of formal workers,
pooled treatment, total and by firm size

	(1)	(2)	(3)
Letter x Post	10.27 (6.510)	13.14* (6.733)	11.49* (6.491)
R ²	0.75	0.86	0.87
Observations	44,304	44,304	44,304
Firms	1,033	1,033	1,033
Baseline mean employment (pre-treatment)	134.13	134.13	134.13
<i>Controls (diff. trends)</i>			
Baseline variables	Yes	No	Yes
Pre-treat mean	No	Yes	Yes
Pre-treat quarter means	No	Yes	Yes

Note: Difference-in-differences models. In columns (1) and (3) differential trends for the following baseline variables are included: tenure, number of formal employees, outsourced employees, total tax payment, number of branches, remuneration relative to sales, remuneration relative to costs, cost relative to sales, fixed assets relative to fixed assets in the sector, fixed assets relative to fixed assets in the activity. In columns (2) and (3) differential trends for mean of number of workers in pre-treatment periods (overall and by quarter) are included. The pre-treatment mean is zero when the firm is not present in the database in that period. Standard errors in parentheses, clustered at firm level. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table 3. Treatment effects on number of formal workers,
deterrence and social treatment letters, total and by firm size

	All firms			Firm size		
	(1)	(2)	(3)	Small (4)	Medium (5)	Large (6)
Deterrence Letter x Post	18.57** (9.265)	20.42** (8.126)	17.95** (7.621)	-1.30 (4.739)	5.14 (6.019)	74.09** (32.017)
Social Norms Letter x Post	1.94 (7.314)	5.95 (6.722)	5.07 (6.701)	-0.07 (3.451)	3.30 (5.291)	6.37 (27.801)
R ²	0.75	0.86	0.87	0.72	0.73	0.85
Observations	44,304	44,304	44,304	18,288	15,588	10,428
Firms	1,033	1,033	1,033	443	362	228
Baseline mean employment (pre-treatment)	134.13	134.13	134.13	60.05	99.60	304.25
<i>Controls and fixed effects (diff. trends)</i>						
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes	Yes
Baseline variables	Yes	No	Yes	Yes	Yes	Yes
Pre-treat mean	No	Yes	Yes	Yes	Yes	Yes
Pre-treat quarter means	No	Yes	Yes	Yes	Yes	Yes

Note: Difference-in-differences models. In columns (1), (3), (4), (5) and (6) differential trends for the following baseline variables are included: tenure, number of employees, outsourced employees, total tax payment, number of branches, remuneration relative to sales, remuneration relative to costs, cost relative to sales, fixed assets relative to fixed assets in the sector, fixed assets relative to fixed assets in the activity. In columns (2), (3), (4), (5) and (6) differential trends for mean of number of workers in pre-treatment periods (overall and by quarter) are included. The pre-treatment mean is zero when the firm is not present in the database in that period. The firm size is defined from the baseline size as: small with up to 80 workers, medium with more than 80 but less than 160 workers, and large with more than 160 workers. Standard errors in parentheses, clustered at firm level. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table 4. Cost-benefit analysis

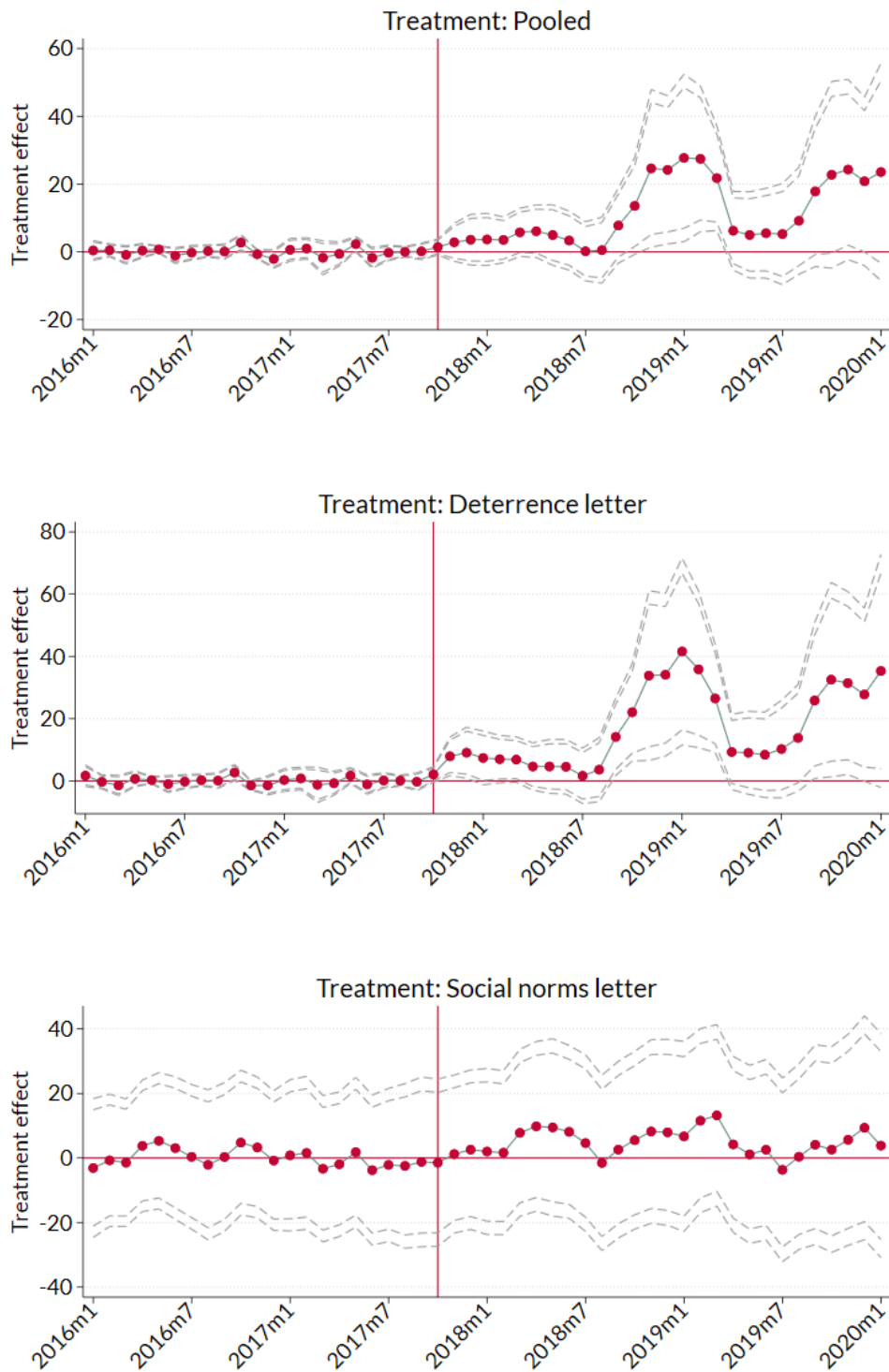
	Both Letters	Deterrence Letter
Letters posted (N)	697	348
Delivery rate (%)	81.5	80.7
Delivered letters (N)	568	281
Avg. effect per delivered firm (Δ workers)	11.49	17.95
Total added workers (peak month)	6,526	5,044
Unit revenue per worker-month (PEN)	162.75	162.75
Total revenue (peak month, PEN)	1,062,159	820,903
Mailing cost per letter (PEN)	30.40	30.40
Total mailing cost (PEN)	21,188.80	10,579.20
Benefit-cost ratio (peak month)	50.13	77.6

Source: Authors' calculations using data from SUNAFIL.

Notes:

- (i) Delivered letters = Posted $\times$ Delivery rate (Both: $697 \times 0.815 = 568.06$; Det.: $348 \times 0.807 = 280.84$).
- (ii) Total added workers (peak month) = Avg. effect $\times$ Delivered letters.
- (iii) Unit revenue per worker-month = 0.175 (social security contribution rate) $\times$ RMV (min. wage) 2018 (930) = 162.75 PEN.
- (iv) Total revenue (peak month) = Unit revenue $\times$ Total added workers.
- (v) Total mailing cost = 30.4 PEN $\times$ posted letters.
- (vi) Benefit-cost ratio = Total revenue / Total mailing cost.

Figure 1. Difference in worker numbers with respect to control group



Note: figures present adjusted differences in means between treated and control groups. These means were calculated conditional to the following baseline controls: tenure, number of employees, outsourced employees, total tax payment, number of branches, remuneration relative to sales, remuneration relative to costs, cost relative to sales, fixed assets relative to fixed assets in the sector, fixed assets relative to fixed assets in the activity. Also, we control for the mean of the total number of employees in the pre-treatment period (overall and by quarter). The pre-treatment mean is zero when the firm is not present in the database in that period. Confidence intervals at 90% and 95% significance levels.

Online Appendix

Table A1. Experimental design

Letters were sent between October 20th and December 7th, 2017	
Sample: 1 045 Peruvian private firms with 50 or more employees	
Treatment Group	Deterrence Letter 348 firms
	Social Norms Letter 349 firms
Control Group	No letter 348 firms
The impact is measured by comparing the number of formal workers of firms in the treatment group to firms in the control group	

Source: Authors' elaboration

Table A2. Compliance with the experiment design

Groups	Firms	Firms that received the letter		Firms with information in the social security administrative record	Firms that received the letter and with information in the social security administrative record	
		N	%		N	%
Control	348			335		
Deterrence	348	281	80.7	334	273	80.9
Social Norms	349	287	82.2	337	283	82.9
Total	1045	568		1006	556	

Source: Authors' elaboration

Table A3. Experimental balance: Mean of firm characteristics at baseline for treatment and control groups

	(1) Control Group (N=335)	(2) Pooled Treatment (N=671)	(3) Difference (1)-(2) p-value
Tenure	11.26 (0.43)	10.45 (0.31)	0.128
Number of employees	136.84 (7.47)	142.23 (5.96)	0.573
Outsourced employee	10.09 (0.78)	10.93 (0.59)	0.391
Total tax payments	17.45 (2.20)	17.21 (1.37)	0.928
Number of branches	2.49 (0.22)	2.28 (0.13)	0.398
Remuneration relative to sales	14.21 (0.76)	14.96 (0.57)	0.430
Remuneration relative to costs	12.78 (0.93)	12.32 (0.65)	0.686
Cost relative to sales	36.36 (2.02)	34.38 (1.43)	0.425
Fixed Assets relative to sector	2.07 (0.34)	2.13 (0.31)	0.895
Fixed Assets relative to activity	7.51 (0.94)	8.14 (0.83)	0.615

Note: "Total tax payment" was divided by 100,000; and Fixed Assets were multiplied by 100.

Table A4. Treatment effects on number of formal workers, total and by firm size, without controls

	Total		Small	Firm size	
	(1)	(2)	(3)	Medium	Large
	(4)	(5)			
Letter x Post	13.67*				
	(7.148)				
Deterrence Letter x Post		23.01**	7.08	2.74	76.73*
		(11.544)	(5.086)	(7.519)	(44.797)
Social Norms Letter x Post		4.37	4.43	-3.08	14.35
		(6.521)	(4.814)	(6.428)	(24.212)
R ²	0.72	0.72	0.45	0.57	0.64
Observations	44,304	44,304	18,288	15,588	10,428
Firms	1,033	1,033	443	362	228
Baseline mean employment (pre-treatment)	134.13	134.13	60.05	99.60	304.25
<i>Controls and fixed effects (diff. trends)</i>					
Firm FE	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes
Baseline variables	No	No	No	No	No
Pre-treat mean	No	No	No	No	No
Pre-treat quarter means	No	No	No	No	No

Note: Difference-in-differences models. The firm size is defined from the baseline size as: small with up to 80 workers, medium with more than 80 but less than 160 workers, and large with more than 160 workers. Standard errors in parentheses, clustered at firm level. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Figure A1. Deterrence Letter

	PERÚ	Superintendencia Nacional de Fiscalización Laboral	Intendencia Nacional de Inteligencia Inspectiva
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"Año del Buen Servicio al Ciudadano"

Lima,

OFICIO N° - 2017-SUNAFIL/INII

Señores
(RAZÓN SOCIAL DE LA EMPRESA)
(RUC DE LA EMPRESA)
(Dirección completa de la empresa)

Asunto : Formalización laboral

De mi consideración:

Sirva la presente para saludarle cordialmente y a la vez comunicarle que la Superintendencia Nacional de Fiscalización Laboral (SUNAFIL) viene ejecutando un proceso de formalización laboral a nivel nacional a través de su función inspectiva de trabajo, en el marco de la política gubernamental 2016-2021 y de las políticas nacionales y sectoriales sobre empleo digno y productivo.

En ese sentido, se precisa que la normativa vigente tipifica como infracción grave el no registrar a los trabajadores en las planillas de pago y/o no inscribirlos en los regímenes de seguridad social en salud y pensiones. Con el fin de sancionar las conductas de incumplimiento sobre la materia, se imponen multas muy severas conforme se detalla a continuación:

- o Microempresa: hasta 1,823 soles
- o Pequeña empresa: hasta 18,225 soles
- o Resto de empresas: hasta 91,125 soles

En este contexto, se le invoca revisar la situación actual de la fuerza de trabajo de su representada y, de corresponder, proceder con regularizar la situación de los trabajadores que no lo estén (registro en la Planilla Electrónica, ante EsSalud y en el sistema previsional correspondiente), así como cumplir con las obligaciones que se deriven de ello.

En caso tenga alguna consulta sobre el proceso de registro de trabajadores en la Planilla Electrónica y en la seguridad social (salud y pensiones), puede consultar la siguiente dirección electrónica: <http://www.sunafil.gob.pe/derechos-sociolaborales.html>.

Sin otro particular, me despido.

Intendente Nacional de Inteligencia Inspectiva

Figure A1. Social Norms Letter

	PERÚ	Superintendencia Nacional de Fiscalización Laboral	Intendencia Nacional de Inteligencia Inspectiva
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"Año del Buen Servicio al Ciudadano"

Lima,

OFICIO N° _____ - 2017-SUNAFIL/INII

Señores
(RAZÓN SOCIAL DE LA EMPRESA)
(RUC DE LA EMPRESA)
(Dirección completa de la empresa)

Asunto : Formalización laboral

De mi consideración:

Sirva la presente para saludarle cordialmente y a la vez comunicarle que la Superintendencia Nacional de Fiscalización Laboral (SUNAFIL) viene ejecutando un proceso de formalización laboral a nivel nacional a través de su función inspectiva de trabajo, en el marco de la política gubernamental 2016-2021 y de las políticas nacionales y sectoriales sobre empleo digno y productivo.

Formalizar la situación laboral de los trabajadores dependientes registrándolos en la planilla de la empresa, en EsSalud y ante el sistema pensionario correspondiente, además de proteger al trabajador contra riesgos de salud y accidentes de trabajo, **tiene la ventaja de hacer más productiva a la empresa:** el sector formal representa el 80% del valor agregado bruto nacional.

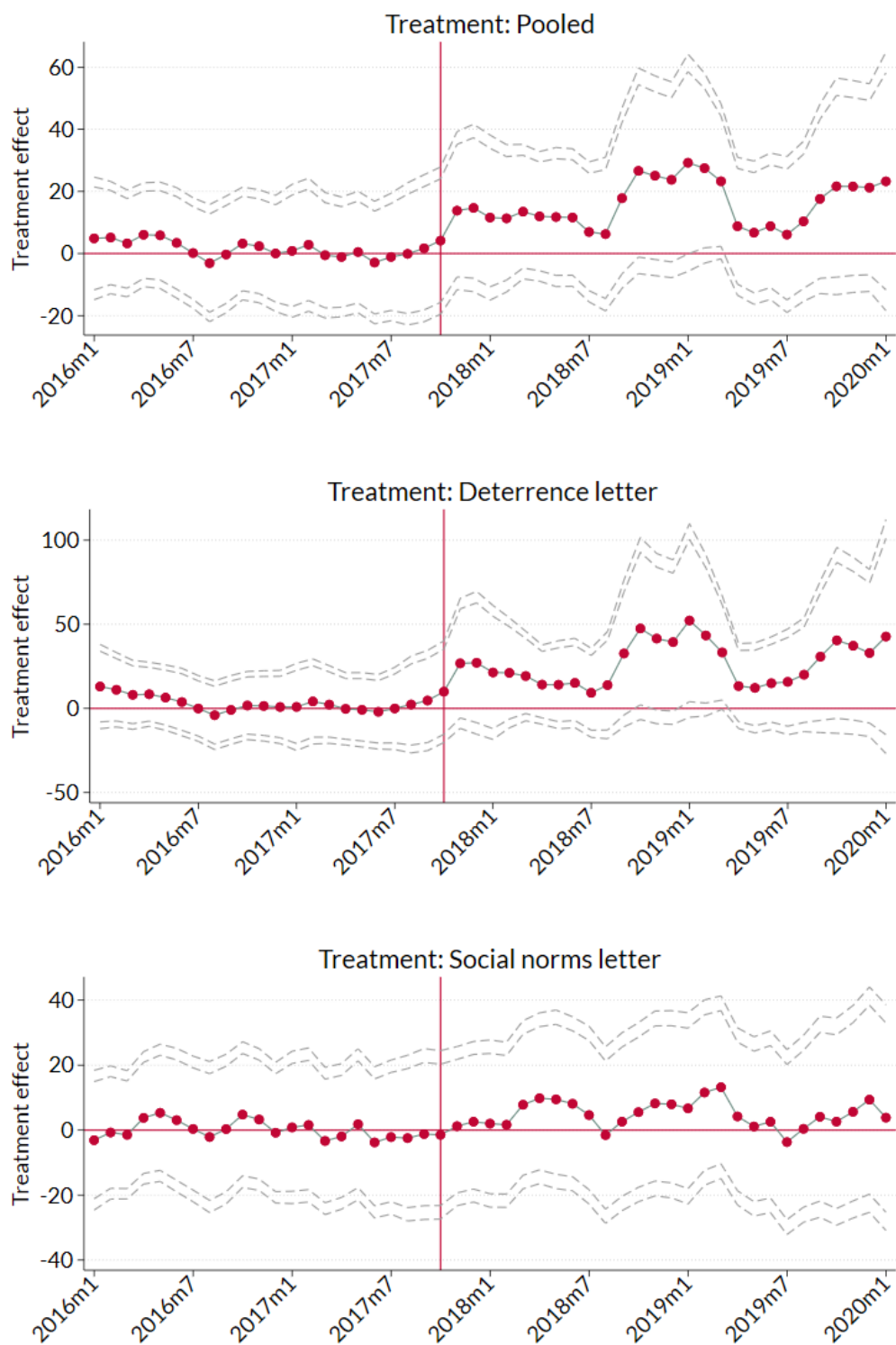
En este contexto, **se le invoca revisar la situación actual de la fuerza de trabajo** de su representada y, de corresponder, proceder con regularizar la situación de los trabajadores que no lo estén (registro en la Planilla Electrónica, ante EsSalud y en el sistema previsional correspondiente), así como cumplir con las obligaciones que se deriven de ello.

En caso tenga alguna consulta sobre el proceso de registro de trabajadores en la Planilla Electrónica y en la seguridad social (salud y pensiones), puede consultar la siguiente dirección electrónica: <http://www.sunafil.gob.pe/derechos-sociolaborales.html>.

Sin otro particular, me despido.

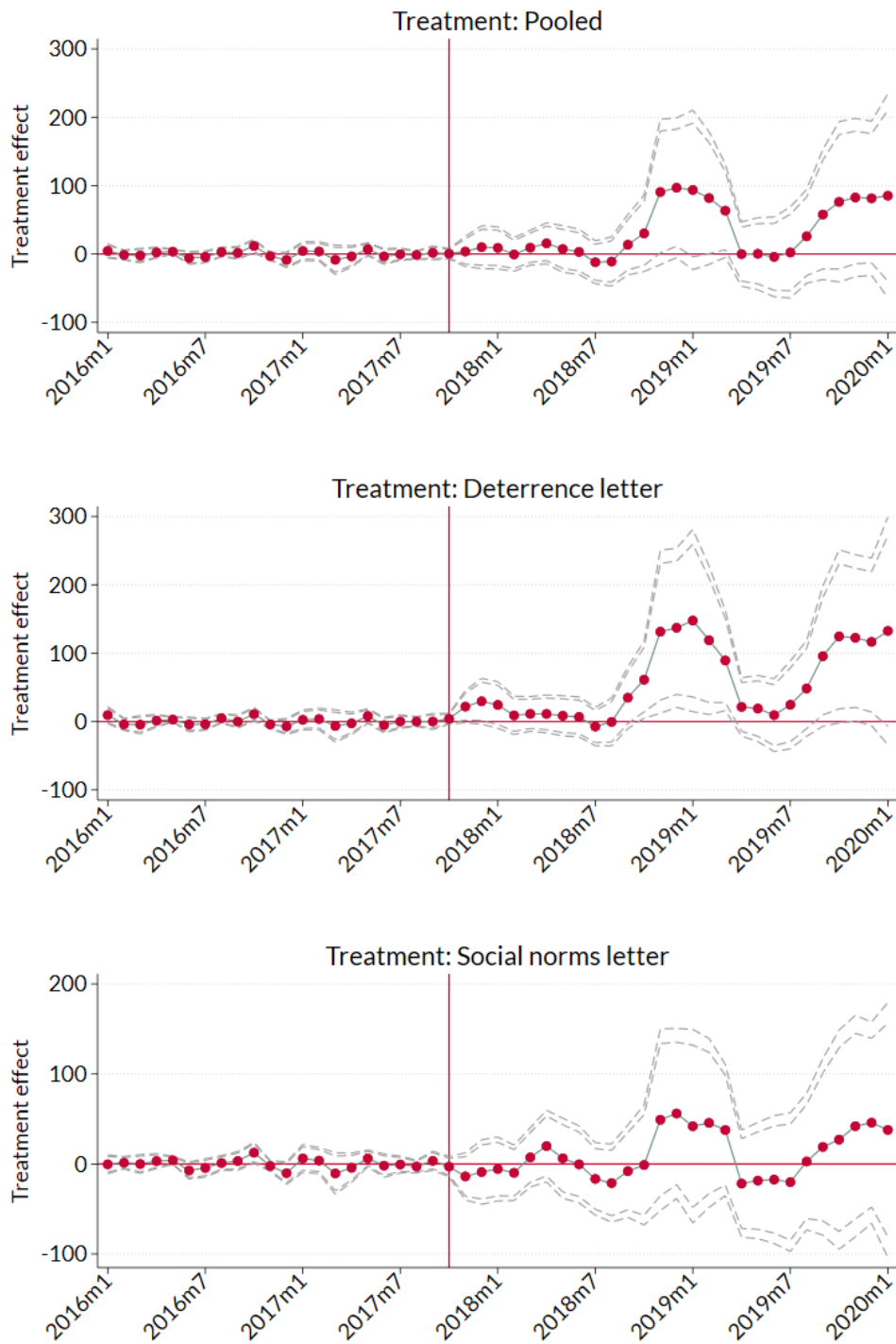
Intendente Nacional de Inteligencia Inspectiva

Figure A2. Difference in worker numbers with respect to control group, without controls



Note: figures present plain differences in means between treated and control groups. Confidence intervals at 90% and 95% significance levels.

Figure A3. Difference in worker numbers with respect to control group, large firms, with controls



Note: figures present differences in means between treated and control groups. These means were calculated conditional to the following baseline controls: tenure, number of employees, outsourced employees, total tax payment, number of branches, remuneration relative to sales, remuneration relative to costs, cost relative to sales, fixed assets relative to fixed assets in the sector, fixed assets relative to fixed assets in the activity. Also, we control for the mean of the total number of employees in the pre-treatment period (overall and by quarter). The pre-treatment mean is zero when the firm is not present in the database in that period. Confidence intervals at 90% and 95% significance levels.