

The Role of Cash in Illegal Labor Market Practices: Evidence from Uruguay*

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PRELIMINARY AND INCOMPLETE

Abstract

This paper studies the effect of prohibiting the use of cash for wage disbursements on labor markets in developing countries. We study a reform in Uruguay that mandated wage payments to be disbursed using only electronic methods. Using a difference-in-differences approach based on sector-level cash intensity prior to the reform, our results indicate that firms in high cash intensity sectors are significantly more likely to discontinue formal activities post-reform. Active firms show a slight reduction in the number of employees and an increase in reported wages. These results are driven by low productivity firms. Complementary results using survey data indicate an increase in informal employment and a decrease in collusive underreporting of earnings partially explain these results. Overall, results suggest that, while eliminating cash for wage payments enhances tax compliance among formal workers, it may also shift some economic activity into full informality, offsetting the revenue gains from improved payroll tax compliance.

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1. Introduction

Developing countries often have low levels of financial inclusion, with a majority of the population relying on cash for most transactions and saving. In low- and middle-income countries, typically less than half of the population over 15 years of age owned a bank account as of 2014 (Demirgüç-Kunt et al., 2022). The widespread use of cash has raised concerns due to its low traceability, which can undermine fiscal transparency and facilitate tax evasion, corruption, and other illicit activities (e.g. Rogoff, 2017; Gupta et al., 2017). In response, governments have introduced a range of financial inclusion policies aimed at reducing cash usage—such as expanding access to bank accounts, promoting debit card use, incentivizing electronic payments, and limiting cash availability.

Despite growing policy efforts to increase financial inclusion and limit cash usage, evidence remains limited regarding how these changes affect labor markets, which are also likely to be affected by the prevalence of cash. Labor markets in developing countries are often characterized by high levels of informality and regulatory non-compliance—patterns that cash usage may help sustain due to its lower traceability. For instance, recent evidence finds that cash is the primary method used to compensate formal workers off-the-books (Feinmann et al., 2024). Other studies link cash use to broader tax evasion: at the macroeconomic level, cash use is associated with underreporting of value-added taxes in the European Union (Pappadà and Rogoff, 2025), while a sharp reduction in cash availability led firms to increase their reported sales in India (Das et al., 2023). Yet, a gap remains in understanding how cash usage—and efforts to limit it—can affect labor market outcomes, such as hiring practices and wage reporting.

In this paper, we study the labor market effects of prohibiting the use of cash for wage disbursements. Specifically, we study a 2015 reform in Uruguay in which the government mandated all disbursements of wage payments to be made using any form of electronic payment (e.g. bank transfer, electronic wallets, pre-paid cards, etc). This was part of a broader effort from the Uruguayan government to increase the levels of digitization and formalization, especially since Uruguay’s levels of financial inclusion were significantly lower than those of countries of similar levels of income.¹

Using rich administrative tax records and labor force household survey data, we leverage pre-reform degrees of cash usage for wage disbursements at the sector level as a measure of exposure using a difference-in-differences approach, comparing the evolution over time of

¹ The reform also incorporated other measures to boost financial inclusion, such as VAT rebates for debit card purchases and a mandate to disburse pensions and other social assistance programs with electronic methods, among others. We describe the institutional context in more detail in section 2. See the official government website for a discussion of the several goals of the reform, <https://inclusionfinanciera.uy/porque/>, accessed on April 2024.

sectors with higher pre-reform cash intensity to those with lower cash intensity. The intuition behind our identification strategy is that sectors that were unlikely to rely on cash for wage disbursements prior to the reform are likely to be less affected by the no-cash mandate relative to sectors in which cash was a primary method for wage payments.

We find that the mandate was successful in reducing cash usage for wage payments, with the gap in cash usage across sectors significantly shrinking in the quarters following the reform. For each percentage point higher cash intensity in the pre-reform period, we find a reduction of 0.63 percentage points in the gap of cash usage for wage payments among formal workers 3 years after the reform, almost completely closing the gap between high and low cash intensity sectors. The reduction in cash usage to disburse wages is mirrored almost perfectly by an increase in the use of bank transfers.

Turning to firm behavior and the labor market, we use firm-level administrative data and find that firms in more cash-intensive sectors are significantly more likely to cease operating formally after the reform. Specifically, firms in sectors 50 percentage points more cash intensive are about 6 percentage points less likely to be active 3 years after the reform. Conditional on remaining formally active after the reform, firms in high cash intensity sectors show a significant reduction in the number of employees on payroll, of about 6 percent for sectors 50 percentage points higher in pre-reform cash intensity. In addition, firms that remain active show a significant increase in average reported wages: firms in sectors with 50 percentage points higher cash intensity show an increase of about 4 percent in wages 3 years after the reform.

The firm-level effects are driven mostly by smaller firms and those that reported lower reported wages prior to the reform, both of which we interpret as indicators of firm productivity (e.g. [Berlingieri et al., 2018](#)).² Large firms in high cash intensity sectors appear to be unaffected and, if anything, are slightly more likely to remain active after the reform. Even though small firms account for most informality ([Ulyssea, 2018](#)) and often have significantly higher levels of collusive underreporting of earnings ([Feinmann et al., 2024](#)), our findings do not immediately imply that firms that disappear switch to operate informally and that the increase in reported earnings is due to a reduction of tax evasion (in a similar logic to value-added taxes as in [Brockmeyer and Sáenz Somarriba, 2025](#) and [Das et al., 2023](#)). It could be that firms that cease to operate formally actually cease operations altogether, and that differential trends in unobservable productivity trajectories among firms that remain active drive increases in real wages.

To further understand the degree to which informality and collusive underreporting of earnings play a role in explaining our results, we complement our previous findings using

² Small firms are also more likely to pay their workers in cash, see Appendix A.

household survey data that covers informality and wage underreporting. We find that formal workers in high cash intensity sectors show no significant break in survey-reported earnings, which suggests the increase in tax-reported wages is due to a reduction in tax evasion. This is further supported by the fact that formal workers in high cash intensity sectors show significant reduction in the probability of underreporting their labor earnings for tax purposes. Taken together, these findings suggest that a reduction in collusive underreporting drives part of the increase in reported earnings we observe in administrative data.

Regarding the role of informal employment, we find that workers in high pre-reform cash intensity sectors are significantly more likely to report being informally employed after the reform. This suggests that transitions into informal employment could be driving part of the effect on the share of firms that are active after the reform and the number of workers on payroll after the reform. Although disentangling overall employment effects is complicated, we do not find an effect on the overall probability of being employed among workers in high cash intensiveness sectors, which suggests that transitions into informality are the main driver behind the reduction of formal employment observed in administrative data.

We conclude with some simple back-of-the-envelope calculations on the revenue implications of the policy. Empirical results suggest two counteracting effects: reducing collusive underreporting of wages increases revenue from formal workers, while the shift to informality shrinks the tax base. The overall impact on government revenues depends on which effect dominates. Using our event study coefficients, we extrapolate a 23.6 percentage point reduction in overall cash intensity due to the reform, which would increase reported wages by 1.88% but decrease formal employment by 4.96%. Assuming a tax schedule that is linear with respect to the wage mass, the reform would ultimately result in a 3.08% decrease in revenues, with the reduction of formal employment more-than-compensating the improvement in payroll tax compliance.

Our paper contributes to several branches of the literature. First, we contribute to the literature studying the effects of reducing the use of cash and boosting financial inclusion. Some recent papers have focused on the financial implications of such policies, such as how the disbursement of debit cards for the poor affects savings ([Bachas et al., 2021](#)) and the adoption of electronic payment technology ([Higgins, 2024](#); [Crouzet et al., 2023](#)). More related papers have analyzed the effects of reduced cash usage and tax compliance. For instance, [Brockmeyer and Sáenz Somarriba \(2025\)](#) study the effects of value added tax rebates for debit card purchases in Uruguay and find no effect on tax compliance. [Das et al. \(2023\)](#) study the demonetization policy in India and find that it led to a significant increase in reported tax sales. Our findings contribute to this literature by showing that cash usage for wage payments is related to illegal labor market practices such as informal employment and collusive

underreporting of earnings. However, the effect is not a straightforward reduction of evasion after the reduction in cash usage, but rather a reduction in evasion among employment that remains formal after the reform but combined with an increase in fully informal employment. This presents a cautionary tale regarding policy recommendations to reduce the use of cash: even if doing so can improve tax compliance among firms that remain formal, it can also have detrimental effects on overall revenue if transitions into fully off-the-books operations are possible.

Our paper also contributes to the literature studying labor markets in developing countries, specifically regarding informality and collusive underreporting of labor earnings. A vast body of research has studied the spread and consequences of informal employment (e.g. [Williams and Lansky, 2013](#); [Bitran, 2014](#)). A significant fraction of this literature has focused on how taxes and registration costs affect informality (see [La Porta and Shleifer, 2014](#) and [Ulyssea, 2020](#) for reviews of this literature). Our paper indicates that the use of cash is a significant factor driving informal hiring of employees: forbidding the use of cash for wage disbursements shifts some employment into full informality. This suggests that some features of informal employment as a form of tax non-compliance could be different to those of, for instance, evasion of value-added taxes.

Regarding collusive underreporting of earnings, recent research has challenged the notion that third-party reporting eliminates the possibility of collusive underreporting from [Kleven et al. \(2011\)](#). For instance, [Kumler et al. \(2020\)](#) infer sizeable unreported labor earnings from area-by-industry-by-firm size reported wages in household surveys compared to administrative data in Mexico. [Bíró et al. \(2022\)](#) study a reform to the establishment audits rule in Hungary and document that bunching at the minimum wage is partly driven by collusive underreporting of earnings. [Feinmann et al. \(2024\)](#) find sizeable and widespread engagement in collusive underreporting of labor earnings in Brazil, with cash payments referenced as one of the most prevalent methods for the disbursement of payments under the table. Our paper indicates that reducing the use of cash for wage disbursements can reduce the spread of collusive underreporting of earnings, in a similar fashion as demonetization led to a reduction of value-added tax evasion in India ([Das et al., 2023](#)).

More broadly, our paper also contributes to the vast literature studying tax enforcement (e.g. [Slemrod and Yitzhaki, 2002](#), [Andreoni et al., 1998](#)), particularly in developing countries (e.g. [Besley and Persson, 2013](#)). Some papers have found that third-party reporting can improve tax compliance (e.g. [Pomeranz, 2015](#); [Naritomi, 2019](#)), although evasion can shift to the cost margin (e.g. [Carrillo et al., 2017](#); [Slemrod et al., 2017](#)). Several papers document how the challenges of tax enforcement in developing countries affect countries' choices of tax instruments (e.g. [Best et al., 2015](#); [Gordon and Li, 2009](#)). Our paper indicates that

widespread use of cash for wage disbursements can contribute to the concealing of labor earnings, complicating tax collection on wages. In addition, our paper highlights that a policy that could be conjectured to reduce tax evasion according to previous research (e.g. [Das et al., 2023](#)) can do so on the intensive margin, but can also increase extensive margin evasion in the form of fully informal economic activity.

The rest of the paper is structured as follows. Section 2 describes the context and institutional setting. Section 3 describes the data and the econometric strategy. Section 4 presents the results. Section 5 discusses the revenue implications of our findings. Section 6 concludes.

2. Context

The Uruguayan context Uruguay is an upper-middle-income country in South America, with a population of around 3.5 million and a GDP per capita of about \$18,000 dollars in 2018 according to data from the World Bank. The country has an established contributory social security system for formal workers, including retirement benefits, unemployment insurance, workers' compensation, disability insurance, health insurance, and parental leave, all of which are handled by the Social Security Agency (SSA) called *Banco de Previsión Social*. The funding for this system comes from social security contributions levied on formal workers and employers on a monthly basis, for which employers are required to immediately report the employees they hire to the SSA.

As with many other Latin American countries, Uruguay faces significant challenges with tax evasion, and the financial inclusion reform intended to tackle some of these ([Brockmeyer and Sáenz Somarriba, 2025](#)). The tax administration estimates that at least 20 percent of potential VAT revenues were evaded in 2012, an equivalent to 2.5 percent of GDP ([Dirección General Impositiva, 2019](#)). The country also has a substantial fraction of employment that is non-registered (about 26% of employees are informally employed throughout the 2014-2019 period) and there is widespread non-compliance with payroll taxes, although both of these measures of informality have been falling in recent years.

Regarding levels of financial inclusion, by 2011 the country was significantly lagging behind other countries of similar income: less than 25% of the population over 15 years of age owned a bank account, while other countries of similar GDP per capita were closer to 50% (see panel A of Figure 1). Panel (b) presents the evolution of account ownership over time for several Latin American countries, indicating that Uruguay significantly increased its share of the population with access to a bank account in the years following the financial inclusion reform.³

³ The countries used in panel (b) include Uruguay, Argentina, Brazil, Panama, Guatemala, Mexico, and

The reform In 2014, the government passed a law intended to increase the levels of bancarization and financial inclusion. The intent was to incorporate segments of the population that were not included in the financial system, reduce the degree to which Uruguay lagged behind countries of similar income in the degree of use of electronic payment methods, and to incentivize formalization and reduce tax evasion.⁴ The reform included many components, such as VAT rebates for debit card purchases, which are analyzed in Brockmeyer and Sáenz Somarriba (2025). It also created a specific type of regulated bank account—referred to as "wage accounts"—for the purpose of receiving salary payments. These accounts were exempt from fees for opening, closing, or maintenance, and carried no minimum balance requirements. In addition, they allowed workers to access certain loans with repayment automatically deducted from their wage accounts.

Specifically regarding wage disbursements, one of the key provisions of the law prohibited cash payments of wages and required that all salary payments be made through an electronic money instrument—such as bank transfers, mobile payment apps, or prepaid cards.⁵ The implementation schedule established that, beginning in October 2015, workers would voluntarily coordinate with their employers to select an electronic payment method with which to receive their salary payments. As of May 2017, the use of an electronic instrument became mandatory for all wage payments. We refer to the period from October 2015 to May 2017 as the *phase-in period*, and the period beginning in May 2017 as the *mandate period*.

Enforcement of the mandate follows the same mechanisms used for other labor market regulations—such as those concerning minimum wages, pension contributions, and paid leave—and relies on a combination of establishment audits and worker complaints submitted to the Ministry of Labor or the Internal Revenue Service. Employers who are found to be paying wages in cash are to be fined with the maximum between 25% of the sum paid in cash and twice the minimum wage. As in most developing country contexts, however, enforcement of labor market regulations is imperfect and there is significant non-compliance. Thus, we will empirically assess the degree to which the mandate effectively translated into lower use of cash in wage disbursements.

Costa Rica.

⁴ See the official government website <https://inclusionfinanciera.uy/por-que/>, accessed on April 2024.

⁵ The reform also stipulated that pensions and other social assistance programs would have to be disbursed electronically.

3. Data and empirical strategy

3.1 Data

Administrative records Our primary data source is firm-level administrative records from the Social Security Administration, based on monthly payroll tax forms that employers are required to file to report and remit social security contributions. These records form a quarterly panel covering the universe of formally registered firms from 2014 to 2019. For each firm, we observe all employees along with their reported wages, the firm’s 2-digit ISIC sector classification, and its legal status. As is typical of administrative data, the records include only formal employees working for legally registered firms.

We define a firm as active in a given quarter if it reports at least one dependent employee during that period, assigning an indicator equal to 1 for active quarters and 0 otherwise. For each active firm-quarter, we compute the number of dependent employees on payroll and the average wage. We restrict the sample to firms that were active at any point between January 2014 and September 2015 and that employed at least three workers on average over that period. The resulting dataset is a balanced quarterly panel of firms observed from the first quarter of 2014 through the last quarter of 2019. Summary statistics are reported in Panel A of Table 1.

Household surveys Our second source of data is individual-level data from the Continuous Household Survey (*Encuesta Continua de Hogares*, ECH), collected by the National Institute of Statistics since 1990. The ECH is a nationally representative survey carried out in accordance with international standards on a quarterly basis. It collects information on living standards, labor force participation, earnings, social security benefits, and sector of employment at the 4-digit ISIC code.

The survey asks employed workers how they receive their wage payments—via cash, bank transfer, prepaid card, or other methods. Based on this question, we construct binary indicators equal to 1 if the worker is paid in cash (and 0 otherwise), and similarly for whether the wage is disbursed through a bank account. These indicators are used not only as dependent variables in some econometric specifications, but also to construct a measure of pre-reform cash intensity at the 2-digit ISIC sector level. Specifically, we calculate the proportion of workers paid in cash during the pre-reform period (the first quarter of 2014 and the third quarter of 2015). We then merge this sector-level indicator of cash intensity to the same 2-digit ISIC code sector in the administrative data.

The ECH also asks whether employers deduct pension contributions from workers’ paychecks. Following standard practice in the literature (e.g., Tornarolli et al., 2014), we use this

to define a binary indicator of formal employment, equal to 1 if contributions are deducted and 0 otherwise. In addition, the survey includes a question aimed at detecting wage under-reporting: formal workers are asked whether social security contributions are based on their total earnings or only a part. The explicit goal of this question is to capture collusive tax evasion between employers and workers (Bergolo and Cruces, 2014). We use this to construct an indicator equal to 1 if the worker reports that only part of their earnings are declared and 0 otherwise.

Our final survey dataset is a quarterly repeated cross-section of workers spanning from the first quarter of 2014 to the last quarter of 2019. All main analyses using the ECH are done using the survey’s sampling weights, and we present unweighted results as robustness in the appendix. Summary statistics are presented in Table 1.⁶

3.2 Econometric strategy

We exploit variation in pre-reform cash intensity across sectors as a measure of differential exposure to the mandate, implementing a difference-in-differences design with continuous treatment intensity. Intuitively, sectors that relied minimally on cash for wage disbursements prior to the reform are expected to be less affected by the mandate than sectors where cash was the dominant payment method. Panel (a) of Figure 2 displays a histogram of the sector-level share of workers paid in cash, revealing substantial variation in exposure to the reform.⁷ Specifically, we estimate the following equation:

$$Y_{ist} = \sum_{k \neq -1} \beta_k \mathbb{1}\{t = e + k\} \times \text{PreCashUse}_s + \alpha_s + \mu_{I(s)t} + \varepsilon_{ist} \quad (1)$$

where Y_{ist} denotes any of our outcomes of interest for unit i in sector s at time t , PreCashUse_s denotes the proportion of workers of sector s who were paid in cash prior to the reform, α_s is a sector fixed effect, $\mu_{I(s)t}$ is a time-by-industry (broader than sector) fixed effect, and ε_{ist} is the error term. We define sectors at the 2-digit ISIC code level and industries at the 1-digit ISIC code level.⁸

The β_k coefficients are the parameters of interest, which measure the differential evolu-

⁶ To ensure reliable estimates of pre-reform cash intensity, we exclude the bottom 10% of 2-digit ISIC sectors with the fewest observations (9 sectors), resulting in a final sample of 75 sectors. Results are robust to including these omitted sectors.

⁷ Because our empirical specifications include industry-by-time fixed effects, we also present a version of the histogram residualized by industry fixed effects in Appendix Figure A.III, which similarly shows considerable within-industry variation. Figure A.II presents the pre-reform cash payment share for each sector within each industry.

⁸ We combine the 1-digit ISIC codes for Electricity and Gas with Water and Waste Disposal, since both industries are fairly small and similar.

tion over time among sectors with higher pre-reform cash intensity compared to sectors with lower cash intensity. For negative values of k , the coefficients allow us to test for the similarities in the pre-reform trends across sectors with different cash intensities, while coefficients associated with positive values of k allow us to capture the dynamics of the effects. In all specifications, we cluster standard errors at the sector level, which is the dimension in which cash intensity varies.

4. Results

4.1 Main results

cash usage for wage payments We begin by exploring whether the reform effectively reduced the use of cash in wage payments. To do so, we first estimate two versions of equation 1, first with the dependent variable being an indicator equal to 1 if the worker reports being paid with cash and second with the dependent variable being an indicator equal to 1 if the worker reports being paid with a bank transfer. For this analysis, we use the sample of formal workers from the household survey in which workers were asked about the disbursement method for their wage payments.⁹

Figure 3 reports OLS estimates and 95% confidence intervals of the β_k coefficients for this exercise. We find stable trends prior to the reform, with a significant reduction in the probability of receiving cash for wage payments during the phase-in period, and a more pronounced reduction during the mandate period. This is further reflected in panel (b) of figure 2, which shows a comparison between cash intensity in the pre-reform and the post-reform periods. Notably, the post-reform distribution is significantly shifted towards lower cash intensity.

Given the continuous definition of our exposure variable, the event-study coefficients should be interpreted as the reduction in the probability of being paid in cash for workers in a sector in which all workers were paid with cash compared to a sector in which no workers were paid in cash. As shown in figure 2, cash intensity prior to the reform is more evenly distributed within the 0-1 interval, so the actual effects should be interpreted as more modest. Notably, the reduction in cash usage for wage payments seems to be completely mirrored by an increase in bank transfer payments.

Firm behavior We then turn to analyzing the effects of the reform on firm behavior using administrative firm-level records, starting with firm survival. Panel (a) of Figure 4 reports

⁹ In appendix figure A.I, we show the raw time series for workers paid in cash and in bank transfer, showing a significant reduction of cash usage in favor of bank transfers.

OLS estimates and 95% confidence intervals of the β_k coefficients from equation 1, with the dependent variable being an indicator equal to 1 if the firm is active and 0 otherwise. Once again, we observe stable pre-reform trends across sectors with varying levels of cash intensity. Once the reform starts, we observe a significant reduction in the probability of the firm being active: two years after the reform, firms in sectors with 50 percentage points higher cash intensity are around 6.5 percentage points less likely to be active. This is reflected in the pooled event study coefficients in column 1 of table 2, indicating a highly significant reduction in the share of active firms.

We then explore the effects of the reform on firm behavior conditional on the firms remaining active. Given that firms that are inactive have no employees on payroll by definition, for this exercise we keep a balanced panel of firms that remained active in all periods in the sample, so as to prevent event-study coefficients from being estimated with different samples in different periods.¹⁰ Panel (b) of figure 4 reports OLS estimates of the β_k coefficients with the dependent variable being the natural logarithm of the number of workers employed by the firm. There is a significant reduction in the number of workers employed by the firm in more cash intensive sectors after the reform: firms in sectors with 50 percent higher cash intensity reduce their number of workers on payroll by about 5.5 percent in the long-run. In panel (c), we report OLS estimates of the event study coefficients for the average wage. We find a significant increase in reported average wages: firms in sectors with 50 percent higher cash intensity report wages about 4 percent higher in the long-run. These event-study coefficients are summarized in pooled coefficients in table 2.

We then analyze the heterogeneous effects of the reform according to firm size and pre-reform wages, both of which we interpret as measures of firm-level productivity (e.g. Berlingieri et al., 2018).¹¹ The literature has also established that informality is more common in small firms (e.g. Ulyssea, 2018), and recent research has found that collusive underreporting of earnings is also more frequent in smaller firms (Feinmann et al., 2024). We define an indicator for small firm if the firm had less than 20 employees on average during the pre-reform period and an indicator for large firm if the firm had 20 or more, and then we interact the event-study coefficients with the indicators of small and large firm.¹²

Figure 5 reports the results from this exercise. Importantly, panel (a) indicates that the reduction in the share of active firms is driven exclusively by small firms, with large firms being unaffected in the short run and, if anything, slightly more likely to be active in the

¹⁰ In appendix figure A.VII we show that our results remain similar when using the unbalanced full sample of firms.

¹¹ The use of cash for wage disbursements is also significantly more widespread for small firms, which makes them more affected by the reform, see Appendix figure A.V.

¹² We choose 20 as a cutoff because it matches one of the categories for firm sized used in the labor force household survey.

long run. This is reflected in the first column of Panel A of table 3. Panel (b) of figure 5 shows that the reduction in the number of workers is also more pronounced in smaller firms, although effects for large firms are economically significant despite statistical insignificance (see Column 2 of Panel A in table 3). Finally, panel (c) of figure 5 shows that the increase in wages comes exclusively from smaller firms.

We then turn to analyzing the heterogeneous effects of the reform based on pre-reform wages. We first residualize wages during the pre-reform periods from time fixed effects and sector fixed effects, and then categorize firms as high wages firms if their residualized average wage is above-median and low wages if their average wage is below median. Figure 6 shows the results from this exercise. Panel (a) of figure 6 shows that the reduction in the probability of the firm being active is more pronounced among firms that paid low wages prior to the reform, although it is still significant for firms paying high wages. Panel (b) indicates that the reduction in the number of workers is more pronounced among firms that paid low wages prior to the reform. Finally, panel (c) indicates that the increase in wages comes exclusively from firms paying low wages prior to the reform. These results are summarized in Panel B of table 3.

Overall, results using administrative data suggest that a ban on cash usage for wage payments reduces the probability of a firm being active, particularly among smaller firms and those that paid lower wages prior to the reform. Conditional on remaining active after the reform, firms in higher cash intensity sectors show a significant reduction in the number of workers that they employ and a significant increase in their reported wages, both also driven primarily by smaller firms and those that paid lower wages prior to the reform.

Although the fact that the effects on firm survival, number of workers, and reported wages come mostly from smaller firms in which tax evasion and informality are more widespread, our findings so far are insufficient to conclusively determine the degree to which informality and tax evasion play a role. While it could be that wages increase because the reduced use of cash allows for less tax evasion, it could also be the case that higher productivity firms that pay higher wages are the ones that remain active after the reform. It is also hard to disentangle the degree to which firms ceasing activity in administrative data reflects actual ceasing operations relative to transition into pure informality. In future versions of the paper, we will explore effects on the wages for incumbent workers and, more broadly, the effects of the reform at the worker level.

Survey data results To further disentangle the degree to which informality and collusive underreporting of earnings drive the results, we complement the previous analysis with household survey data that covers informality and collusive underreporting of earnings. We

begin by studying whether the reform affected wages reported in survey data. Panel (a) of figure 7 reports OLS estimates of the event study coefficients with the dependent variable being the natural logarithm of the wage. Importantly, we do not find any significant increase in wages reported in survey data, which is also reflected in column 2 of table 4. If anything, earnings reported in survey data show a minor reduction in higher cash-intensive sectors.

Panel (c) of figure 7 shows that the share of workers that underreport their earnings falls significantly in more cash-intensive sectors after the reform: workers in sectors 50 percentage points more cash intensive prior to the reform are almost 2 percentage points less likely to state that they underreport their labor earnings for tax purposes in the long run. This is reflected in column 4 of table 4. Although this measure of collusive underreporting of earnings is discrete, which renders us unable to quantify magnitudes on reported earnings, it suggests that a reduction of tax evasion explains in part the increase in earnings reported in administrative data.

Panel (b) of figure 7 shows that workers in more cash intensive sectors show a significant increase in the probability of being informal in the long run, which is also reflected in column 3 of table 4. Specifically, workers in sectors 50 percentage points more cash intensive prior to the reform are about 3.5 percentage points more likely to report being informally employed in the long run. This suggests that part of the reduction in active firms and the number of workers among firms that remain active could potentially be driven by transitions into informality. It is complicated to assess how much of the reduction of formal workers is driven purely by informality, so we approximate the effect on overall employment by leveraging the fact that unemployed workers are asked in which sector they were employed before. Panel (d) of figure 7 shows that there seems to be no effect on the overall probability of a worker being employed, suggesting that transitions into full informality are the main driver.

Table 5 shows heterogeneity of the effects on earnings, informality, and evasion according to firm size using household survey data, where small firm is defined as an establishment with less than 20 employees.¹³ Notably, earnings among formal workers seem to be unaffected by the reform in firms of any size (Column 1), while the degree of earnings underreporting significantly falls in small firms. This can explain the increase in wages observed in administrative data in small firms. Informality, on the other hand, seems to increase in both small and large firms, which is consistent with the drop in employees observed for both types of firms in administrative data.

Overall, results in this section indicate that the elimination of cash for wage payments produces a significant reduction in the probability of firms remaining formally active. Among those that remain active after the reform, we observe a minor reduction in the number of

¹³ Appendix figure A.VI shows the event study coefficients for large and small firms.

workers they employ and a significant increase in reported wages. These effects are driven by smaller firms and those that paid lower wages prior to the reform. Results using survey data suggest that these results are partially driven by transitions into full informality and a reduction in collusive underreporting of earnings among formal workers.

Ruling out alternative financial inclusion reform mechanisms Our interpretation of the results is that the mandate to disburse wages in electronic methods led some firms to exit the formal sector, while reducing formal employment and increasing reported wages among surviving firms, and that informality and tax evasion partially explain these results. An alternative explanation is that the reduction in active formal firms and increased reported wages arose due to other components of the reform (e.g. the VAT rebates on debit card purchases or overall increased bancarization). For instance, it could be that the increase in debit card transactions reduced cash circulation, this subsequently reduced the use of cash to pay for wages, with a subsequent drop in formal businesses, workers, and wage evasion.

We first note that the increase in debit card use for purchases was fairly immediate after the VAT rebates on August 2014 (as documented by [Brockmeyer and Sáenz Somarriba, 2025](#)). This is several quarters prior to the mandate to disburse wages with electronic methods, which was phased-in starting in October of 2015 and became mandatory in May of 2017. If this increase in debit card purchases was driving our results, then we would likely observe a break in trends in the third and fourth quarters in our event studies, but none of our main results show such a pattern. Second, we note that [Brockmeyer and Sáenz Somarriba \(2025\)](#) do not document responses in VAT compliance after the increase in debit card purchases, which could suggest that we should expect limited responses on other margins as well.

Finally, we note that the increase in debit card use for purchases can only significantly affect some sectors such as retail and restaurants. For instance, [Brockmeyer and Sáenz Somarriba \(2025\)](#) study responses to the increase in debit card use by comparing retail firms to wholesale firms. However, our analysis leverages variation in pre-reform cash intensiveness for wage payments across all sectors of the economy, including many that are not exposed to the increased use of debit cards. In addition, we find that our results hold even when omitting sectors that are likely to be highly affected by the increased use of debit cards: retail and restaurants. This exercise has the disadvantage of excluding important sectors of the economy that also show considerable tax evasion and informality, so we lose some statistical significance, but results are qualitatively similar. The results of this can be found in Appendix C.

4.2 Robustness checks

Leave-one-out robustness checks Given that we leverage within-industry levels of cash intensity at the sector level, we assess the degree to which individual industries influence the results using a series of leave-one-out robustness checks. For each of our dependent variables, we estimate the event-study coefficients by sequentially excluding one of the industries at a time and compare it with our baseline estimates. Appendix figures [D.I](#) and [D.II](#) show the results of this exercise using administrative and survey data, respectively. For succinctness, we report the long-run effect coefficient (i.e. $k \in [12, 16]$). In all panels, we observe very similar coefficients across specifications, indicating that our results are not driven by one specific industry.

Alternative cash intensiveness definition Our baseline results use the sector-level share of workers paid in cash prior to the reform as a measure of exposure to the reform. This has the advantage of leveraging varying degrees of exposure to estimate the effects of the reform. To assess the robustness of our main results, we also estimate our main specifications using a discrete definition of cash intensity, separating sectors as within-industry above- and below-median pre-reform cash intensity.¹⁴ Figures [E.I](#) and [E.II](#) show the main event-study coefficients capturing the difference between high and low cash intensiveness sectors. All of our main results remain qualitatively similar when considering this alternative discretized definition of cash intensiveness.

Unbalanced sample robustness checks Given that the reform induced a reduction in the share of firms that are active, to estimate the effects of the reform conditional on remaining active we rely on the balanced sample of firms that remained active throughout the whole sample period. This ensures that event-study coefficients are estimated using the same sample for all time periods. To assess the degree to which constraining the sample to the balanced panel of firms affects the results, we also estimate the event-study coefficients with the full unbalanced sample. Results of this exercise can be found in Appendix figure [A.VII](#). In both panels, results remain virtually identical to estimates using the balanced sample.

Unweighted regression robustness checks Our baseline results using survey data use the survey sampling weights to approximate representativeness of the population. To assess the degree to which the use of sampling weights affects our estimated coefficients, we re-estimate our main survey data specifications using unweighted regressions. The results of this

¹⁴ Since our specifications include industry-by-time fixed effects, we separate sectors as above- and below-median cash intensity within industries.

exercise can be found in Appendix table B.I, which shows results remain virtually unchanged when not using sampling weights.

5. Revenue implications

In this section we present some back-of-the-envelope calculations regarding the effects of the virtual payment mandate on overall government revenues. Empirical results from section 4 suggest that there are two counteracting effects. On one hand, the reduction of collusive underreporting of wages mechanically increases revenue from formal workers. On the other hand, the transition of workers and businesses into informality shrinks the tax base of workers. Which of these effects dominates determines the overall impact on government revenues.

Assuming a simplified tax system in which taxes on wages are collected by applying a flat tax rate τ to formal wages w over formal workers L (as is the case for contributions for social security in Uruguay), we can define government revenues as $T = \tau wL$. Thus, in this simplified setting, total revenue has an elasticity of 1 relative to both formal wages and the number of formal workers. We can then match the changes in formal wages and employment estimated from the empirical analysis.

Starting from a baseline cash intensity among formal workers of 37% (the average in the pre-reform period) and assuming proportionality in the reduction in cash intensity, we can use our pooled long-run event study coefficient of 0.638 (Column 1 of table 4) to attribute a 23.6 percentage point reduction in economy-wide cash intensity to the policy. Given this 23.6 percentage point reduction in cash intensity, given our pooled long-run event study coefficients, we would expect reported wages to increase by 1.88% as a result of the reform. Combining the extensive- and intensive-margin responses on overall formal employment (see Appendix figure A.VIII), we would expect overall formal employment to drop by 4.96%. This yields a negative effect of the policy on revenues of 3.08%, with the drop in registered employment more than compensating revenue gains from improved payroll tax compliance.

6. Conclusion

In this paper, we studied the effects of a reform that mandated wage payments to be made using electronic payments instead of cash in Uruguay. Leveraging pre-reform degrees of cash intensity at the sector level, we study the effects of the reform using a difference-in-differences approach, comparing the evolution over time of sectors with higher cash intensity relative to those with lower cash intensity using rich administrative and survey data.

We find that the reform induced a significant reduction in the share of firms that are active in high cash intensity sectors. Among those that remain active, we find a minor reduction in the number of workers that they employ and a significant increase in reported wages. These effects are driven by smaller firms and those that paid lower wages prior to the reform. Complementary results using survey data suggest that the increase in reported wages is driven in part by a reduction in underreporting of earnings, while transitions into full informality can explain part of the reduction in formally active firms and the number of employees conditional on remaining active.

Our findings provide the first empirical evidence on the effects of cash usage for wage disbursements on labor market outcomes and, specifically, illegal labor market practices. Part of our findings are consistent with recent research that has documented how recent efforts to foster the use of electronic payment methods have led to significant reductions in tax evasion (Das et al., 2023). However, our findings also highlight a potential increase in other types of evasion: even though reported wages increase among firms that remain active after the reform, the reform induced a significant reduction of formal employment and firms, which offsets the revenue gains from better payroll tax compliance.

It is worth noting that the financial inclusion reform had many objectives beyond that of boosting formalization and reducing tax evasion, with the main goal being to increase overall access to financial services. In that sense, despite potential detrimental effects on informality and tax compliance, we do find that the reform increased the use of bank accounts for wage disbursements, which can have benefits beyond that of effects on labor markets.

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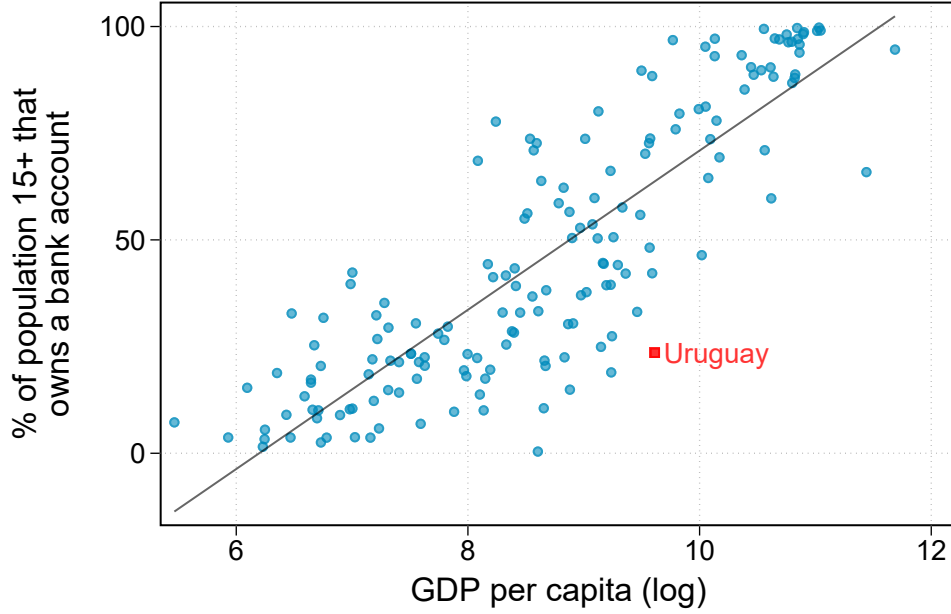
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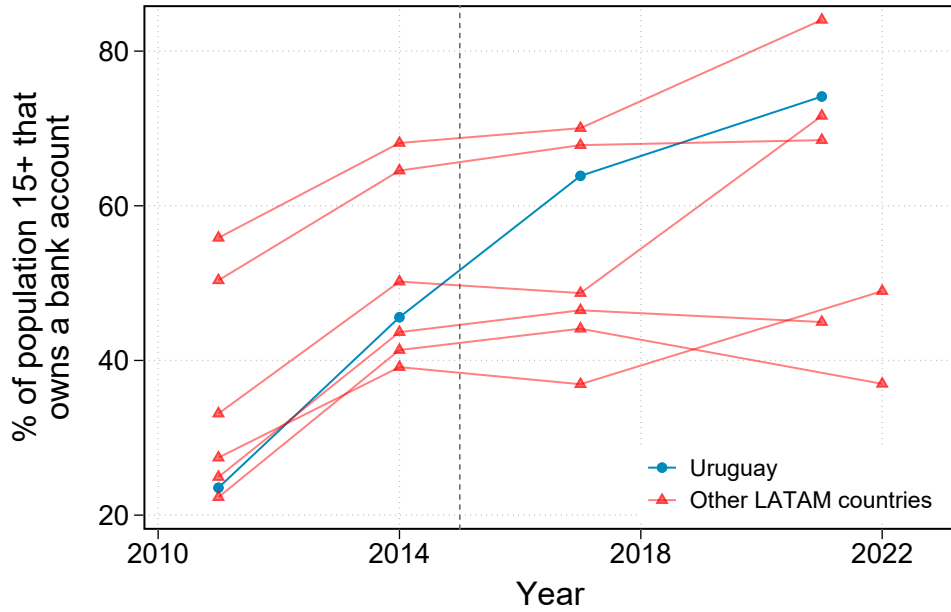
A. Figures

Figure 1: Account ownership across countries

(a) Cross-country account ownership (2011)



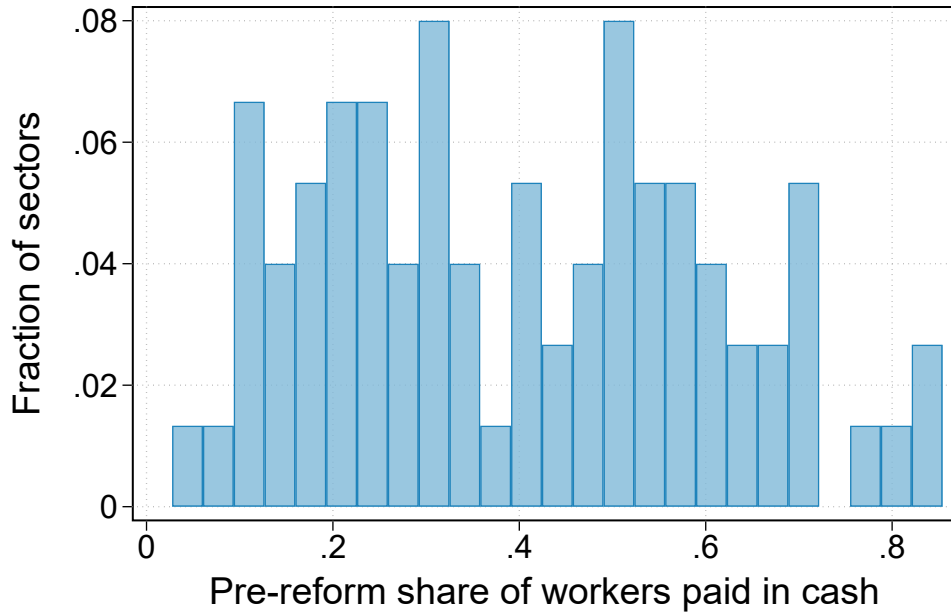
(b) Evolution of account ownership for selected Latin-American countries



Notes: This figure presents cross-country comparisons of account ownership. Panel (a) presents a scatter plot of the percentage of the population aged 15 and higher that owns a bank account at the country level and the corresponding GDP per capita in current US dollars, both measured in the year 2011. Uruguay, the country studied in this paper, is highlighted in red. Panel (b) shows the evolution over time for selected countries in Latin America, with Uruguay highlighted in blue. The dashed line indicates the year of the reform mandating wage payments to be made with electronic methods.

Figure 2: Sector-level cash intensity histogram

(a) Pre-reform

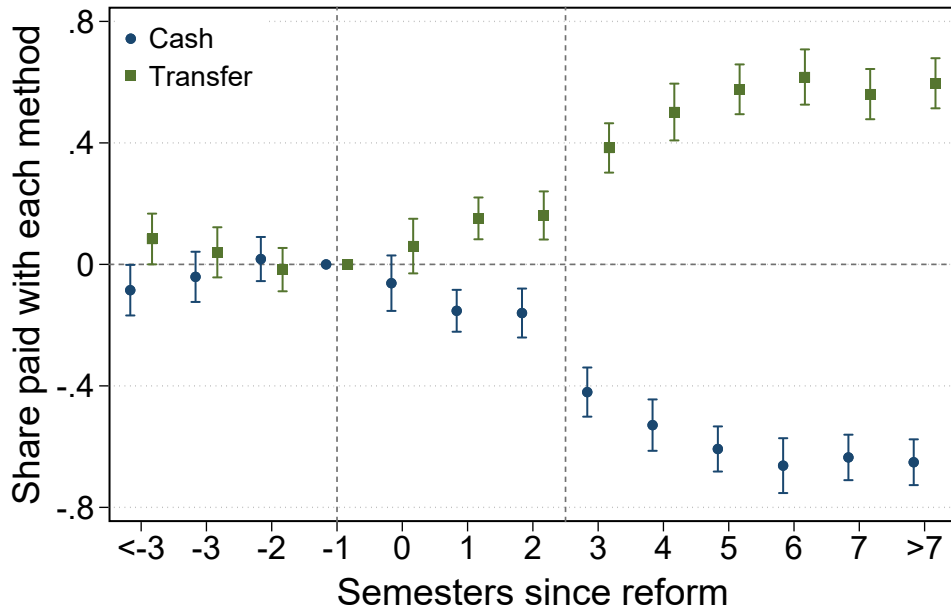


(b) Pre- and post-reform comparison



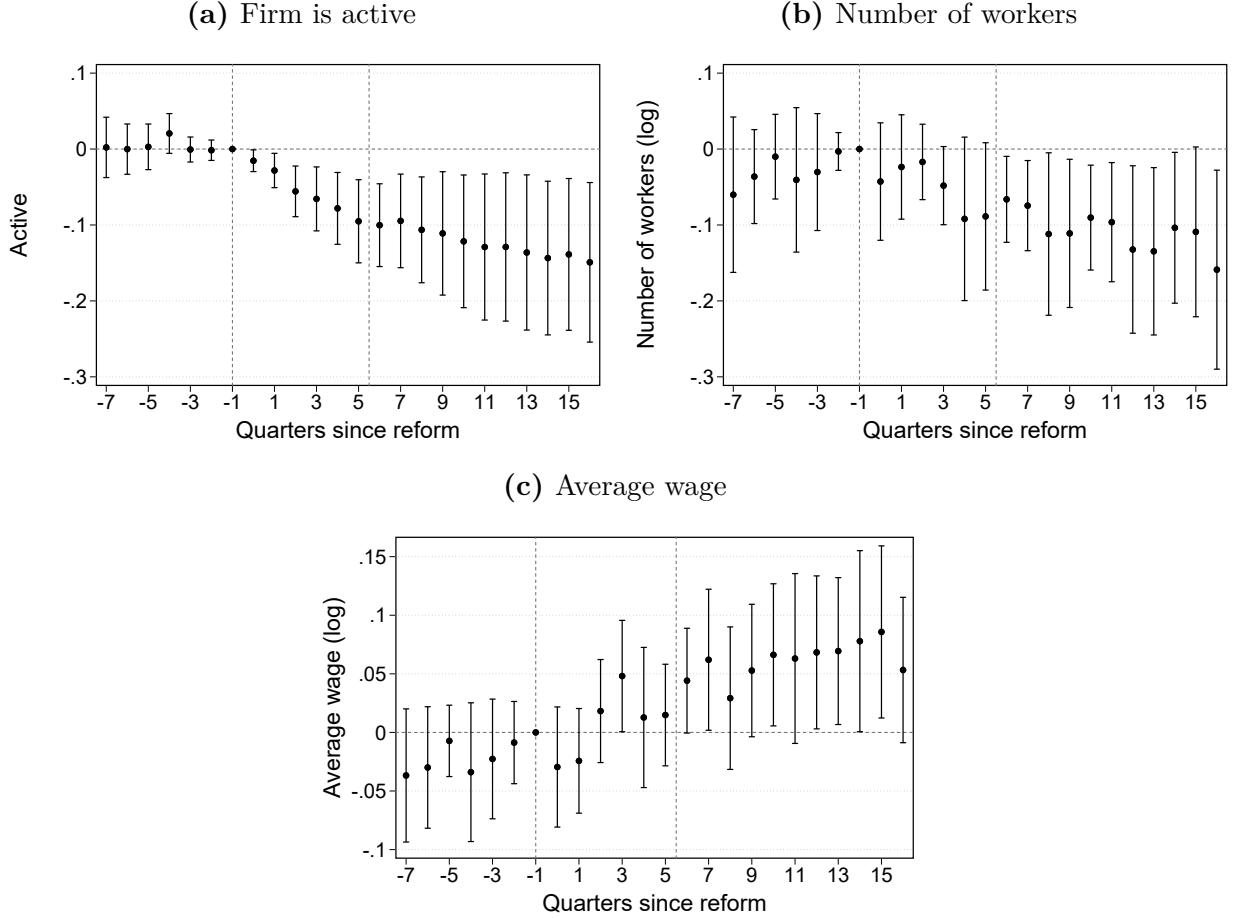
Notes: This figure shows a histogram of the sector-level share of workers who are paid in cash. The sector is defined at the 2-digit ISIC code level. Panel (a) shows a histogram only for the pre-reform period and panel (b) shows a comparison with the post-reform period. The pre-reform period in blue corresponds to the year 2014 and the post-reform period in orange corresponds to the year 2019.

Figure 3: Payment method event study



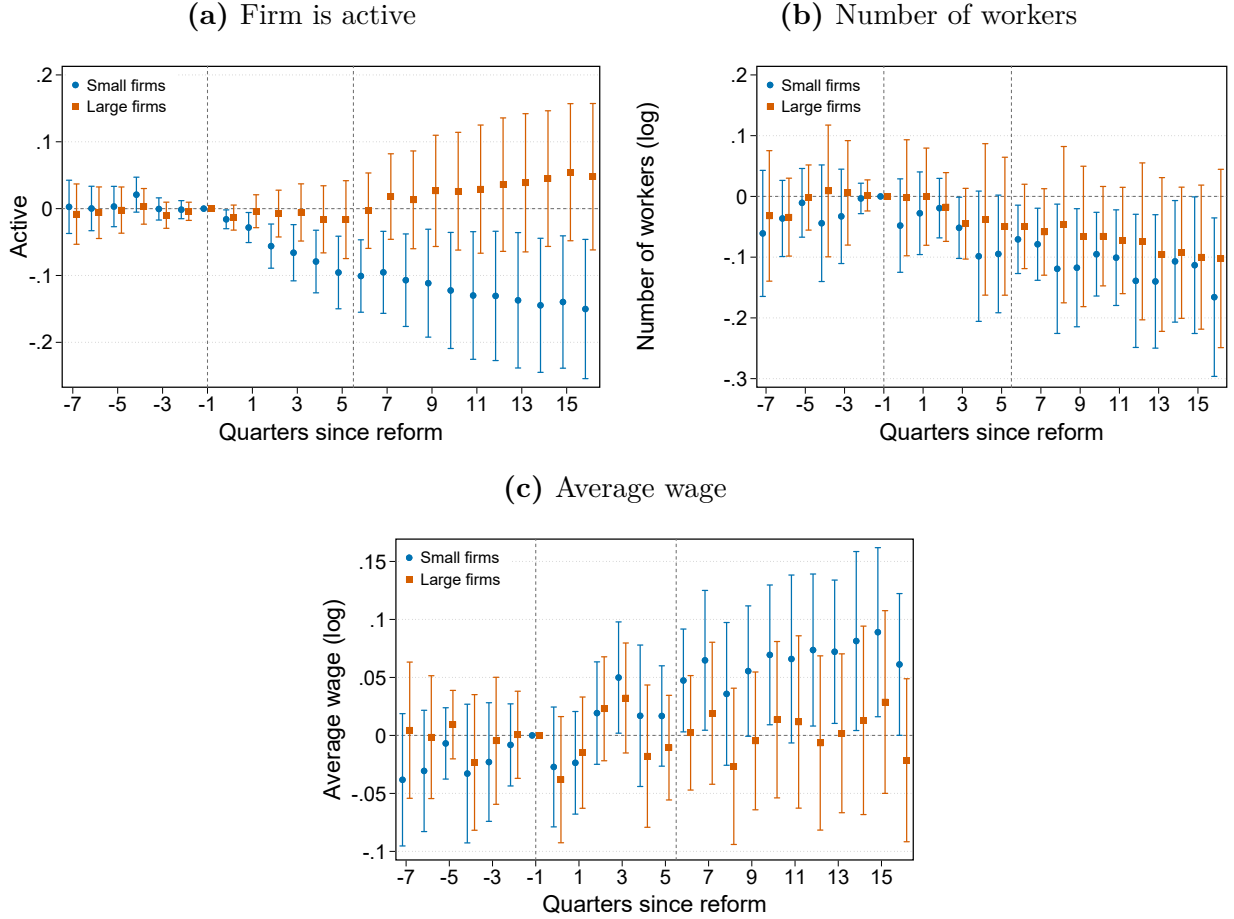
Notes: This figure shows OLS estimates of the β_k coefficients from equation 1 pooled by semesters. The dependent variable for blue coefficients is an indicator equal to 1 if the worker is paid in cash. The dependent variable for green coefficients is an indicator equal to 1 if the worker is paid in with a bank transfer. The first dashed line indicates the beginning of the phase-in period and the second dashed line indicates the beginning of the mandate period. Capped vertical bars represent 95% confidence interval from standard errors clustered at the sector level.

Figure 4: Main effects of the reform (administrative data)



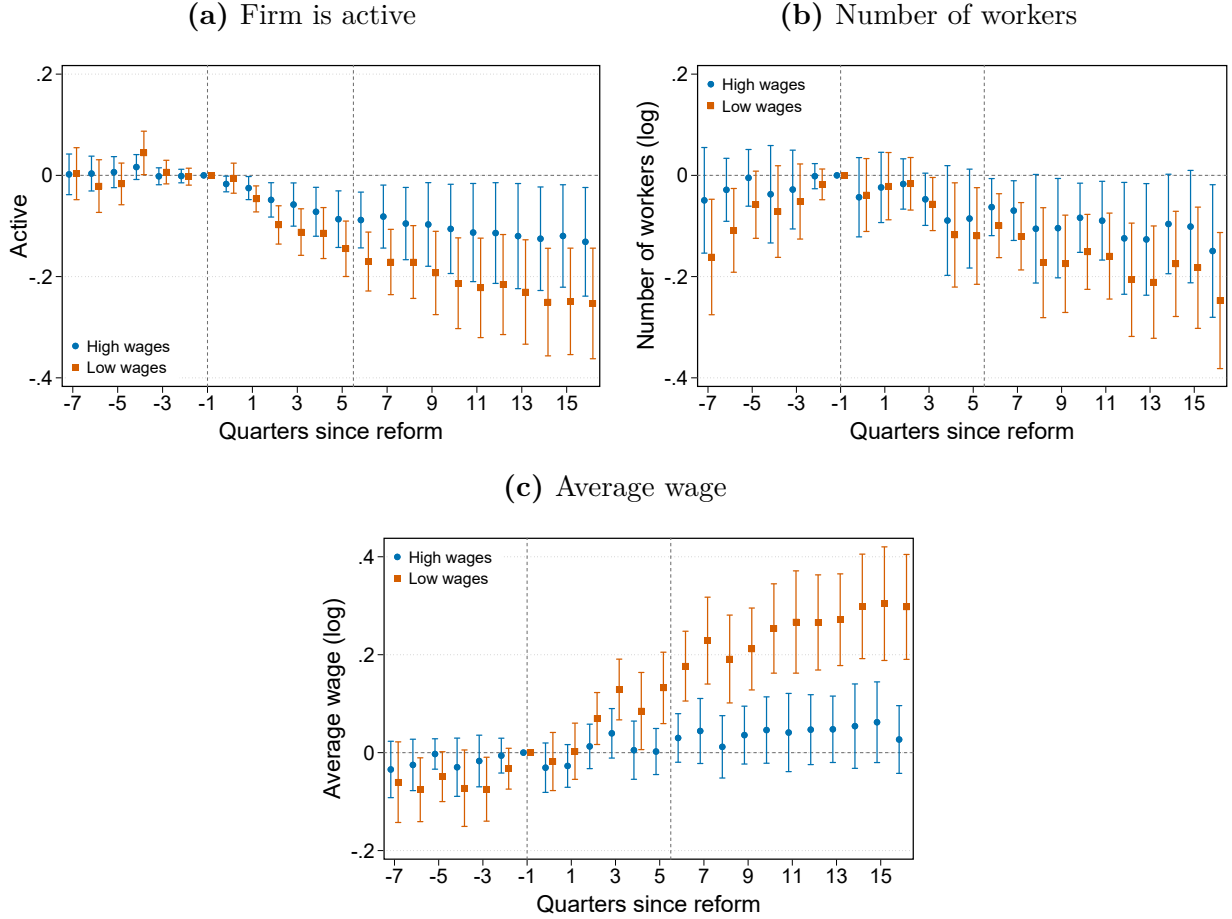
Notes: This figure shows OLS estimates of the β_k coefficients from equation 1. In panel (a) the dependent variable is an indicator equal to 1 if the firm is active. In panel (b) the dependent variable is the natural logarithm of the number of employees on payroll. In panel (c) the dependent variable is the natural logarithm of the average wage of the firm. The first dashed line indicates the beginning of the phase-in period and the second dashed line indicates the beginning of the mandate period. Capped vertical bars represent 95% confidence interval from standard errors clustered at the sector level.

Figure 5: Main effects of the reform - heterogeneity by firm size (administrative data)



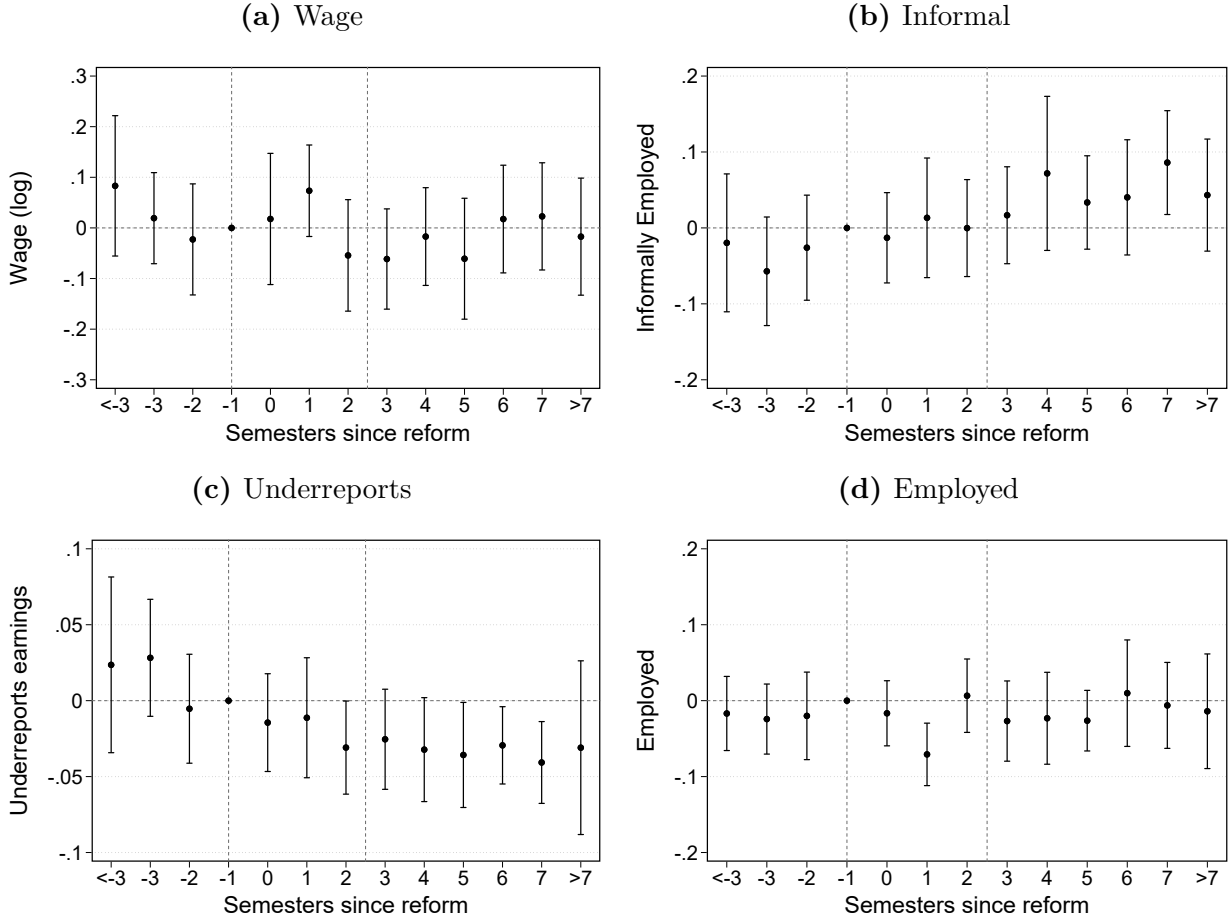
Notes: This figure shows OLS estimates of the β_k coefficients from equation 1 interacted with indicators for small firm and large firm. Blue corresponds to coefficients interacted with an indicator for small firm and orange corresponds to coefficients interacted with an indicator for large firm. Small firm is defined as having less than 20 employees on average during the pre-reform period. In panel (a) the dependent variable is an indicator equal to 1 if the firm is active. In panel (b) the dependent variable is the natural logarithm of the number of employees on payroll. In panel (c) the dependent variable is the natural logarithm of the average wage of the firm. The first dashed line indicates the beginning of the phase-in period and the second dashed line indicates the beginning of the mandate period. Capped vertical bars represent 95% confidence interval from standard errors clustered at the sector level.

Figure 6: Main effects of the reform - heterogeneity by pre-reform wages (administrative data)



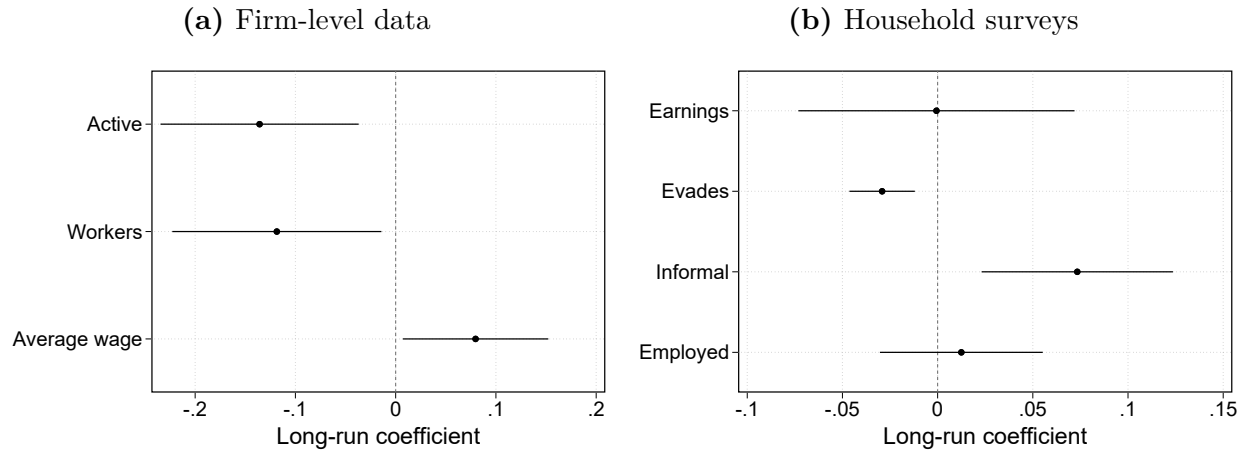
Notes: This figure shows OLS estimates of the β_k coefficients from equation 1 interacted with indicators of the firm having high or low pre-reform wages. Blue corresponds to coefficients interacted with an indicator equal to 1 if the firm has above median pre-reform wages and orange corresponds to interactions with an indicator equal to 1 if the firm has below median pre-reform wages. Pre-reform wages are constructed by residualizing average wages at the firm level during the pre-reform period by time fixed effects and sector fixed effects. In panel (a) the dependent variable is an indicator equal to 1 if the firm is active. In panel (b) the dependent variable is the natural logarithm of the number of employees on payroll. In panel (c) the dependent variable is the natural logarithm of the average wage of the firm. The first dashed line indicates the beginning of the phase-in period and the second dashed line indicates the beginning of the mandate period. Capped vertical bars represent 95% confidence interval from standard errors clustered at the sector level.

Figure 7: Main effects of the reform (survey data)



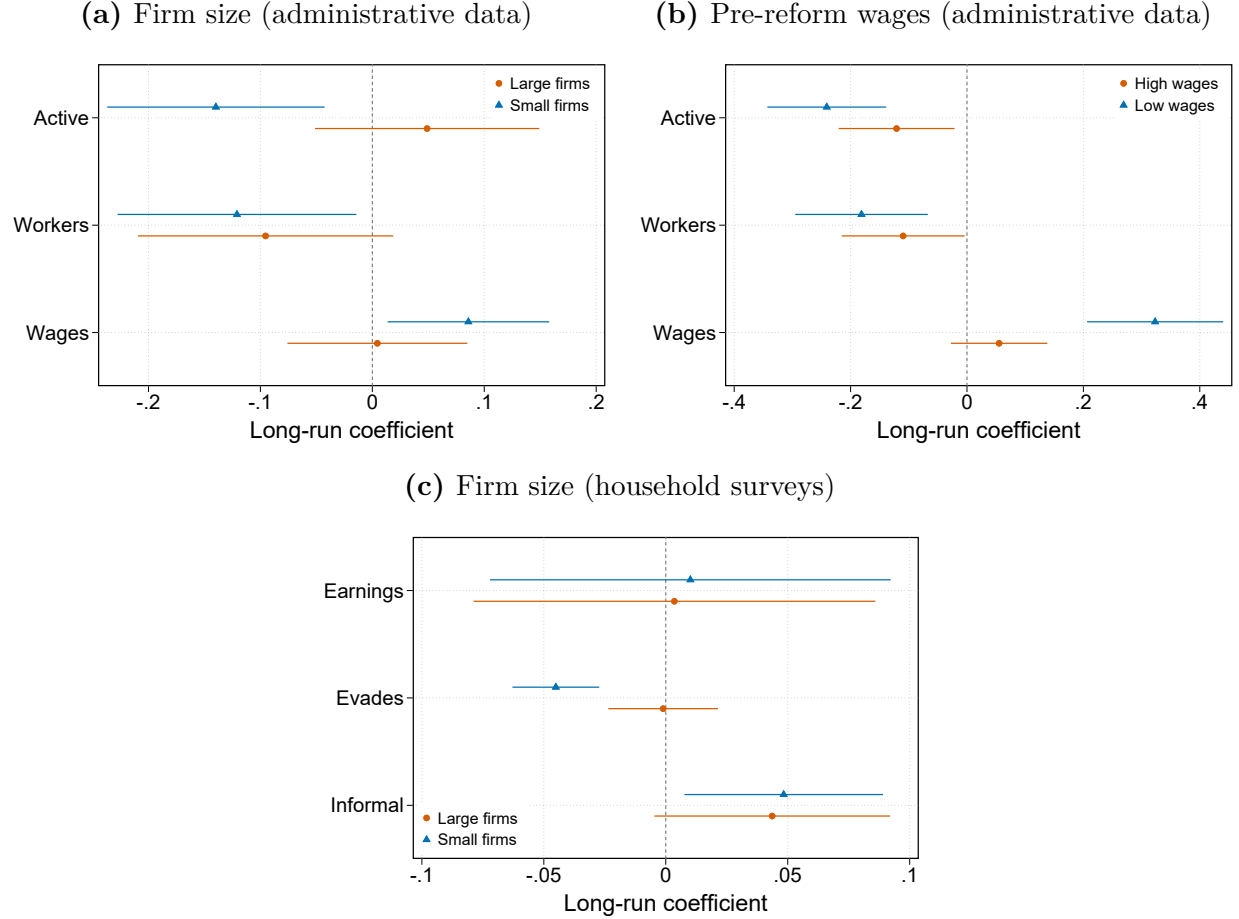
Notes: This figure shows OLS estimates of the β_k coefficients from equation 1 pooled by semesters. In panel (a) the dependent variable is the natural logarithm of the wage. In panel (b) the dependent variable is an indicator equal to 1 if the worker is informally employed. In panel (c) the dependent variable is an indicator equal to 1 if the worker underreports their labor earnings for tax purposes. In panel (d) the dependent variable is an indicator equal to 1 if the worker is employed and 0 if unemployed. The first dashed line indicates the beginning of the phase-in period and the second dashed line indicates the beginning of the mandate period. Capped vertical bars represent 95% confidence interval from standard errors clustered at the sector level.

Figure 8: Difference-in-differences estimates (long-run)



Notes: This figure shows OLS estimates of the β_k coefficients from equation 1 pooled for the last 5 quarters of the mandate period. Panel (a) corresponds to estimates using administrative data and panel (b) corresponds to estimates using household survey data. Capped vertical bars represent 95% confidence interval from standard errors clustered at the sector level.

Figure 9: Difference-in-differences heterogeneity estimates (long-run)



Notes: This figure shows OLS estimates of the β_k coefficients from equation 1 pooled for the last 5 quarters of the mandate period. Panel (a) corresponds to estimates using administrative data and panel (b) corresponds to estimates using household survey data. Capped vertical bars represent 95% confidence interval from standard errors clustered at the sector level.

B. Tables

Table 1: Summary statistics

	Observations	Mean	Standard Deviation	Median
<i>Panel A. Administrative data</i>				
Active	805,656	0.856	0.352	1.000
Number of workers	689,278	17.513	96.613	6.000
Average wage	689,278	33968.850	33575.948	25692.000
Small firm	804,336	0.870	0.336	1.000
<i>Panel B. Household survey data</i>				
Paid in cash	189,992	.305	.46	0
Female	605,766	.498	.5	0
Age	605,766	36.7	23.5	35
Informally employed	280,742	.258	.438	0
Underreports earnings	164,697	.0353	.185	0
Wage	280,742	17232	18691	14500
Small firm	283,065	.582	.493	1

Notes: This table presents summary statistics from our two datasets. Panel A reports summary statistics for administrative data. Active is an indicator equal to 1 if the firm is active in a given period and zero otherwise. Number of workers is the total number of dependent workers employed by a firm in a given period. Average wage is the average wage of the firm in a quarter. Small firm is an indicator equal to 1 if the firm had less than 20 employees on average during the pre-reform period. Panel B reports summary statistics for household survey data. Paid in cash is an indicator equal to 1 if the worker reports being paid in cash. Female is a dummy variable equal to 1 if the respondent is female. Age is the age of the respondent in years. Informally employed is a dummy variable equal to 1 if the worker is informally employed (does not make pension contributions). Underreports earnings is a dummy variable equal to 1 if the respondent states that they underreport their labor earnings for tax purposes. Wage is the workers' earnings in current Uruguayan pesos. Small firm is an indicator equal to 1 if the firm has less than 20 employees.

Table 2: Main results (firm-level)

	(1)	(2)	(3)
	Active	Workers (log)	Average wage (log)
Cash intensity $\times$ Pre period [$k \in [-7, -4]$]	0.00711 (0.0137)	-0.0256 (0.0242)	-0.0165 (0.0138)
Cash intensity $\times$ Phase-in [$k \in [0, 5]$]	-0.0557*** (0.0166)	-0.0409 (0.0270)	0.0171 (0.0173)
Cash intensity $\times$ Short-run [$k \in [6, 11]$]	-0.110*** (0.0361)	-0.0806** (0.0338)	0.0634* (0.0320)
Cash intensity $\times$ Long-run [$k \in [12, 16]$]	-0.139*** (0.0492)	-0.117** (0.0535)	0.0814** (0.0365)
Observations	805656	557184	555902
Clusters	75	75	75

Notes: This table shows OLS estimates from pooling several β_k coefficients from equation 1. Cash intensity is the pre-reform share of workers paid in cash. Phase-in pools the β_k coefficients for the phase in period ($k \in [0, 5]$). Short-run pools the β_k coefficients for the first 6 quarters in the mandate period ($k \in [6, 11]$). Long-run pools the β_k coefficients for the last 5 quarters in the mandate period ($k \in [12, 16]$). In column 1, the dependent variable is an indicator equal to 1 if the firm is active and 0 otherwise. In column 2, the dependent variable is the natural logarithm of the number of workers employed in the firm. In column 3, the dependent variable is the natural logarithm of the average wage of the firm. All specifications include sector fixed effects and industry-by-time fixed effects. Standard errors are clustered at the sector level * Significant at the 10% level ** Significant at the 5% level *** Significant at the 1% level.

Table 3: Main results heterogeneity (firm-level)

	(1) Active	(2) Workers (log)	(3) Average wage (log)
<i>Panel A. Heterogeneity by firm size</i>			
Cash intensity $\times$ Pre period [$k \in [-7, -4]$] $\times$ Large firm	0.00136 (0.0150)	-0.0173 (0.0247)	-0.00139 (0.0142)
Cash intensity $\times$ Phase-in [$k \in [0, 5]$] $\times$ Large firm	-0.00585 (0.0176)	-0.0278 (0.0306)	-0.00301 (0.0182)
Cash intensity $\times$ Short-run [$k \in [6, 11]$] $\times$ Large firm	0.0229 (0.0369)	-0.0622 (0.0384)	0.00387 (0.0348)
Cash intensity $\times$ Long-run [$k \in [12, 16]$] $\times$ Large firm	0.0490 (0.0503)	-0.0954* (0.0573)	0.00449 (0.0403)
Cash intensity $\times$ Pre period [$k \in [-7, -4]$] $\times$ Small firm	0.00740 (0.0138)	-0.0259 (0.0246)	-0.0168 (0.0139)
Cash intensity $\times$ Phase-in [$k \in [0, 5]$] $\times$ Small firm	-0.0562*** (0.0164)	-0.0446* (0.0264)	0.0190 (0.0175)
Cash intensity $\times$ Short-run [$k \in [6, 11]$] $\times$ Small firm	-0.110*** (0.0359)	-0.0849** (0.0336)	0.0668** (0.0319)
Cash intensity $\times$ Long-run [$k \in [12, 16]$] $\times$ Small firm	-0.140*** (0.0488)	-0.121** (0.0535)	0.0858** (0.0362)
Observations	804336	555912	554630
Clusters	75	75	75
<i>Panel B. Heterogeneity by pre-reform wages</i>			
Cash intensity $\times$ Pre period [$k \in [-7, -4]$] $\times$ Below median wages	0.00109 (0.0163)	-0.0767*** (0.0284)	-0.0287 (0.0204)
Cash intensity $\times$ Phase-in [$k \in [0, 5]$] $\times$ Below median wages	-0.0881*** (0.0182)	-0.0387 (0.0281)	0.102*** (0.0272)
Cash intensity $\times$ Short-run [$k \in [6, 11]$] $\times$ Below median wages	-0.191*** (0.0375)	-0.123*** (0.0378)	0.257*** (0.0509)
Cash intensity $\times$ Long-run [$k \in [12, 16]$] $\times$ Below median wages	-0.241*** (0.0512)	-0.181*** (0.0572)	0.323*** (0.0587)
Cash intensity $\times$ Pre period [$k \in [-7, -4]$] $\times$ Above median wages	0.00814 (0.0139)	-0.0201 (0.0245)	-0.0153 (0.0138)
Cash intensity $\times$ Phase-in [$k \in [0, 5]$] $\times$ Above median wages	-0.0501*** (0.0168)	-0.0411 (0.0271)	0.00798 (0.0187)
Cash intensity $\times$ Short-run [$k \in [6, 11]$] $\times$ Above median wages	-0.0957** (0.0365)	-0.0760** (0.0333)	0.0426 (0.0359)
Cash intensity $\times$ Long-run [$k \in [12, 16]$] $\times$ Above median wages	-0.121** (0.0500)	-0.110** (0.0530)	0.0552 (0.0416)
Observations	805656	557184	555902
Clusters	75	75	75

Notes: This table shows OLS estimates of interactions from pooling several β_k coefficients from equation 1. Cash intensity is the pre-reform share of workers paid in cash. Panel A interacts the event study coefficients with indicators of whether the firm is small or large. Panel B interacts the event study coefficients with indicators of whether the firm has below or above average pre-reform wages. Phase-in pools the β_k coefficients for the phase in period ($k \in [0, 5]$). Short-run pools the β_k coefficients for the first 6 quarters in the mandate period ($k \in [6, 11]$). Long-run pools the β_k coefficients for the last 5 quarters in the mandate period ($k \in [12, 16]$). Pre-reform wages are constructed from the residuals of regressing average wages at the firm level on time fixed effects and sector fixed effects in the pre-reform period. Small firm is a dummy variable equal to 1 if the firm had less than 20 employees on average during the pre-reform period and zero otherwise. Above median wages is an indicator equal to 1 if the firm had above median wages during the pre-reform period and below median wages is an indicator equal to 1 if the firm had below median wages during the pre-reform period. In column 1, the dependent variable is an indicator equal to 1 if the firm is active and 0 otherwise. In column 2, the dependent variable is the natural logarithm of the number of workers employed in the firm. In column 3, the dependent variable is the natural logarithm of the average wage of the firm. All specifications include sector fixed effects and industry-by-time fixed effects. Standard errors are clustered at the sector level * Significant at the 10% level ** Significant at the 5% level *** Significant at the 1% level.

Table 4: Main results (survey data)

	(1)	(2)	(3)	(4)	(5)
	Paid in cash	Earnings (log)	Underreports	Informal	Employed
Cash intensity $\times$ Pre period [$k \in [-7, -4]$]	0.0000811 (0.0277)	-0.00349 (0.0404)	0.0270* (0.0159)	-0.0231 (0.0261)	-0.00122 (0.0163)
Cash intensity $\times$ Phase-in [$k \in [0, 5]$]	-0.105*** (0.0270)	-0.00139 (0.0351)	-0.0137 (0.0115)	0.0137 (0.0213)	-0.0125 (0.0127)
Cash intensity $\times$ Short-run [$k \in [6, 11]$]	-0.499*** (0.0344)	-0.0596* (0.0348)	-0.0259* (0.0141)	0.0540** (0.0245)	-0.0113 (0.0174)
Cash intensity $\times$ Long-run [$k \in [12, 16]$]	-0.630*** (0.0346)	-0.000609 (0.0364)	-0.0291*** (0.00863)	0.0734*** (0.0252)	0.0125 (0.0215)
Observations	165498	165530	164695	280738	410757
Clusters	75	75	75	75	75

Notes: This table shows OLS estimates from pooling several β_k coefficients from equation 1. Cash intensity is the pre-reform share of workers paid in cash. Phase-in pools the β_k coefficients for the phase in period ($k \in [0, 5]$). Short-run pools the β_k coefficients for the first 6 quarters in the mandate period ($k \in [6, 11]$). Long-run pools the β_k coefficients for the last 5 quarters in the mandate period ($k \in [12, 16]$). In column 1, the dependent variable is an indicator equal to 1 if the reports receiving their wage payment in cash. In column 2, the dependent variable is the natural logarithm of labor earnings. In column 3, the dependent variable is a dummy variable equal to 1 if the worker is informally employed. In column 4, the dependent variable is a dummy variable equal to 1 if the worker underreports their earnings for tax purposes. All calculations are done using the survey sampling weights. All specifications include sector fixed effects, industry-by-time fixed effects, and region-by-time fixed effects. Standard errors are clustered at the sector level * Significant at the 10% level ** Significant at the 5% level *** Significant at the 1% level.

Table 5: Main results heterogeneity (survey data)

	(1) Earnings (log)	(2) Informal	(3) Underreports
Small firm	-0.424*** (0.0478)	0.190*** (0.0566)	0.0278*** (0.00703)
Small firm $\times$ Cash intensity	0.310*** (0.0867)	0.327** (0.149)	0.0570*** (0.0117)
Small firm $\times$ Cash intensity $\times$ Pre period [$k \in [-7, -4]$]	0.0135 (0.0421)	-0.0293 (0.0230)	0.0209 (0.0149)
Small firm $\times$ Cash intensity $\times$ Phase-in [$k \in [0, 5]$]	0.00321 (0.0381)	0.00785 (0.0194)	-0.0170 (0.0131)
Small firm $\times$ Cash intensity $\times$ Short-run [$k \in [6, 11]$]	-0.0405 (0.0389)	0.0262 (0.0204)	-0.0375** (0.0151)
Small firm $\times$ Cash intensity $\times$ Long-run [$k \in [12, 16]$]	0.0101 (0.0412)	0.0483** (0.0204)	-0.0451*** (0.00893)
Large firm $\times$ Cash intensity $\times$ Pre period [$k \in [-7, -4]$]	0.000878 (0.0413)	-0.0266 (0.0238)	0.0214 (0.0159)
Large firm $\times$ Cash intensity $\times$ Phase-in [$k \in [0, 5]$]	-0.0110 (0.0397)	-0.00169 (0.0203)	-0.00753 (0.0126)
Large firm $\times$ Cash intensity $\times$ Short-run [$k \in [6, 11]$]	-0.0310 (0.0424)	0.0328 (0.0219)	-0.0134 (0.0137)
Large firm $\times$ Cash intensity $\times$ Long-run [$k \in [12, 16]$]	0.00354 (0.0413)	0.0436* (0.0243)	-0.00107 (0.0113)
Observations	165530	280738	164695
Clusters	75	75	75

Notes: This table shows OLS estimates from pooling several β_k coefficients from equation 1. Cash intensity is the pre-reform share of workers paid in cash. Phase-in effect pools the β_k coefficients for the phase in period ($k \in [0, 5]$). Short-run effect pools the β_k coefficients for the first 6 quarters in the mandate period ($k \in [6, 11]$). Long-run effect pools the β_k coefficients for the last 5 quarters in the mandate period ($k \in [12, 16]$). In column 1, the dependent variable is an indicator equal to 1 if the reports receiving their wage payment in cash. In column 2, the dependent variable is the natural logarithm of labor earnings. In column 3, the dependent variable is a dummy variable equal to 1 if the worker is informally employed. In column 4, the dependent variable is a dummy variable equal to 1 if the worker underreports their earnings for tax purposes. All calculations are done using the survey sampling weights. All specifications include sector fixed effects, industry-by-time fixed effects, and region-by-time fixed effects. Standard errors are clustered at the sector level * Significant at the 10% level ** Significant at the 5% level *** Significant at the 1% level.

The Role of Cash in Illegal Labor Market Practices: Evidence from Uruguay

Appendix

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C Omitting the retail and restaurant sectors	x
D Leave-one-out robustness checks	xii
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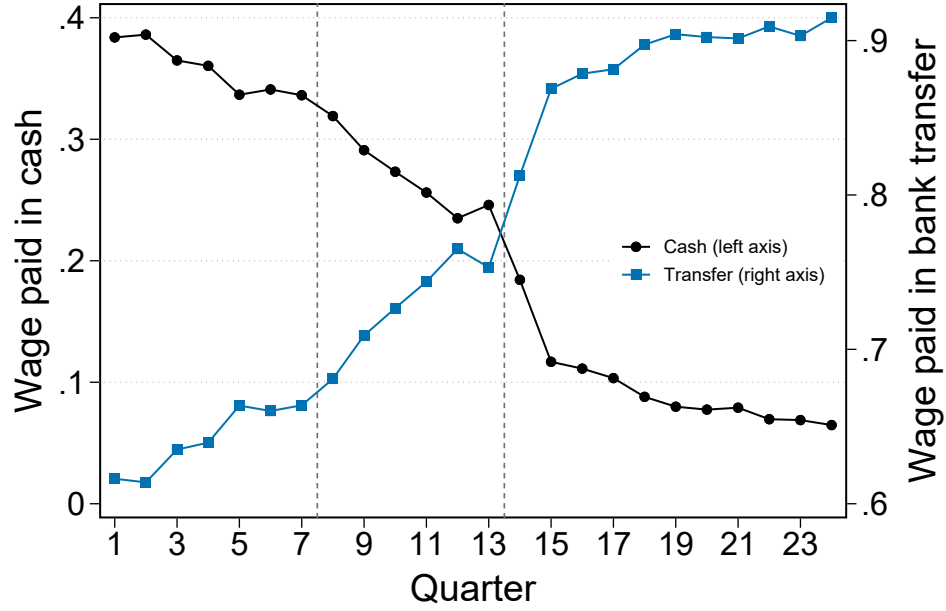
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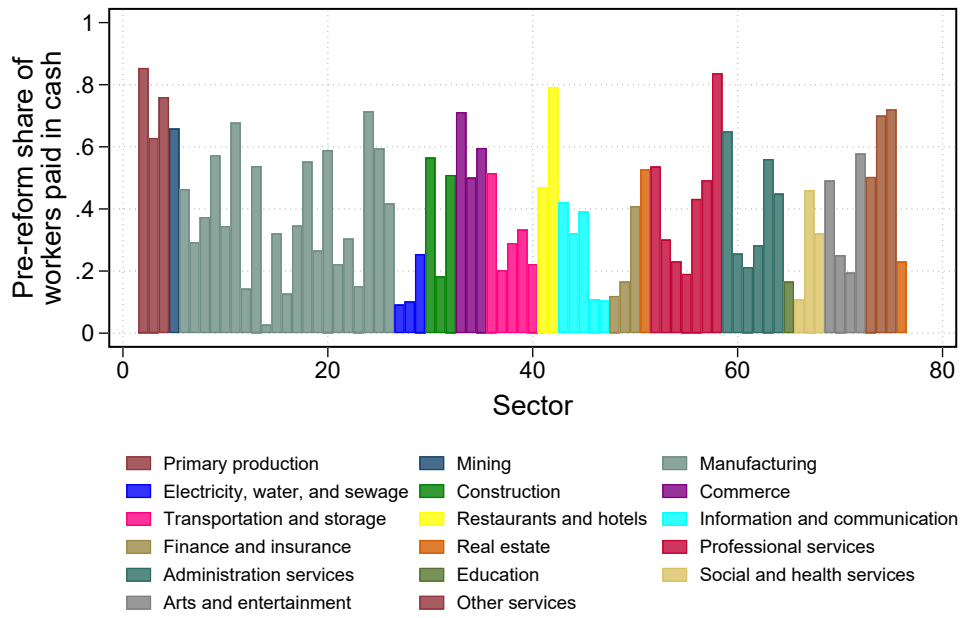
A. Additional figures

Figure A.I: Share of workers paid in cash and bank transfer over time



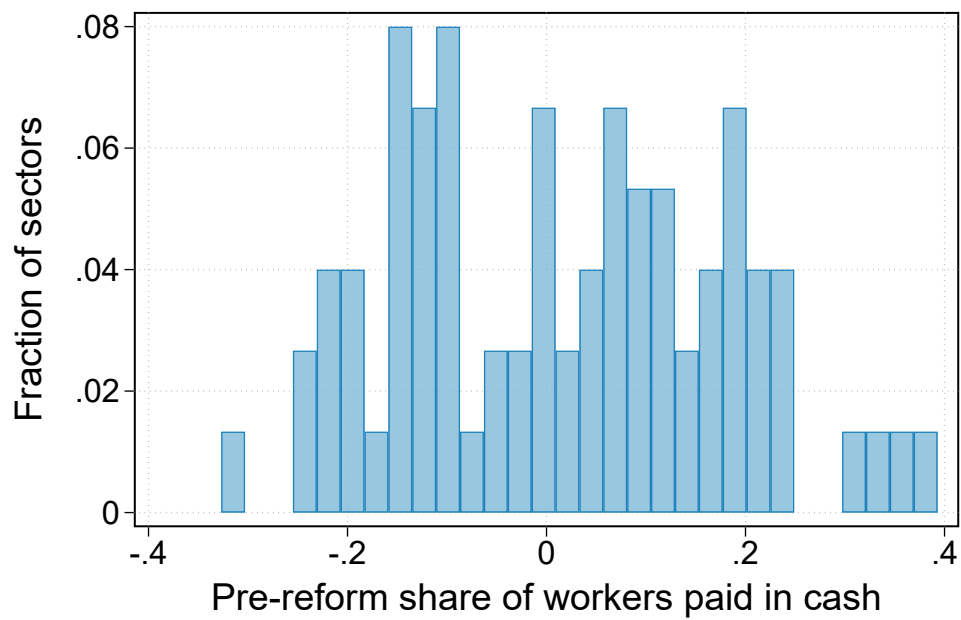
Notes: This figure shows a the proportion of formal workers that are paid in cash (in black corresponding to the left axis) and the proportion that are paid with a bank transfer (in blue corresponding to the right axis) in each quarter. The first dashed line indicates the beginning of the phase-in period and the second dashed line indicates the beginning of the mandate period.

Figure A.II: Within-industry cash-intensiveness pre-reform



Notes: This figure shows the share of workers paid in cash during the pre-reform period for each sector. The bar colors indicate the industry grouping. The sector is defined at the 2-digit ISIC code level and the industry is defined at the 1-digit ISIC code level.

Figure A.III: Cash-intensiveness pre-reform (residualized from industry fixed effects)



Notes: This figure shows a histogram of the pre-reform sector-level share of workers who are paid in cash, residualized from industry fixed effects. The sector is defined at the 2-digit ISIC code level and the industry is defined at the 1-digit ISIC code level.

Figure A.IV: Correlations between cash usage and illegal labor market practices

(a) Informal employment

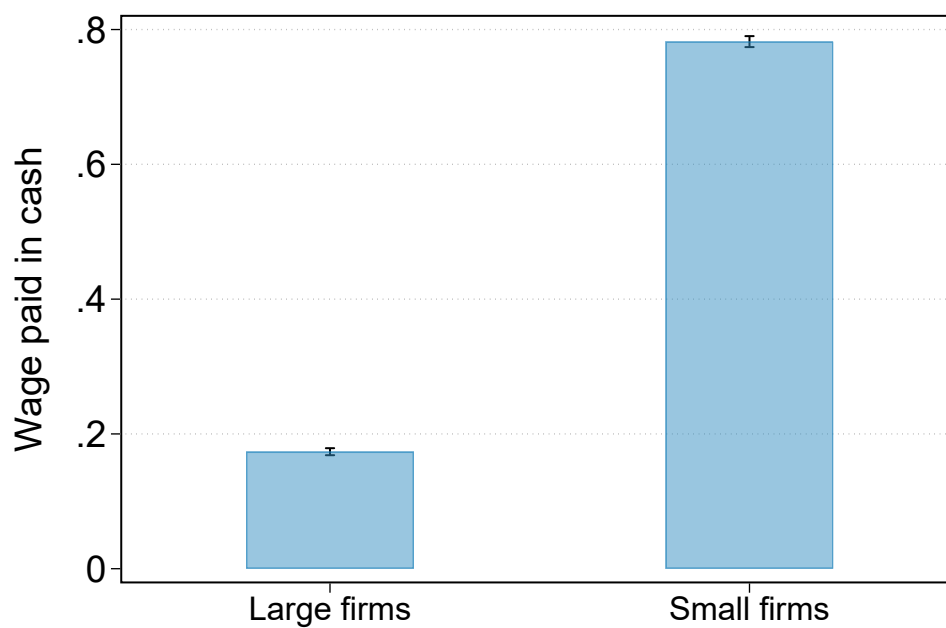


(b) Wage evasion



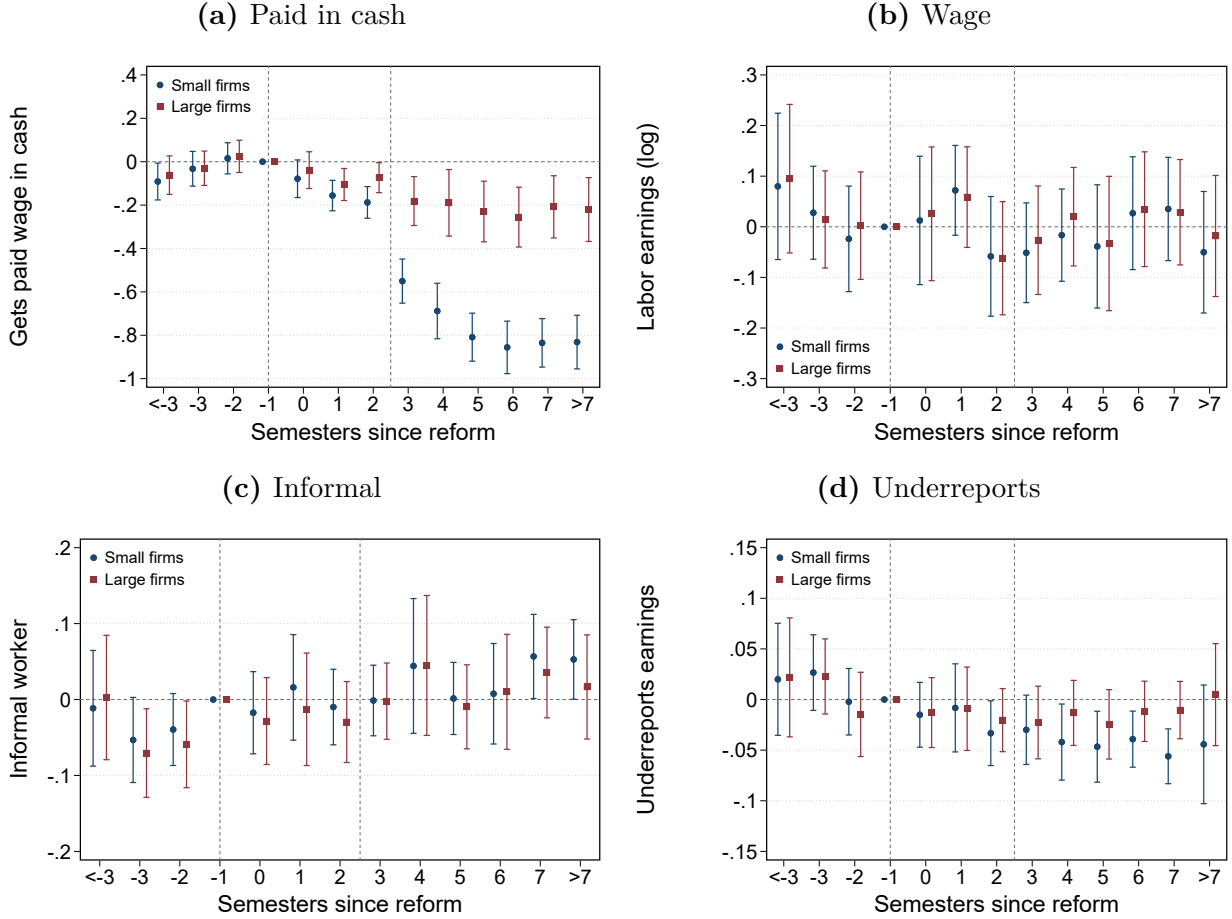
Notes: This figure shows binned scatterplots of the sector-level spread of illegal labor market practices and the share of formal workers that reports being paid in cash in the year prior to the reform. Panel (a) shows the share of workers who are informally employed and panel (b) shows the share of formal employees who admit to underreporting their labor earnings for tax purposes.

Figure A.V: Proportion of workers paid in cash by firm size



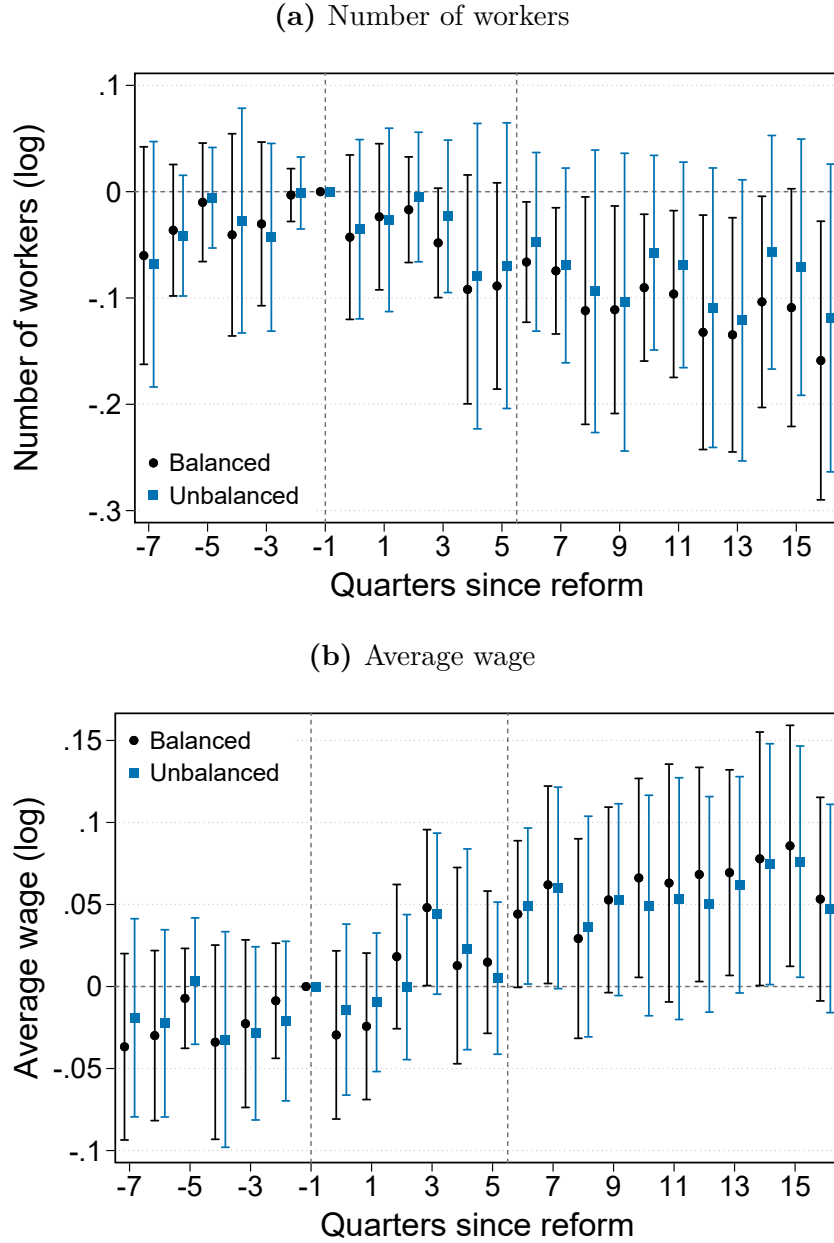
Notes: This figure shows the proportion of workers that report being paid in cash for each corresponding firm size in the pre-reform year. Small firm corresponds to firms with fewer than 20 workers and large firm corresponds to 20 or more. Vertical bars represent 95% confidence intervals from robust standard errors.

Figure A.VI: Heterogeneous effects of the reform - firm size (survey data)



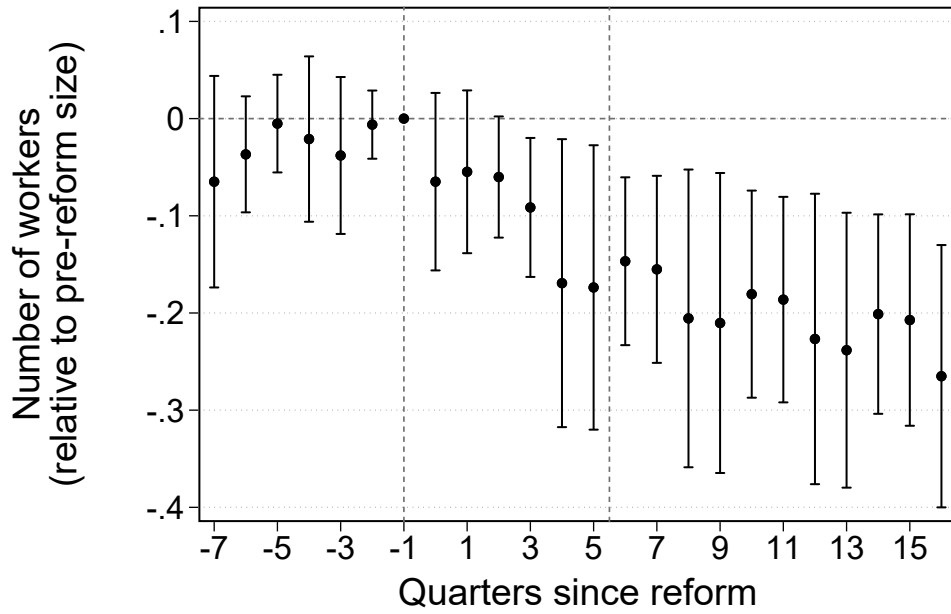
Notes: This figure shows OLS estimates of the β_k coefficients from equation 1 pooled by semesters interacted with an indicator for small firm and an indicator for large firm. Blue coefficients correspond to small firms (less than 20 employees) and red coefficients correspond to large firms (20 or more employees). In panel (a) the dependent variable is an indicator equal to 1 if the worker is paid in cash. In panel (b) the dependent variable is the natural logarithm of the wage. In panel (c) the dependent variable is an indicator equal to 1 if the worker is informally employed. In panel (d) the dependent variable is an indicator equal to 1 if the worker underreports their labor earnings for tax purposes. The first dashed line indicates the beginning of the phase-in period and the second dashed line indicates the beginning of the mandate period. Capped vertical bars represent 95% confidence interval from standard errors clustered at the sector level.

Figure A.VII: Balanced panel of firms robustness check



Notes: This figure shows OLS estimates of the β_k coefficients from equation 1 using the full sample of firms and restricting to the balanced panel of always-active firms. In panel (a) the dependent variable is the natural logarithm of the number of employees on payroll. In panel (b) the dependent variable is the natural logarithm of the average wage of the firm. Coefficients in black correspond to baseline estimates using the balanced panel of always active firms. Blue corresponds to estimates using the full sample of firms. The first dashed line indicates the beginning of the phase-in period and the second dashed line indicates the beginning of the mandate period. Capped vertical bars represent 95% confidence interval from standard errors clustered at the sector level.

Figure A.VIII: Number of workers (extensive and intensive margin combined)



Notes: This figure shows OLS estimates of the β_k coefficients from equation 1. The dependent variable is the number of workers employed in the firm relative to the average number of workers employed during the pre-reform period. Inactive firms are coded as having zero workers. The first dashed line indicates the beginning of the phase-in period and the second dashed line indicates the beginning of the mandate period. Capped vertical bars represent 95% confidence interval from standard errors clustered at the sector level.

B. Additional tables

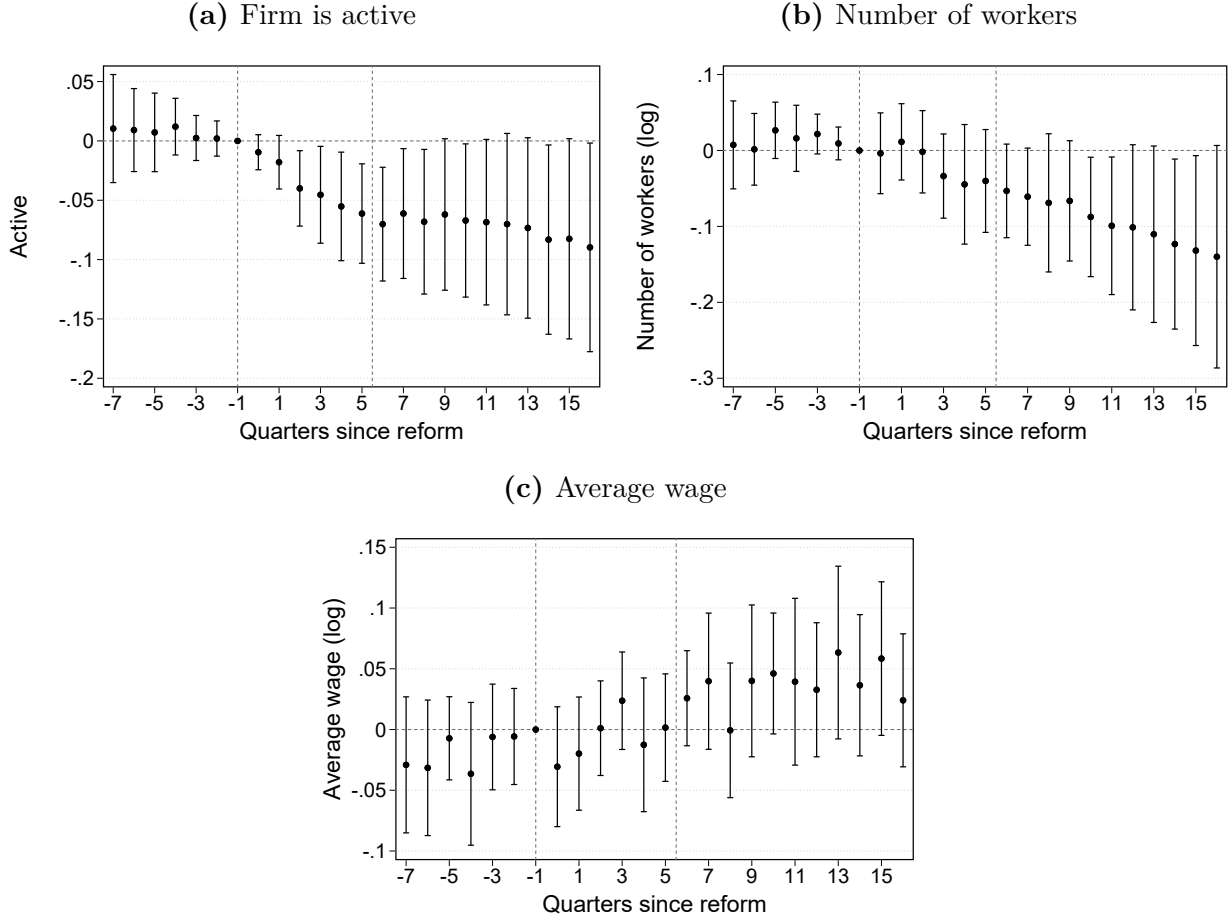
Table B.I: Unweighted regression robustness check (survey data)

	(1)	(2)	(3)	(4)	(5)
	Paid in cash	Earnings (log)	Underreports	Informal	Employed
Cash intensity $\times$ Pre period [$k \in [-7, -4]$]	0.00129 (0.0286)	0.00909 (0.0406)	0.0245 (0.0164)	-0.0280 (0.0245)	-0.00194 (0.0163)
Cash intensity $\times$ Phase-in [$k \in [0, 5]$]	-0.111*** (0.0260)	0.00181 (0.0360)	-0.0149 (0.0104)	0.00966 (0.0212)	-0.0134 (0.0129)
Cash intensity $\times$ Short-run [$k \in [6, 11]$]	-0.501*** (0.0348)	-0.0673* (0.0355)	-0.0269* (0.0142)	0.0440* (0.0235)	-0.0110 (0.0175)
Cash intensity $\times$ Long-run [$k \in [12, 16]$]	-0.638*** (0.0347)	0.00458 (0.0377)	-0.0290*** (0.00875)	0.0731*** (0.0272)	0.0153 (0.0223)
Observations	165498	165530	164695	280738	410757
Clusters	75	75	75	75	75

Notes: This table shows OLS estimates from pooling several β_k coefficients from equation 1. Cash intensity is the pre-reform share of workers paid in cash. Phase-in pools the β_k coefficients for the phase in period ($k \in [0, 5]$). Short-run pools the β_k coefficients for the first 6 quarters in the mandate period ($k \in [6, 11]$). Long-run pools the β_k coefficients for the last 5 quarters in the mandate period ($k \in [12, 16]$). In column 1, the dependent variable is an indicator equal to 1 if the reports receiving their wage payment in cash. In column 2, the dependent variable is the natural logarithm of labor earnings. In column 3, the dependent variable is a dummy variable equal to 1 if the worker is informally employed. In column 4, the dependent variable is a dummy variable equal to 1 if the worker underreports their earnings for tax purposes. All specifications include sector fixed effects, industry-by-time fixed effects, and region-by-time fixed effects. Standard errors are clustered at the sector level * Significant at the 10% level ** Significant at the 5% level *** Significant at the 1% level.

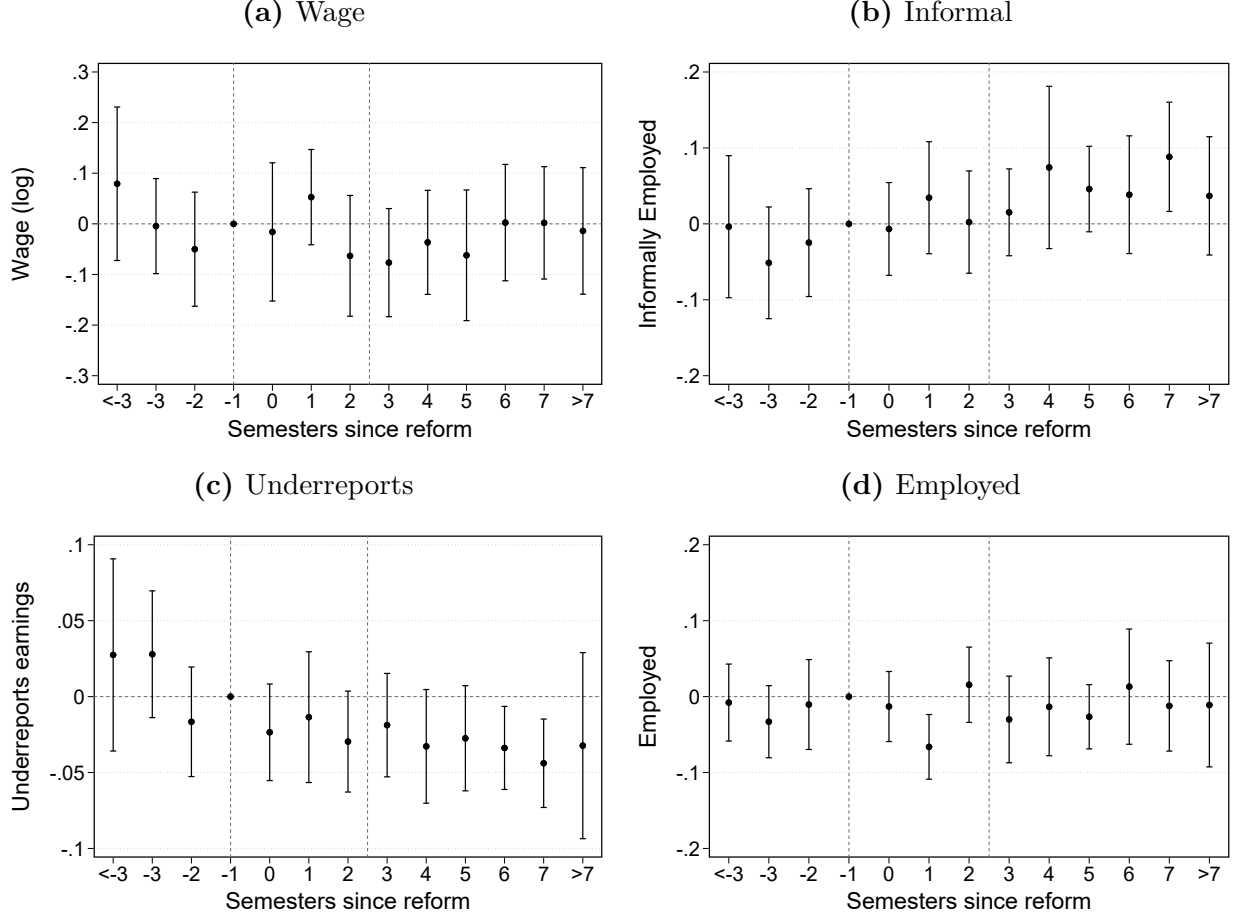
C. Omitting the retail and restaurant sectors

Figure C.I: Main results (administrative data) - omitting retail and restaurants



Notes: This figure shows OLS estimates of the β_k coefficients from equation 1. In panel (a) the dependent variable is an indicator equal to 1 if the firm is active. In panel (b) the dependent variable is the natural logarithm of the number of employees on payroll. In panel (c) the dependent variable is the natural logarithm of the average wage of the firm. The first dashed line indicates the beginning of the phase-in period and the second dashed line indicates the beginning of the mandate period. Capped vertical bars represent 95% confidence interval from standard errors clustered at the sector level.

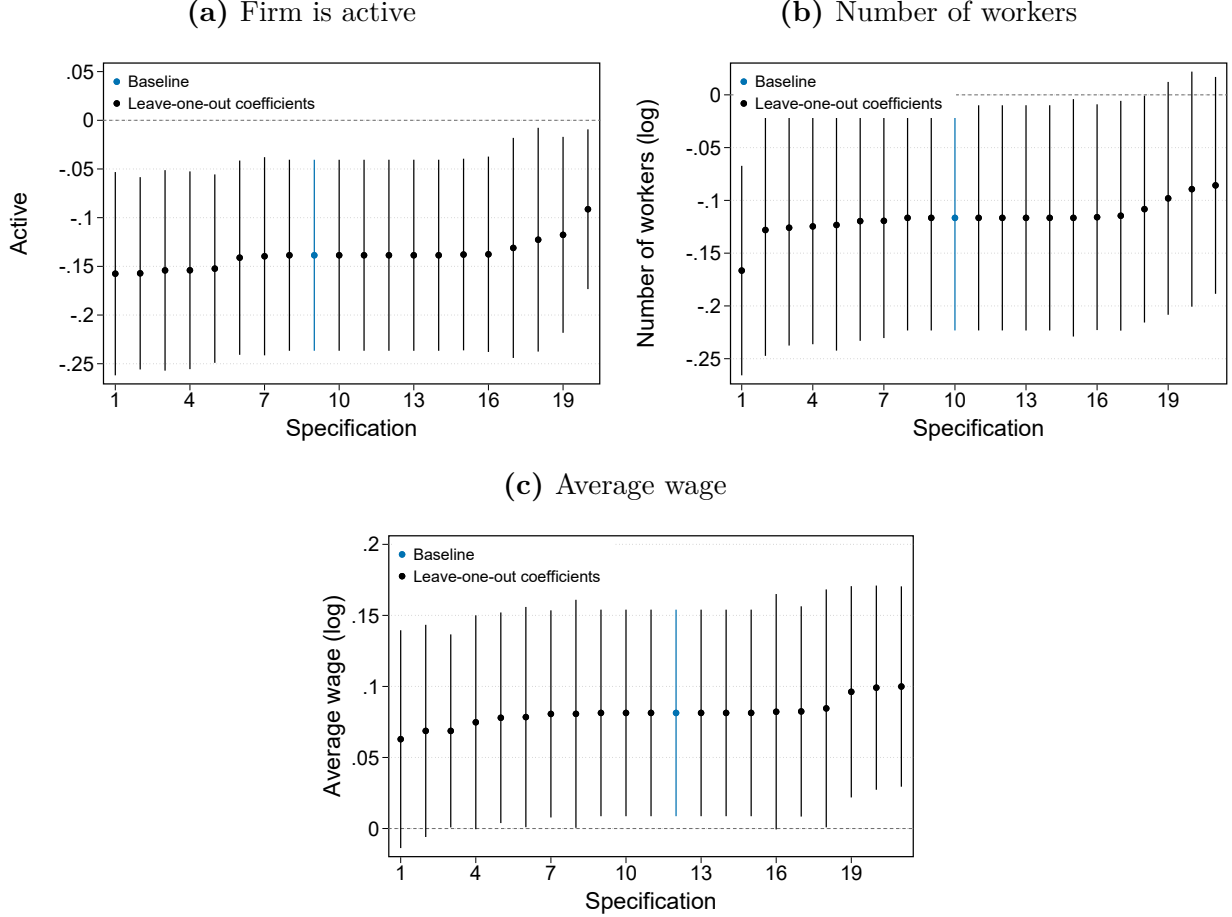
Figure C.II: Main results (survey data) - omitting retail and restaurants



Notes: This figure shows OLS estimates of the β_k coefficients from equation 1 defining cash intensiveness discretely as above and below median pre-reform cash intensity pooled by semesters. In panel (a) the dependent variable is the natural logarithm of the wage. In panel (b) the dependent variable is an indicator equal to 1 if the worker is informally employed. In panel (c) the dependent variable is an indicator equal to 1 if the worker underreports their labor earnings for tax purposes. In panel (d) the dependent variable is an indicator equal to 1 if the worker is employed and 0 if unemployed. The first dashed line indicates the beginning of the phase-in period and the second dashed line indicates the beginning of the mandate period. Capped vertical bars represent 95% confidence interval from standard errors clustered at the sector level.

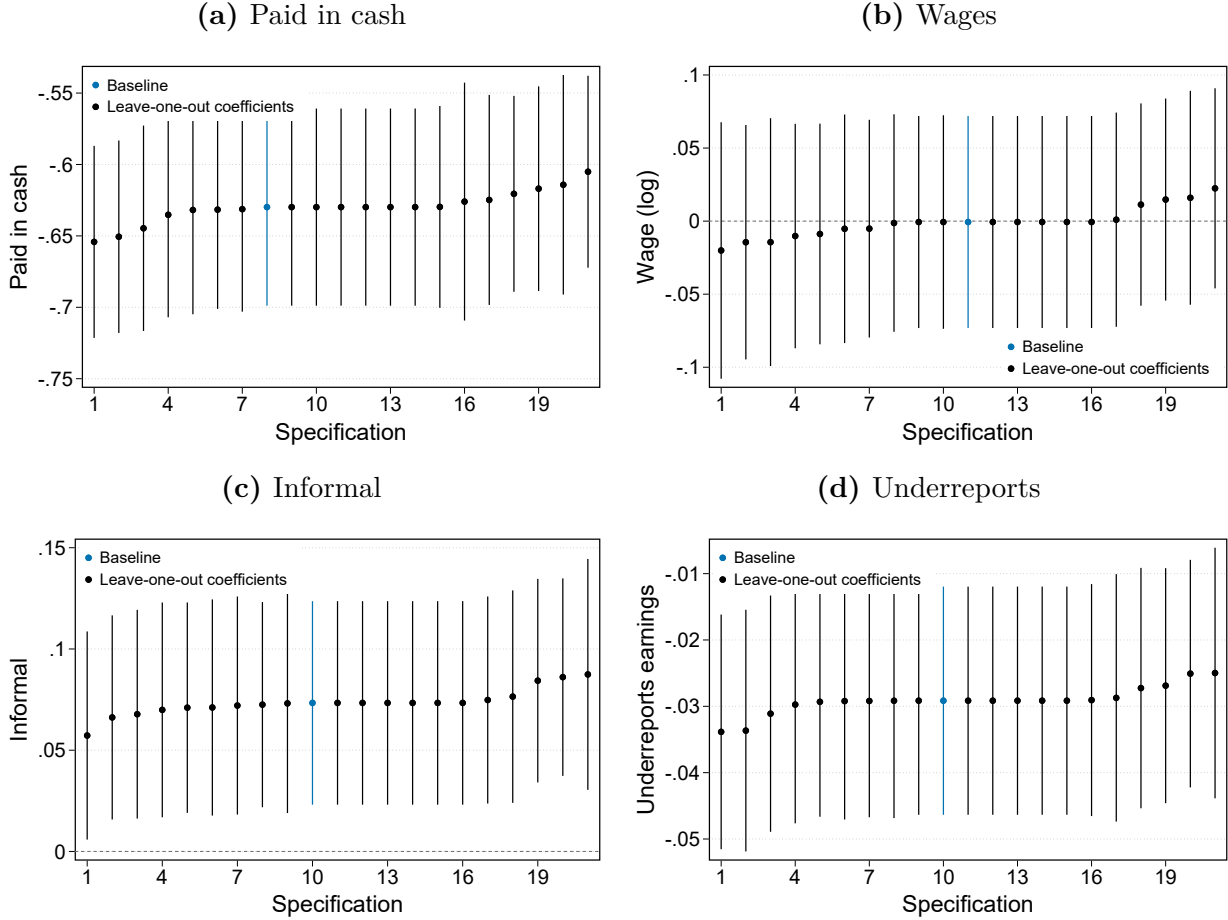
D. Leave-one-out robustness checks

Figure D.I: Leave-one-out robustness checks - Administrative data



Notes: This figure reports OLS estimates of the pooled β_k coefficients from equation 1 for $k \in [12, 16]$ sequentially dropping each industry using administrative data. Baseline coefficients are reported in blue and leave-one-out coefficients are reported in black. In panel (a) the dependent variable is an indicator equal to 1 if the firm is active. In panel (b) the dependent variable is the natural logarithm of the number of employees on payroll. In panel (c) the dependent variable is the natural logarithm of the average wage of the firm. Specifications are sorted by coefficient size in each panel and numbers need not correspond to the same specification across panels. Vertical bars represent 95% confidence interval from standard errors clustered at the sector level.

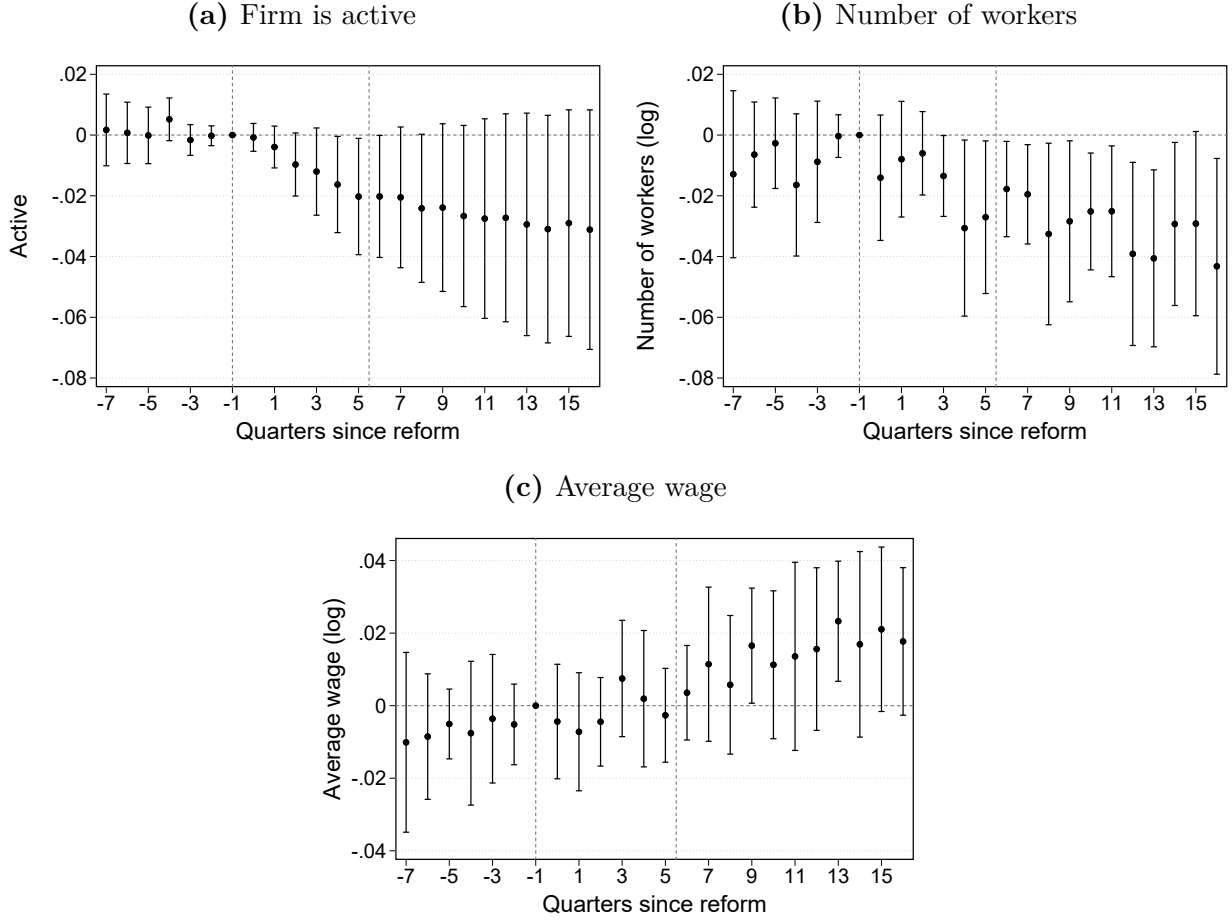
Figure D.II: Leave-one-out robustness checks - Survey data



Notes: This figure reports OLS estimates of the pooled β_k coefficients from equation 1 for $k \in [12, 16]$ sequentially dropping each industry using survey data. Baseline coefficients are reported in blue and leave-one-out coefficients are reported in black. In panel (a) the dependent variable is an indicator equal to 1 if the worker's wage is paid with cash. In panel (b) the dependent variable is the natural logarithm of the wage. In panel (c) the dependent variable is an indicator equal to 1 if the worker is informal. In panel (d) the dependent variable is an indicator equal to 1 if the worker underreports their earnings for tax purposes. Specifications are sorted by coefficient size in each panel and numbers need not correspond to the same specification across panels. Vertical bars represent 95% confidence interval from standard errors clustered at the sector level.

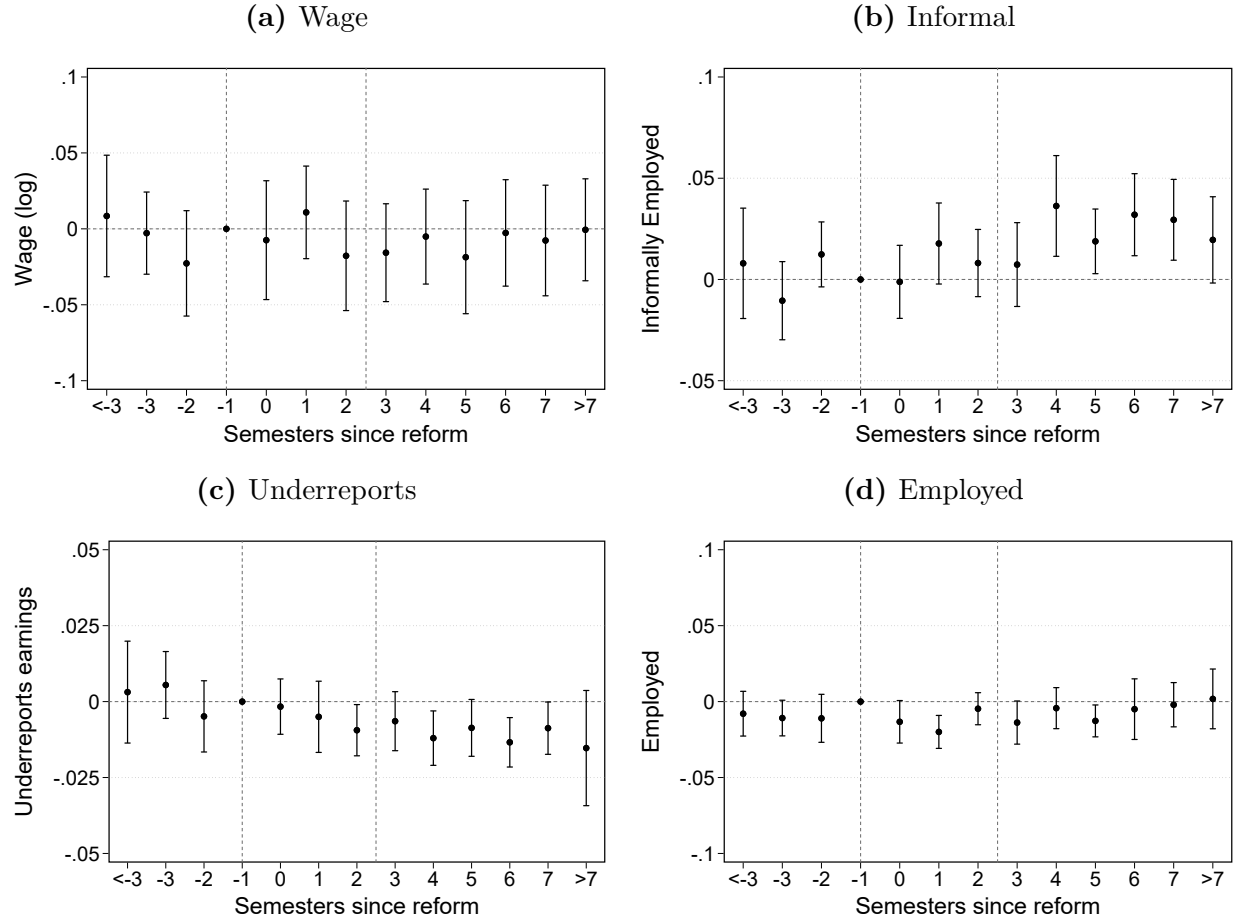
E. Discrete cash-intensiveness robustness check

Figure E.I: Main results (administrative data) - discrete cash intensiveness robustness check



Notes: This figure shows OLS estimates of the β_k coefficients from equation 1 defining cash intensiveness discretely as above and below median pre-reform cash intensity. In panel (a) the dependent variable is an indicator equal to 1 if the firm is active. In panel (b) the dependent variable is the natural logarithm of the number of employees on payroll. In panel (c) the dependent variable is the natural logarithm of the average wage of the firm. The first dashed line indicates the beginning of the phase-in period and the second dashed line indicates the beginning of the mandate period. Capped vertical bars represent 95% confidence interval from standard errors clustered at the sector level.

Figure E.II: Main results (survey data) - discrete cash intensiveness robustness check



Notes: This figure shows OLS estimates of the β_k coefficients from equation 1 defining cash intensiveness discretely as above and below median pre-reform cash intensity pooled by semesters. In panel (a) the dependent variable is the natural logarithm of the wage. In panel (b) the dependent variable is an indicator equal to 1 if the worker is informally employed. In panel (c) the dependent variable is an indicator equal to 1 if the worker underreports their labor earnings for tax purposes. In panel (d) the dependent variable is an indicator equal to 1 if the worker is employed and 0 if unemployed. The first dashed line indicates the beginning of the phase-in period and the second dashed line indicates the beginning of the mandate period. Capped vertical bars represent 95% confidence interval from standard errors clustered at the sector level.