Collateral Consequences: The Debt Channel of Investment Tax Incentives*

Carolina Nunes† Nora M. Strecker‡

Preliminary Draft: February 15, 2026

Abstract

As the global financial crisis highlighted, firms' choice between external or internal funds to finance investment has large-scale implications for the wider economy. While tax policy has shaped debt–equity preferences, less attention has been devoted to how it can motivate the use of internal financing. This paper studies the Deduction of Retained and Reinvested Profits (DRRP), a Portuguese tax incentive meant to encourage the self-financing of tangible fixed assets investment. We evaluate DRRP's impact on firm investment, financing decisions, and workforce composition. Our findings show that, as intended, investment and reserves respond to the take-up of the tax credit. However, debt financing also increases significantly, suggesting that instead of switching between external and internal financing, firms use the newly acquired assets as collateral to secure additional funding. As employment and real wages grow, there is no evidence of skill-biased investments.

Keywords: Tax Incentives, Investment Financing, Portugal, Tangible Fixed Assets
JEL classification: H25, D25, D24, D22, H32

*The authors thank Benjamin Elsner, João Pereira dos Santos, Ron Davies, Enda Hargaden, Georg Thunecke, Katarzyna Bilicka, Ricardo Duque Gabriel, Isabel Proença, and the U-TAX team, as well as participants in the conference "The division of corporate tax revenue in a globalized world" at the Max Planck Institute for Tax Law and Public Finance, LAGV 2025, PEJ 18th Annual Meeting, Irish Public Economics Workshop, ISEG Summer School 2025, and UCD PhD Seminar for comments and suggestions. Errors are our own.

†University College Dublin, School of Economics; E-mail: carolina.nunes@ucdconnect.ie.

‡UCD Economics, CEPR, IPEN, Skatteforsk, Geary Institute, Address: University College Dublin, School of Economics, Newman Building, G205, Dublin, D04 V1W8, Ireland; E-mail: nora.strecker@ucd.ie.

1 Introduction

The relationship between tax policy and firm investment has wide-ranging implications for national economies and been a feature of both the corporate and public finance literature.[1] Given the close link between debt and investment, firm's financing decisions (such as the choice of internal versus external finance or equity versus debt) play an important role in their ability to respond to tax incentives. Especially the corporate tax literature has long favored external financing, further preferring debt over equity (Modigliani and Miller, 1958; Stiglitz, 1973; King, 1974), since interest payments are almost universally deductible in the calculation of taxable profits, whereas dividends (as arise under equity finance) are not. These tax advantages make debt financing cheaper and give firms an incentive to borrow instead of raising capital. To address this debt-equity bias and achieve tax neutrality, several countries have additionally introduced Allowance for Corporate Equity (ACE) schemes, whereby firms are allowed to deduct a notional interest rate on their equity (Boadway and Bruce, 1984; Klemm, 2006; Hebous and Ruf, 2017).[2]

However, external financing is not the only option for firms. Investments can be financed through internal funds, such as retained earnings or asset sales (Borisova and Brown, 2013; Edmans and Mann, 2019). The cost of internal financing is frequently lower than the cost of external financing sources (Fazzari et al., 1988; Bond and Meghir, 1994; Hennessy and Whited, 2007). Moreover, high debt levels are associated with higher default risk during recessions (Chiu et al., 2017). Yet, external financing continues to be most commonly used. This raises the question of whether tax policy can be used to reduce corporate leverage by incentivizing firms to use their own funds to invest and grow, rather than relying so intensively on external sources of financing. Particularly in periods of crisis, when firm leverage is high and investment levels drop, tax incentives may be a relevant tool to motivate the use of internal sources of financing.

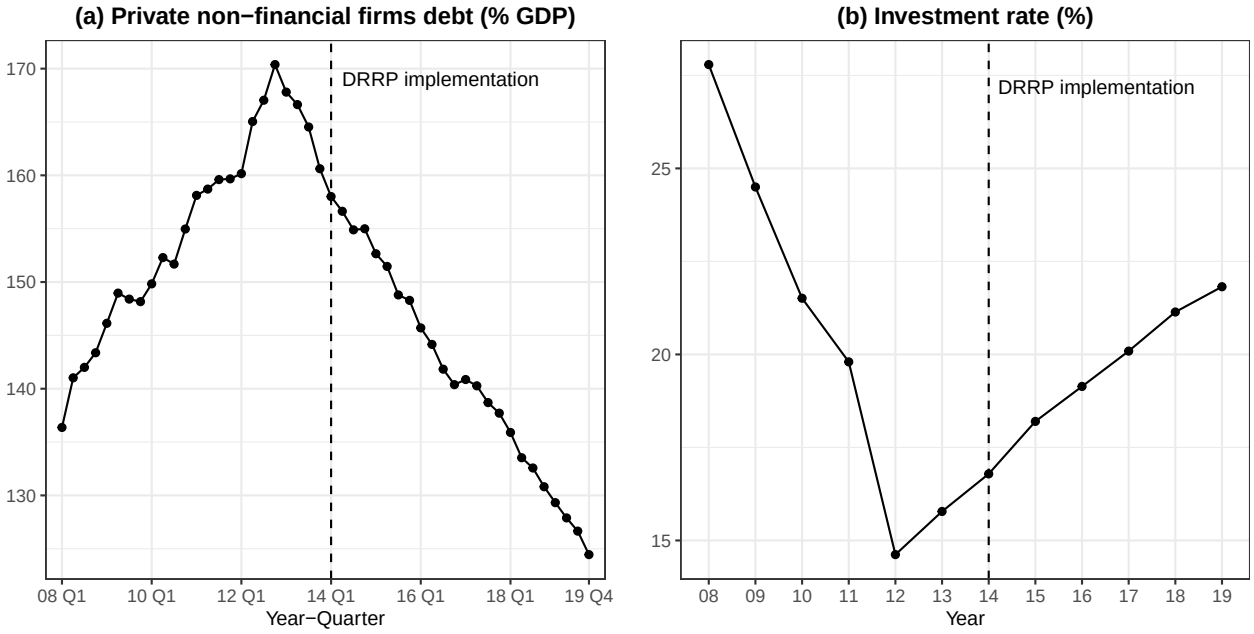
In this paper, we analyze the Deduction of Retained and Reinvested Profits (in Portuguese,

[1] For comprehensive overviews of the literature, see Hassett and Hubbard (2002) and Bond and Van Reenen (2007).

[2] Portugal introduced its ACE scheme in 2010. The scheme targeted small and medium-sized enterprises with specific ownership structures (i.e., individuals, venture capital owners, and business angels) and expanded to a broader set of SMEs in 2013. Since 2017, the size restrictions were eliminated and the scheme expanded to all firms, after the initial scheme for SMEs was found to be ineffective in stimulating new investment (OECD, 2017).

Dedução por Lucros Retidos e Reinvestidos), hereafter DRRP, a tax incentive scheme designed to induce the self-financing of investment for small and medium-sized enterprises (SMEs). The DRRP allowed SMEs to deduct 10% of retained profits from their tax bill if they had been set aside to be reinvested in tangible fixed assets. The policy was introduced by the Portuguese government in 2014, as a tool to recover investment levels, restore competitiveness, and foster the growth of private sector firms following the global financial crisis.[3] As Figure 1 highlights, the introduction of this policy came during a period when firm indebtedness had reached historical highs and investment had fallen by nearly half – a clear consequence of the excessive leverage prevalent during the global financial crisis (Farinha and Prego, 2013; Gebauer et al., 2017). The conjunction of high debt and low investment forms the perfect context to study the question of whether tax incentives can simultaneously promote investment and reduce firm's reliance on external financing.

Figure 1: Aggregate Firm Investment and Indebtedness: Portugal, 2008-2019



Notes: This figure plots the evolution of Portuguese private non-financial firms debt (% of GDP) in panel (a) and the investment rate in panel (b) between 2008 and 2019. *Source:* Bank of Portugal and Statistics Portugal.

Our analysis leverages several Portuguese firm-level administrative datasets over the period 2010-2019. We estimate event-study regressions to capture the dynamic effects of the policy on firm behavior, splitting the analysis by the year when firms first make a claim under the DRRP. We first show that reserves as a share of pre-tax profits and the tangible fixed assets investment rate

[3]We postpone a thorough description of the DRRP to Section 2.

respond as expected and in the timeline outlined by the legislation. Buildings and basic equipment were the main asset classes driving firms' tangible fixed asset investment. However, our findings also indicate the existence of anticipatory behavior, suggesting that the users of this policy were most likely firms that would have invested regardless of the tax credit.

We subsequently focus on firms' financing decisions. Despite the use of retained earnings for investment, we find that total debt rises by approximately 40%, driven by an almost one-to-one increase in secured debt. We interpret these findings as evidence that firms used the acquired tangible fixed assets as collateral to signal their credit worthiness and secure additional funding (Bester, 1985; Besanko and Thakor, 1987). Further, equity financing also increases following the use of DRRP, but at a much lower magnitude. On the positive side, the liabilities-to-assets ratio of treated firms falls and the total number of establishments grows relative to the non-treated group, suggesting that firms using the DRRP were able to improve their balance sheets and expand their business.

Finally, we study the labor composition effects of the investments. The total number of employees and real wages grew more for firms using the DRRP, although we find evidence of strong anticipation effects. At the same time, the share of high-educated and high-skilled workers remains unchanged following DRRP investments. These results are aligned with the literature on the complementarity between capital and labor (Krusell et al., 2000). We find, however, that the share of temporary workers increases following DRRP use, especially among later-treated firms (those using the DRRP after 2015). We believe these findings result from strong employment protection laws, which discourage firms in Portugal from hiring permanent employees and lead to a greater reliance on temporary contracts (European Commission, 2018).

Tax incentives to support and induce investment have been features of pro-business tax policies for many years. However, such policies predominantly focused on supporting investment in intangible assets through tax subsidies and tax relief for research and development (R&D) expenditures, and other innovation expenses, including patenting.[4] The results on these incentives are mixed, with elasticities varying widely depending on the country and the context of the analysis. Evidence from

[4]See Mitchell et al. (2019) and Ladinska et al. (2015) for detailed surveys of earlier works on R&D tax incentives.

Norway (Cappelen et al., 2012; Bøler et al., 2015), the UK (Dechezleprêtre et al., 2023; Melnik and Smyth, 2024), China (Jia and Ma, 2017; Tian et al., 2020), and Canada (Agrawal et al., 2020; Tavakoli, 2024) all points to the expansion of R&D activities, expenditures, and patenting following the introduction of R&D tax incentives. Similar to Agrawal et al. (2020), our analysis focuses on small and medium-sized firms.

In addition to the tax credits for R&D expenditures, countries also adopted other approaches to incentivize investment through the tax system. One common and broadly successful policy instrument are accelerated depreciation incentives (see Zwick and Mahon, 2017; Eichfelder and Schneider, 2018; Ohrn, 2019; Eichfelder et al., 2023; Hosono et al., 2023), which allow firms to speed up the depreciation schedule and deduct the cost of investment expenditures from taxable income faster. Other investment tax incentives include dividend tax cuts (Yagan, 2015; Alstadsæter et al., 2017) and retained earnings tax cuts (Hsieh and Parker, 2006). Our contribution to this literature relies on studying yet another tax policy to incentivize investment, but with two unique features: (i) DRRP targets only investment in tangible fixed assets; and (ii) there is an interplay between tax incentives and firms' financing decisions. Moreover, while previous research predominantly focuses on investment, fewer studies explore the impact of tax credits on other firm fundamentals, such as business expansion or workforce composition.

As previously mentioned, tangible fixed asset investment incentives are not a common feature in either tax laws or the literature. Generally, governments opt for more active intervention when tangible investments are required – such as through the provision of loan guarantees or grants after natural disasters or in economically disadvantaged areas. In this paper, we build on two notable examples. Bronzini et al. (2008) study Italy's 388/2000 Law, which granted firms that invest (both in tangible and intangible assets[5]) in less developed areas a tax exemption of a percentage of the firm's annual net capital expenditure. The authors find that Law 388/2000 was effective in stimulating investment, with no negative side effects on factor efficiency or profitability. Moreover, there is evidence that treated firms reduced their debt levels and used this tax credit as a substitute for external financing. Following Bronzini et al. (2008), we will explore DRRP's impact on firms'

[5]The DRRP was similarly extended to allow investment in intangible assets after 2020.

debt levels and external financing usage. Lerche (2022) explores an increase in the investment tax credit rate for manufacturing firms in Germany's new Länder following the German re-unification. The results show that treated firms increase their capital stock, overall employment, and domestic sales. However, the findings also show a reduction in wages and no effects on labor productivity.

Despite the availability of more than 100 corporate income tax incentives in Portugal (Grupo de Trabalho para o Estudo dos Benefícios Fiscais, 2019), work on the empirical impact of these incentives across the tax bases is scarce. Blattner et al. (2017) evaluate the impact of firm debt on the take-up of CFEI I, a large temporary investment tax credit available between June and December 2013. The authors find that debt has a strong, non-linear effect on the likelihood that firms take-up the tax credit. In 2024, the Portuguese government approved the creation of U-TAX, an independent technical unit to permanently monitor and help design the fiscal incentives available to individuals and firms. Their first official report provided an empirical evaluation of the SIFIDE, the Portuguese R&D tax incentives program, and the RFAI, a tax incentive for tangible fixed and intangible assets available since 2009 targeting specific sectors and regions (U-TAX, 2025). The evaluation of the SIFIDE is well-aligned with previous findings in the literature, highlighting positive effects on intangible investment and the number of R&D workers.[6] For the RFAI, U-TAX's analysis also shows positive effects on investment, employment, and wages; however, there is significant heterogeneity by firm size.

The remainder of the paper is structured as follows: Section 2 provides an overview of the institutional background and legal details of the DRRP. Section 3 introduces the data and descriptive statistics. Section 4 presents the empirical methodology used in our analysis. Section 5 shows the main results. Section 6 details the heterogeneity and sensitivity analysis. Section 7 concludes.

2 Institutional background

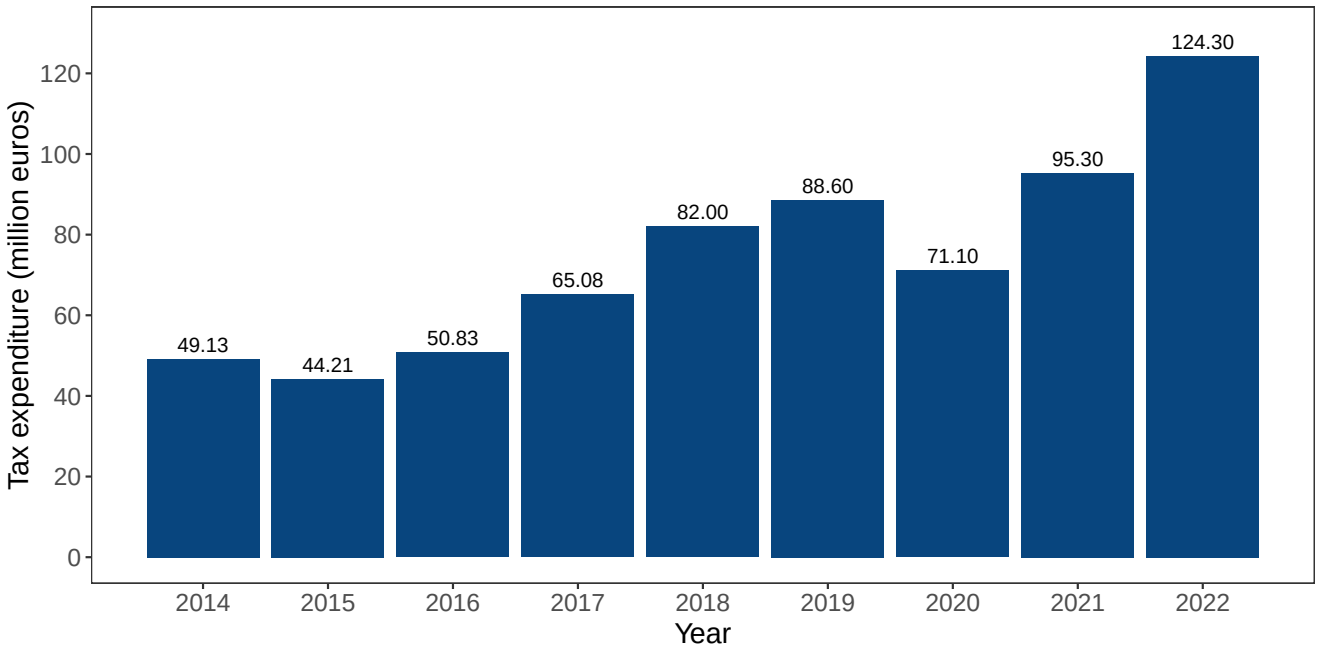
The Deduction of Retained and Reinvested Profits was introduced on 26 November 2013, as part of the 2014 State Budget (Assembleia da República Portuguesa, 2013). Its final form was announced

[6]Basto et al. (2021) and Bernard et al. (2023) also study the impacts of the SIFIDE, finding similarly positive results.

on 31 December 2013 and applied to all tax periods from 1 January 2014 onwards. The Portuguese 2014 Budget introduced a tough austerity plan as required by Portugal's economic adjustment program, following the EU and IMF bailout of Portugal.

The DRRP allowed firms to deduct 10% of retained profits from their tax bill if they were set aside to be reinvested in tangible fixed assets, thereby creating an incentive for firms to self-finance their investments. During its availability, the DRRP was one of the largest corporate income tax incentives in Portugal (Grupo de Trabalho para o Estudo dos Benefícios Fiscais, 2019; Ruano, 2025). Figure 2 presents the total cost of the DRRP measured as tax expenditure, the forgone tax revenue incurred by the use of the DRRP, between 2014 and 2022. Over this period, total cost more than doubled – going from €49.13 million in 2014 to €124.30 million in 2022.

Figure 2: DRRP tax expenditure, 2014-2022

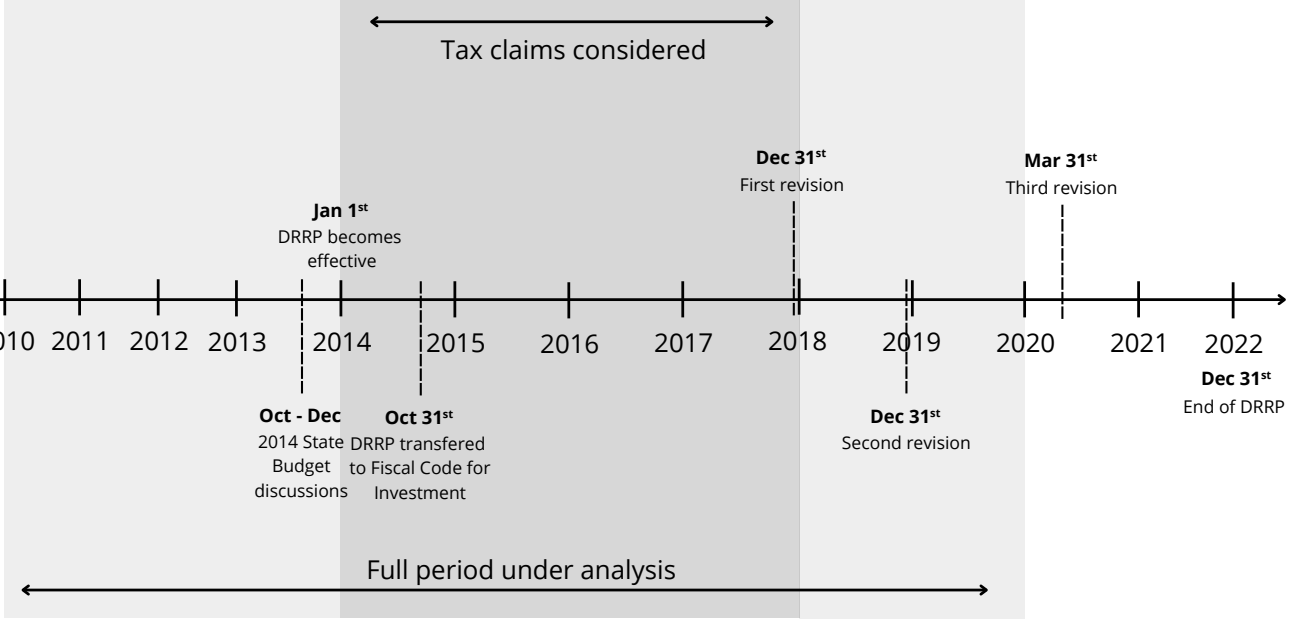


Notes: This figure plots the total DRRP tax expenditure (in million euros) according to official reports between 2014 and 2022. *Source:* Relatórios da Despesa Fiscal (2020-2022) and Grupo de Trabalho para o Estudo dos Benefícios Fiscais (2019).

A timeline of the evolution of the DRRP is shown in Figure 3. In July 2014, following the policy's implementation, the government approved the creation of a new Fiscal Code for Investment (in Portuguese, *Código Fiscal do Investimento*) to regulate the main investment tax incentive schemes. The new legislation was officially published on October 31, 2014 (Ministério das Finanças, 2014). As part of these legislative changes, the DRRP was integrated into the new Fiscal Code

for Investment and regulated under Articles 27 to 34 of the tax code, until its ultimate end in December 2022. The DRRP underwent three main revisions over the years. These revisions included extensions in the reinvestment period, increases in the maximum amount of retained earnings allowed, and expansions to allow for investment in intangible assets. To abstract from these changes, we will restrict our analysis to tax credit claims made between 2014 and 2017. This allows us to be sure that our results are not a consequence of the incentive expansion. We will follow firms before and after they take-up the tax credit, between the years 2010 to 2019.

Figure 3: Timeline of main events



Notes: This figure plots the timeline of the main events since the implementation of the DRRP in 2014 until its end in 2022. The full period under analysis ranges between 2010 and 2019. We restrict the analysis to tax claims made between 2014 and 2017.

The legislation governing the DRRP restricted the eligibility in four ways. Firms needed to (i) be classified as a micro, small, or medium-sized enterprise[7]; (ii) use the Organized Accounting Regime, which includes the mandatory use of a certified accountant who ensures the compliance with tax obligations and accounting standards; (iii) use direct reporting of taxable income; and (iv) have no debts towards the tax authority.

During the period we are considering, firms had two years after their tax claim to invest (e.g., a

[7]Firm size is defined according to the European Union's standards. Firms are classified as micro if they have less than 10 employees and a turnover or total balance sheet below €2 million. Small firms have less than 50 employees and a turnover or total balance sheet below €10 million. Medium firms have less than 250 employees, a turnover below 50 million euros or a total balance sheet below €43 million.

firm claiming in 2014 had to reinvest the retained earnings in 2015 and/or 2016). Firms claiming the DRRP could retain up to €5 million per year. However, the tax credit only covered up to 25% of the total tax bill. In the event that these limits were exceeded, the amount not eligible for the deduction was not claimable at a later date. Thus, when firms claim the tax credit more than once, each subsequent claim must be framed as a new investment with a new vesting period.

In addition, the DRRP could not be combined with any other investment tax incentives of the same kind for the same eligible investments. However, for different investments and while respecting the overall maximum limits set under Articles 13 and 24 of the Portuguese Fiscal Code for Investment, it could be combined with two other investment tax incentives – the RFAI and the BFCIP. We account for this possibility in our empirical strategy, detailed in Section 4.

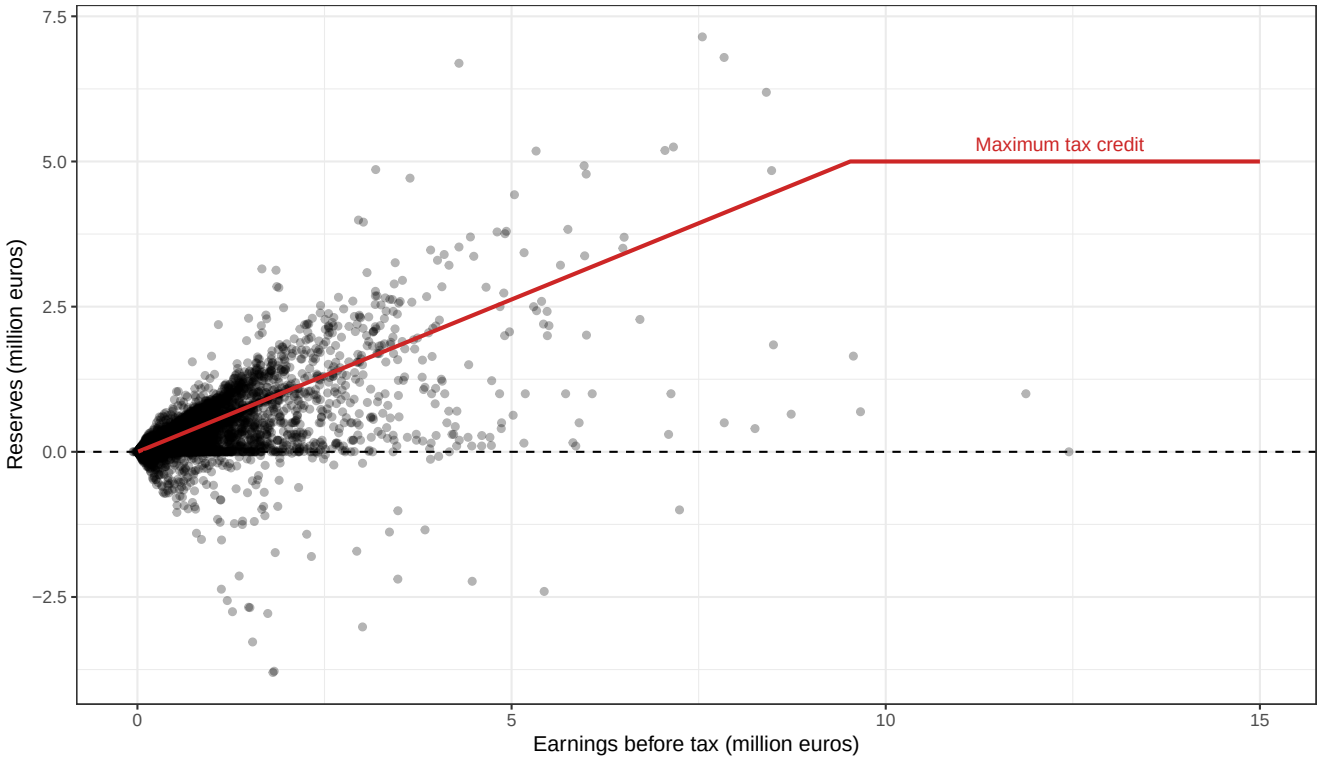
Eligible investments under the DRRP had to be new tangible fixed assets with the purpose of creating a new establishment, increasing existing capacity, or diversifying or fundamentally changing production. There were some important sectoral exemptions. Land was only an eligible investment for firms in extractive sectors. Buildings (their construction, acquisition, or repair) were eligible only if directly related to the firm's activity. Unless a firm was part of the hospitality sector, investment in furniture and decorative items were not eligible. Vehicles (such as passenger cars, boats, or tourism planes) or assets related to activities under concession or public-private partnership agreements with public sector entities were not eligible. Lastly, firms had to keep the acquired assets for at least five years.

The process to take advantage of the DRRP followed specific steps. First, firms had to create a special reserve in the balance sheet for the retained earnings. This reserve had to be approved by the firm's shareholders in a General Assembly meeting, usually held by the end of March of the year after the retained profits were earned. Upon approval, the firms could claim the tax incentive when filling their tax return. When filing their claim, firms had to identify the amount of retained and reinvested profits, lodge the relevant investment plan, and the total investment amount. Finally, the investment could be carried out in the two years after the claim.

The tax savings for firms using this program could be sizable, especially given the size of the SMEs

in Portugal. In 2014, SMEs assessed at a corporate income tax rate of 17% in the first €15,000 of taxable income and 23% above that threshold. Thus, a firm with a taxable income of €30,500 (the median among treated firms between 2010-2013, before the introduction of the DRRP), assuming no other fiscal incentives are used, would face a tax bill of €6,115. The maximum tax credit this firm could claim is €1,528.75 (25% of the tax bill). To maximize its tax credit, the hypothetical firm would need to retain €15,287.5. After the DRRP, the firm's tax bill would fall to €4,586.25, implying a drop in the effective tax rate from 20% to 15%.

Figure 4: Flow of reserves and earnings before tax



Notes: This figure plots the flow of reserves as a function of the earnings before tax (EBT) in million euros. The red line traces the retained earnings that maximize the tax credit, given the current EBT. Each black dot represents a firm claiming DRRP in our sample between 2014 and 2017.

To check whether firms in our sample exploit the tax credit to its maximum, we plot the flow of reserves (i.e., the yearly additions to or withdrawals from reserves) as a function of earnings before tax (EBT) in Figure 4. The red line traces the retained earnings that maximize the tax credit, given current EBT. Each black dot represents a firm claiming the DRRP in our sample in a given year. The figure highlights the following results. First, firms are concentrated at the lower end of the pre-tax profits distribution. This is expected given their SME status. Second, although

there is significant variation, a large share of firms seem to be using the tax credit close to the maximum.[8]

3 Data

We combine multiple administrative datasets for the purpose of this study, accessed confidentially via the safe center of the Portuguese National Statistical Office (Statistics Portugal) and the external server of the Banco de Portugal Microdata Research Laboratory (BPLIM). The different datasets and components are described below. The data was linked through firm's anonymized tax identification numbers.

3.1 Balance sheet data

The firm-level data comes from the Simplified Corporate Information dataset, provided by Statistics Portugal. This dataset is a panel of detailed firm-level accounting data that covers nearly all Portuguese non-financial corporations in the period between 2006 and 2023. The data is collected through a mandatory annual declaration filled online (IES - *Informação Empresarial Simplificada*). We have access to extensive data on firm's balance sheet and profit and loss account, as well as additional information such as the number of employees, sector of activity, location, and indicators for firm entry and exit.

3.2 Credit register data

To study the financing decisions of firms, we use the Harmonized Central Credit Register, provided through the Bank of Portugal's Microdata Research Laboratory, BPLIM.[9] The harmonized

[8]It is important to note that the reserves we have available in our balance sheet data do not specifically identify the portion of retained earnings related to the use of the DRRP. Consequently, some firms may retain more earnings than this specific incentive allows, likely because the data include additional retained earnings and other reserve inflows. Similarly, the negative flow of reserves may reflect firms that both add to and withdraw from this balance sheet item, but whose yearly withdrawals exceed the additions.

[9]The Portuguese Central Credit Register underwent a major revision in September 2018 which increased the granularity of the data collection. To correct for breaks in the series during the transition period, BPLIM harmonized the data since 2009 for a set of the most relevant variables. External researchers can access the data at the firm and bank-firm level.

credit register covers the period between 2009 and 2023 and provides monthly information on each borrowing firm's regular credit, secured credit, potential credit, overdue credit, and written-off credit amounts. All credit obligations above the reporting threshold of €50 are included. The data does not include private persons, individual entrepreneurs, and foreign firms operating in Portugal without a valid tax identification number. We consider only the credit stocks at the end of the year (December).

Unfortunately, we cannot merge the Credit Register data with the data provided by Statistics Portugal. Thus, for the analysis on firm indebtedness, we rely on the Bank of Portugal's Central Balance Sheet data and mirror our original data cleaning steps.[10]

3.3 Employment and establishment data

Our third source of information is *Quadros de Pessoal* (QP), a comprehensive matched employer-employee dataset. QP is an administrative census collected annually by the Ministry of Employment since 1986. All firms with at least one paid employee in the Portuguese private sector are legally obligated to provide detailed information based on their October payroll. For each firm, we obtain the total number of establishments, their locations, sector of activity, and number of employees. Information on employees includes gender, education, age, occupation, nationality, hiring date, monthly wages, and hours worked. We only consider wage earners (as opposed to unpaid workers) and aggregate the worker-level data at the firm-level.

3.4 Tax incentives data

The firm-level information is merged with data on the amounts of yearly DRRP tax credit per firm, publicly available online by the Portuguese tax authority. In these data, the tax authority identifies all firms that receive an overall amount of corporate income tax incentives of at least €1,000 per year, irrespective of which incentives firms are receiving.[11]

[10]The Bank of Portugal's Central Balance Sheet data are also based on information reported through *Informação Empresarial Simplificada*; however, the data verification and cleaning procedures of the Bank of Portugal differ from those of Statistics Portugal.

[11]While this threshold might seem very large for SMEs, Figure A.1 in the Appendix illustrates that the tax authority's list still captures between 95-98% of the total official DDRP tax expenditures per year. Thus, we can

For each firm, we have information on the amount saved in taxes by type of tax and type of incentive used. The raw data include 15,938 firms using the DRRP between 2014 and 2017, of which we are able to identify 9,945 in the firm-level data. The tax incentives data are available between 2010 and 2023; however, we restrict our analysis up to and including 2019 to avoid the effects of the COVID-19 pandemic and the expansions in the scope of the DRRP.

3.5 Data cleaning

We take several data cleaning steps to ensure the comparability of DRRP-treated and control firms. We start by keeping only firm-year observations with positive turnover, positive total assets, and at least one paid employee. As the tax incentive under analysis is available only for SMEs, we remove all large firms from the analysis. In addition, we keep only firms located in Mainland Portugal, as firms located in the islands of Madeira and Azores are subject to different tax laws, and firms born before 2014, the year the DRRP was implemented.

We restrict the control group to firms that claim other kinds of corporate tax incentive other than the DRRP during our period of analysis and remove all treated or control firms that claim other investment tax incentives (i.e., RFAI, BFCIP or CFEI I) between 2010 and 2019. We defer a more detailed description of the treatment and control groups to Section 4.

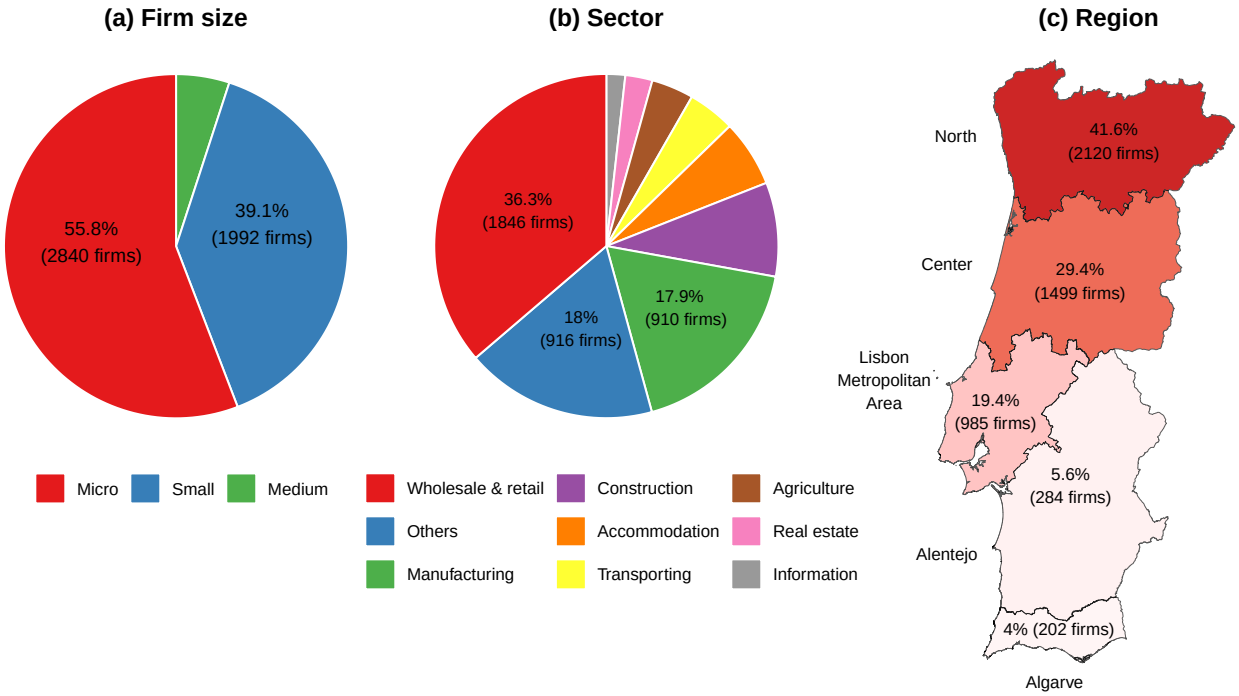
Lastly, we remove outliers at the 1st and 99th percentiles for key variables to reduce the impact of extreme values on our analysis. These variables are the flow of reserves (% EBT), tangible fixed assets investment rate, turnover, labor productivity (defined as turnover over number of employees), effective tax rate (defined as income tax over earnings before tax), real wages, liabilities, liabilities-to-assets, and interest expenses over turnover. Average wages are deflated using the Consumer Price Index (2012=100).

be confident that we are capturing the vast majority of DRRP users.

3.6 Descriptive Statistics

Figure 5 presents the distribution of treated firms by size, sector, and region in the first year they claim the DRRP. In our sample, around 95% of the firms using this tax incentive are micro and small firms. While this incentive is targeted towards SMEs, this result is still surprising, since larger firms have been associated with a better knowledge of the tax system and higher use of tax incentives (Bachas et al., 2025).[12] As expected, DRRP-using firms are concentrated in capital-intensive sectors, such as manufacturing, wholesale and retail trade, and construction. Regionally, treated firms are mainly located in the North and Center regions of Portugal, followed by the Lisbon Metropolitan Area. This follows the regional distribution of RFAI users (U-TAX, 2025). The North and Center are the main industrial hubs of the country, where large industries such as manufacturing, automotive, and textiles are located, while Lisbon is Portugal's economic center.

Figure 5: Distribution of treated firms by size, sector, and region



Notes: This figure plots the distribution of treated firms in the first year they claim the DRRP by firm size (panel a), sector of activity (panel b), and NUTS II region (panel c).

[12] U-TAX (2025) document that the majority of firms using RFAI are large firms. Both tax incentives targeted tangible fixed assets investment, with the DRRP restricted to SMEs only; therefore, there is a possibility that smaller firms found the DRRP more accessible while larger firms relied on other tax incentives.

Table B.1 in the Appendix presents the descriptive statistics for the remaining outcomes of interest over the full period under analysis (2010–2019) between our treated and control firms. We can thus check the comparability of the two groups. While their average labor composition is similar, treated firms have higher inflow of reserves (% EBT) and tangible fixed asset investment rate. On the other hand, control firms are more indebted on average. We further split the treated group between one-time users (i.e., firms claiming the DRRP only once) and repeated users (i.e., firms claiming multiple times) in Table B.2. As would be expected, repeated users tend to be slightly larger than one-time users.

4 Methodology

We next describe our empirical strategy and give a more thorough explanation of how we define the treatment and control groups in our analysis. We implement a difference-in-differences (DiD) event study and separate the analysis according to the first year of the DRRP take-up.

4.1 Estimation strategy

We estimate the following event study equation:

$$Y_{it} = \sum_{k=2010, k\neq 2013}^{2019} \beta_k \times 1[t = k] \times 1[i = DRRP] + \delta_i + \gamma_t + \epsilon_{it} \tag{1}$$

where Y_{it} is the outcome of interest for each firm i in year t. $1[i = DRRP]$ is a treatment indicator equal to one for firms that claim the DRRP. $1[t = k]$ are year dummy variables. δ_i are firm-fixed effects and γ_t are year-fixed effects. β_k are our coefficients of interest. Standard errors are clustered at the firm level. The omitted year is 2013, the year before the DRRP was implemented.

For a subset of our results, we estimate a variant of (1) which aggregates the year indicators in only two post-treatment time periods as follows:

$$Y_{it} = \alpha \times 1[t \leq t_{\text{claim}}] + \theta \times 1[t \geq t_{\text{inv}}] + \\ \gamma \times 1[t \leq t_{\text{claim}}] \times 1[i = DRRP] + \eta \times 1[t \geq t_{\text{inv}}] \times 1[i = DRRP] + \delta_i + \epsilon_{it} \tag{2}$$

where $1[t \leq t_{\text{claim}}]$ represents the period after 2013 until the year of the first claim (i.e., the period of possible anticipation behavior for later-treated firms) and $1[t \geq t_{\text{inv}}]$ represents the investment period and the following years until 2019. Our coefficients of interest are γ and η. The remaining variables are defined as before.

We consider a firm as treated if it claims the DRRP at least once between 2014 and 2017. The DRRP became available for all firms at the same time, but it was the firm's decision whether to use this tax credit and when to do so. As such, the timing of adoption varied across treated firms. To account for this, we separate the analysis according to the first year firms claim the DRRP, i.e., we estimate (1) four times per outcome, each time restricting our sample of treated firms according to their first year of treatment. The control group remains the same in all specifications.

As previously stated, the control group is restricted to firms that are included in the tax authority's list of firms using tax incentives and that claim some kind of corporate income tax incentive other than the DRRP during the period of analysis. This addresses the concern that unobservable factors determine why some firms claim the DRRP and others do not. Focusing our analysis on firms that use other corporate tax incentives allows us to account for the possibility that some firms might not be able to use tax incentives for other reasons.

Further, all companies in Portugal – public and private limited companies – are required to adopt the Organized Accounting Regime.[13] One of the requirements of this regime is that firms must have a certified accountant to ensure compliance with tax and accounting regulations. Thus, we only observe firms that are required to use the Organized Accounting Regime and either have a certified internal or external accountant. This means that all firms in our sample have access to professional advice, who can inform them about the DRRP and its advantages. This reduces the concerns that some firms do not take advantage of this policy because they are not aware of it.

[13]Sole proprietors and liberal professionals are only required to adopt this regime if their annual net income exceeds €200,000.

Our final restriction is that firms cannot claim other investment tax incentives at any point during the period under analysis. In particular, we remove firms that claim the RFAI, the BFCIP, or the CFEI I. As previously mentioned in Section 2, the DRRP could be used simultaneously with two other investment tax incentives, the RFAI and the BFCIP. We also exclude the CFEI I since it was a large temporary investment tax incentive available between June and December 2013, exactly 6 months before the introduction of the DRRP. Thus, the use of the CFEI I could have impacted the outcomes of firms going forward. These incentives, although different in their access conditions and requirements, share the same objective of increasing firm investment. We remove firms using these incentives from our sample to avoid capturing treatment effects not directly related with the DRRP.

4.2 Identifying assumptions

Our empirical strategy relies on two key identifying assumptions (Roth et al., 2023). The first is that there are no anticipation effects before claiming the DRRP. While this might be true for firms that claim the DRRP for the first time in 2014, as the policy was only announced a few months prior to its implementation during the State Budget discussions and received little public debate before the budget, that may not be the case for firms that first claim the DRRP in later years. Later-treated firms, aware of this policy for at least a year before their claim, might adjust their operations prior to actual take-up. Given this possibility, we explicitly allow for anticipatory behavior in all specifications and omit 2013, the year before the policy was implemented. Because the policy was available to all firms beginning in 2014, we explicitly don't rely on a staggered DiD strategy in our analysis, despite the self-directed staggered adoption of the incentive by firms.

The second identifying assumption is the existence of parallel trends. We assume that, in the absence of treatment, the outcomes of treated and control firms would have evolved along parallel trends. The idea is that any deviation from this trend should be caused by the treatment. It is not possible to test this assumption, as we cannot observe the counterfactual trends. Instead, to provide supporting evidence of its validity, we inspect whether the two groups followed similar trends prior to 2013 through our event study specification (Roth, 2022).

5 Results

In this section, we report and discuss our results based on (1) and (2). We start by presenting the direct impact of the DRRP on reserves and investment. We then show the indirect impact of the policy on financing decisions. Finally, we present our findings on the labor composition effect of the investments.

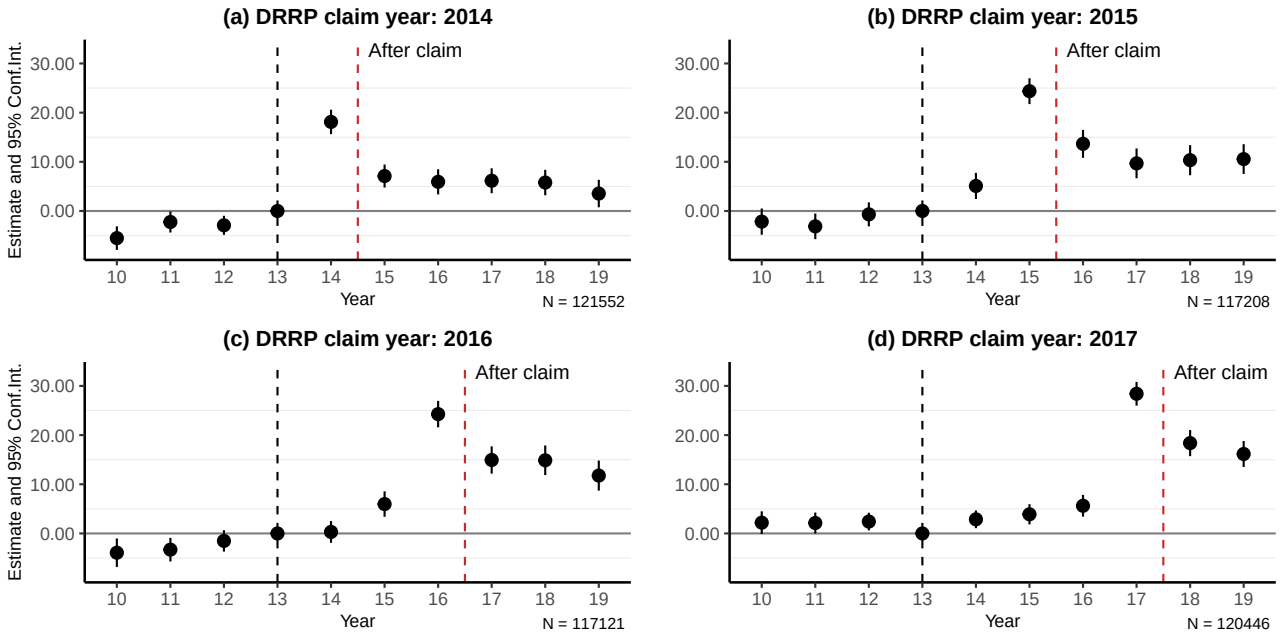
5.1 Direct Impact on Reserves and Investment

Figure 6 shows the results for the flow of reserves as a share of pre-tax profits (EBT). To benefit from this tax credit, firms had to create a *Special reserve* item in the balance sheet instead of using the standard retained earnings item. While we do not have access to the specific *Special reserve* in our data, we rely on information from *Other reserves*, a higher level item which includes, among others, the retained earnings related to this tax incentive. Unusually, the retained earnings must be declared prior to undertaking any investment; we therefore move the timeline by one year to observe the effect on reserves.

As expected, our findings show a spike in the year of claiming the tax credit and a subsequent drawn down as investments are made. Reassuringly, we observe that the evolution of reserves as a share of pre-tax profits was similar between treated and non-treated firms before 2013. Reserves as a share of pre-tax profits increase between 20 and 30 percentage points in the year the first claim is made. As will be discussed in Section 6.1, this result is driven by firms that claim the DRRP multiple times, since they keep on retaining earnings to finance their investments. For firms that use the DRRP only once, reserves as a share of pre-tax profits quickly fall back to pre-treatment levels following the tax claim.

Following the rise in reserves, we next explore the impact on the investment rate, shown in Figure 7. As this policy targets investment in tangible fixed assets, we focus on the investment rate for tangible fixed assets, estimated as the increase in tangible fixed assets over last year's total assets. It is important to remember that firms must claim the tax credit first and then perform the respective investment only in the two years after the claim.

Figure 6: Reserves (share of pre-tax profits)

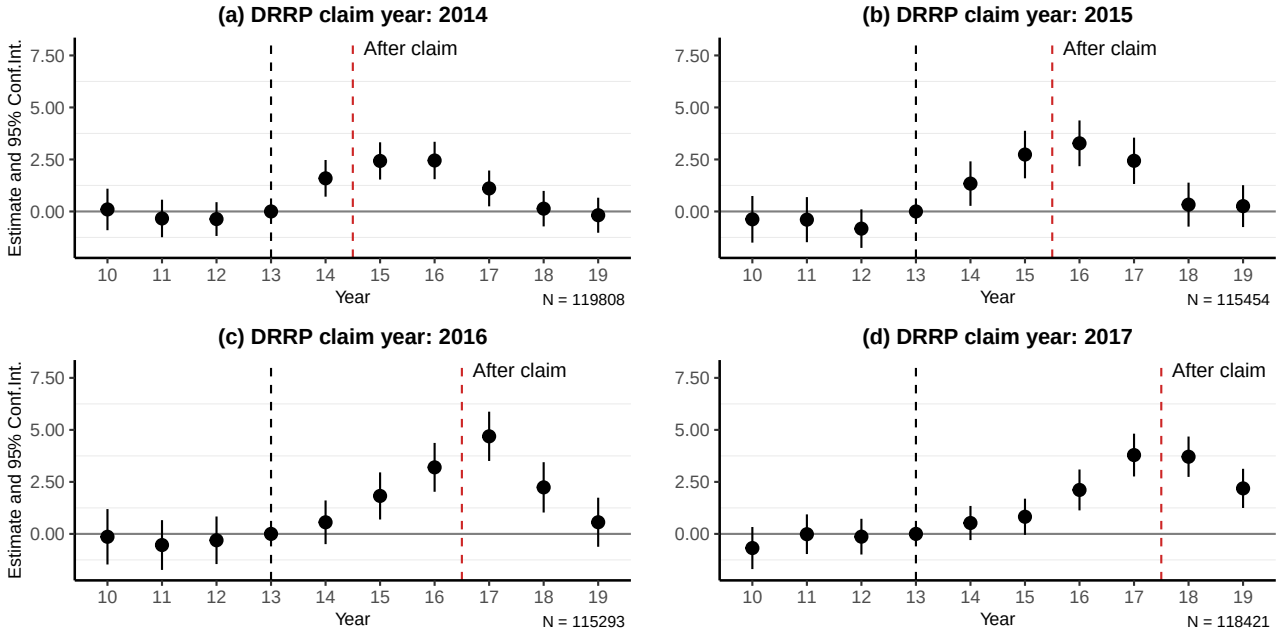


Notes: This figure plots the β_k coefficients estimated with (1). The outcome variable is measured as a percentage. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. The black vertical dashed line marks the year before the policy's implementation and the red line separates the claim year from the investment period.

A few interesting results emerge from this analysis. First, we report evidence that the parallel trends' assumption holds. Second, we find that the investment rate in tangible fixed assets increases in the two years after the tax credit claim, with estimated effects ranging between 2.2 and 4.7 percentage points. Third, the investment rate starts to drop after firms are allowed to invest following the claim. This tells us two things: (i) firms perform the majority of their investments in the first year they are allowed to do so; and (ii) firms use the DRRP to perform larger investments; however, the effect is short-lived, as the investment rate quickly returns to pre-treatment levels. Finally, we find that regardless of the first year of the DRRP claim, the estimated effects are positive and significant for at least one or two years before the investment could be performed, including in the year of the claim itself. In addition to flagging clear anticipatory behavior, we interpret these results as evidence that the DRRP was used by firms that were already on an investment path. This incentive seems to have been used by firms that would probably have invested anyways, and not so much by firms that would not have had the ability to invest otherwise.

In addition to estimating the effects for the overall tangible fixed assets investment rate, we go

Figure 7: Tangible fixed assets investment rate

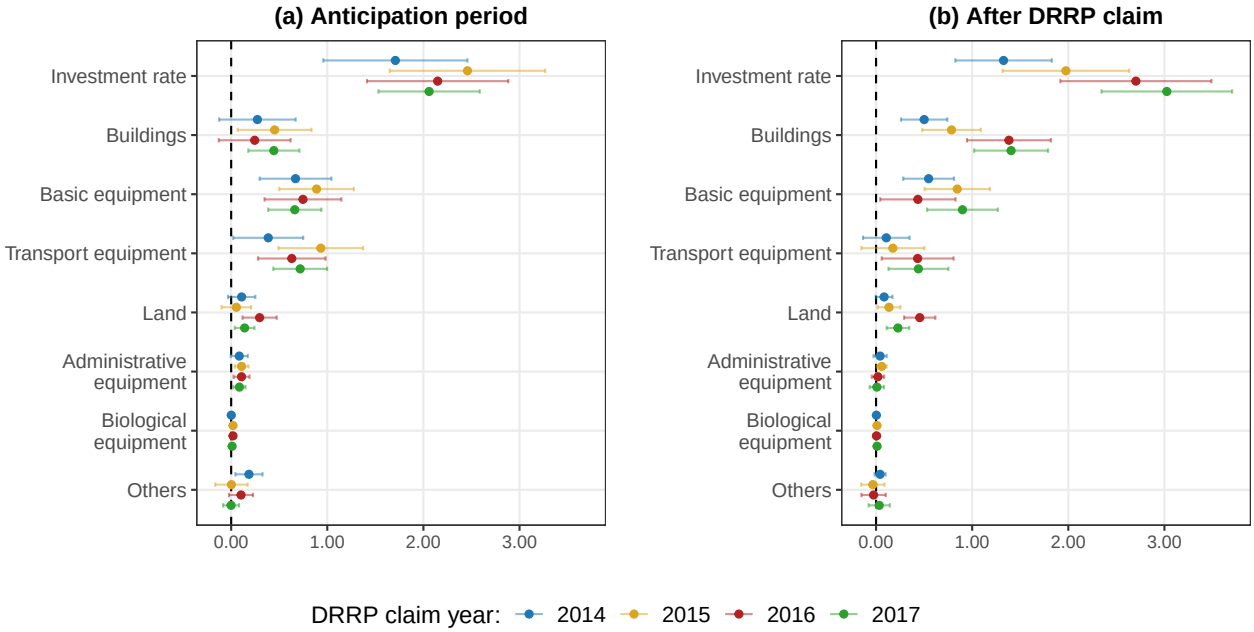


Notes: This figure plots the β_k coefficients estimated with (1). The outcome variable is measured as a percentage and computed as the ratio of investment in tangible fixed assets to total assets in year t-1. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. The black vertical dashed line marks the year before the policy's implementation and the red line separates the claim year from the investment period.

one step further in our analysis by using (2) and breaking down the impact on the investment rate for the different classes of tangible fixed assets. Due to the anticipation effects found above, we split the post-treatment period (after 2013) into pre- and post-DRRP claim years. Panel (a) of Figure 8 shows the estimates for the anticipation period (between 2014 and the year of the first the DRRP claim) and Panel (b) shows the impact after the DRRP claim until 2019.

Our findings show that the overall effect on the investment rate masks important heterogeneities. We find that the investment rate in buildings increases significantly between 0.5 and 1.4 percentage points after the DRRP claim. The magnitude of this effect, higher for later-treated firms, might partly reflect the rise of property prices in Portugal. Basic equipment (e.g., machines or tools used for the production of goods or provision of services) is the second most responsive asset class, although treated firms were already investing more in this category before they claimed the DRRP. We also find small positive and significant effects for the investment rate in land, although it was only considered an eligible investment for firms in extractive sectors. In contrast, the investment rate in transport equipment, for which we find clear evidence of anticipation effects, falls and

Figure 8: Investment rate by type of tangible fixed asset



Notes: This figure plots the estimates of the γ coefficient in panel (a) and the η coefficient in panel (b), estimated with (2). The outcome variables are measured as a percentage and computed as the ratio of investment in each type of tangible fixed asset to total assets in year t-1. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Basic equipment includes machinery and tools used for the production of goods or provision of services; administrative equipment covers office supplies, furniture, hardware, and similar; biological equipment comprises livestock and plants.

becomes insignificant following the DRRP claim. This is reassuring, as treated firms were not allowed to use DRPP to invest in a wide range of vehicles. We do not find significant changes in the investment rate in administrative (e.g., office supplies, furniture, hardware, etc.) or biological equipment (e.g., livestock or plants).

In absolute terms, Figure A.5 in the Appendix highlights the composition of total investment spending across tangible fixed asset classes for treated firms in the two years following their first DRRP claim – that is, the period in which firms were required to carry out their investments. The distribution of investment spending is very similar across the different groups of treated firms. On average, firms spend a larger share on basic equipment (33-37%), transport equipment (27-28%), and buildings (17-19%).

5.2 Indirect Impact on Financing Decisions

Having established that reserves and investment, the two main outcomes directly targeted by this policy, respond largely in the way and the timeline outlined by the tax credit, we now turn to the

effect on financing decisions. In addition to using internal financing, firms can rely on external sources to finance their investments, namely through debt or equity financing. As previously stated, the DRRP was introduced as part of an austerity budget, during a period when Portuguese firms were highly indebted and there were widespread concerns about their ability to service their debts and recover investment levels amid a fragile economic recovery. By incentivizing firms to retain profits to finance investment, the Portuguese government indirectly aimed to reduce firms' reliance on external financing. We use the Bank of Portugal's Central Credit Register to explore the indirect effect of the DRRP on firms' financing decisions.

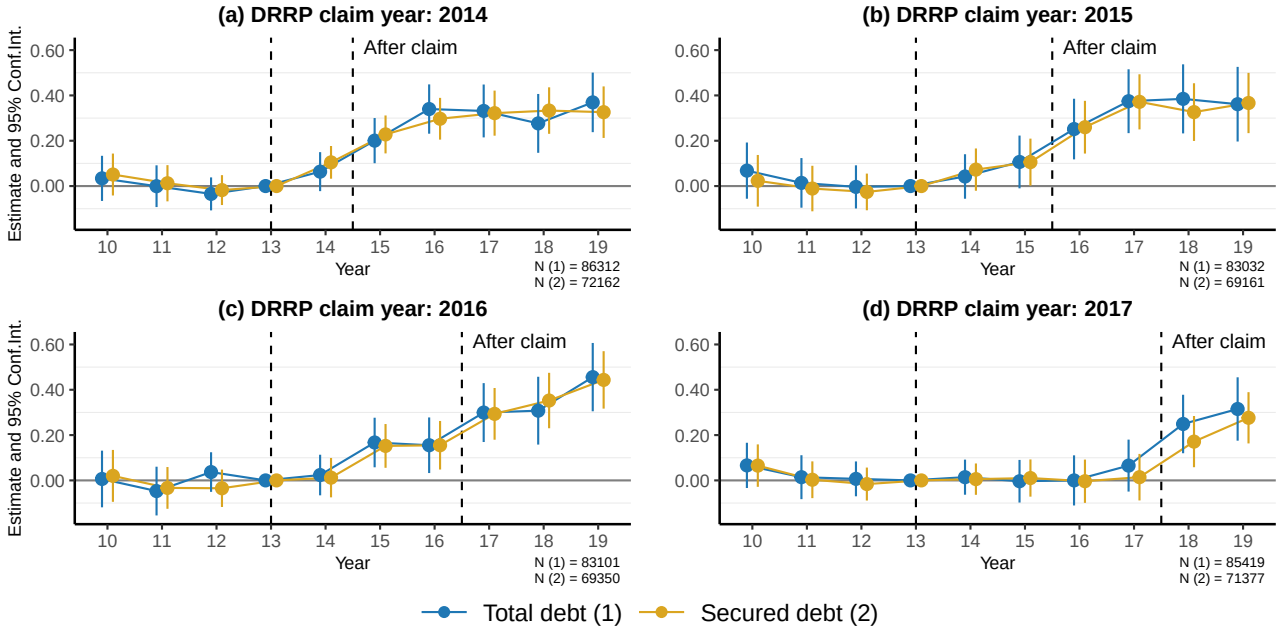
Figure 9 shows the impact on total debt (in blue) – a firm's total amount of credit in good standing – and on secured debt (in yellow) – a firm's total amount of credit in good standing that is backed-up by at least one type of collateral.[14]. Before 2013, there were no significant differences in the evolution of these outcomes between treated and untreated firms. After the DRRP became available, and contrary to stated government goals, firms using the tax credit did not substitute away from debt towards retained earnings to invest. Instead, the total debt of treated firms significantly increased by nearly 40% after the claim compared with untreated firms.[15] While there is evidence of some anticipation, the effect is mainly concentrated in the period of the investment itself and persists over time.

One plausible explanation for the previous finding is that firms use the newly acquired tangible fixed assets to secure additional external funding. Previous literature has motivated collateral as a signaling device for borrower quality (Bester, 1985; Besanko and Thakor, 1987; Boot et al., 1991; Jiménez et al., 2006). To expand upon this idea, we check the effects on secured debt. As suspected, the effect on total debt is driven by a near one-for-one increase in debt backed by collateral. Firms claiming this tax credit acquired assets through their investments, which they then used as collateral to increase external funding. Using the DRRP may also have partly offset

[14]The types of collateral considered include, among others, retail, residential, and industrial commercial property, commercial property offices, property under construction for commercial purposes, residential properties (completed, under construction, and land), gold, cash and deposits or equivalent, publicly-quoted and unquoted debt securities, loans, shares and other equity (quoted and unquoted), credit derivatives and other financial guarantees, commercial receivables, pledges of insurance and guarantors, and sureties. The register does not provide information on the type of collateral used.

[15]Similar effects are found for total liabilities (see Figure A.2).

Figure 9: Total debt and secured debt



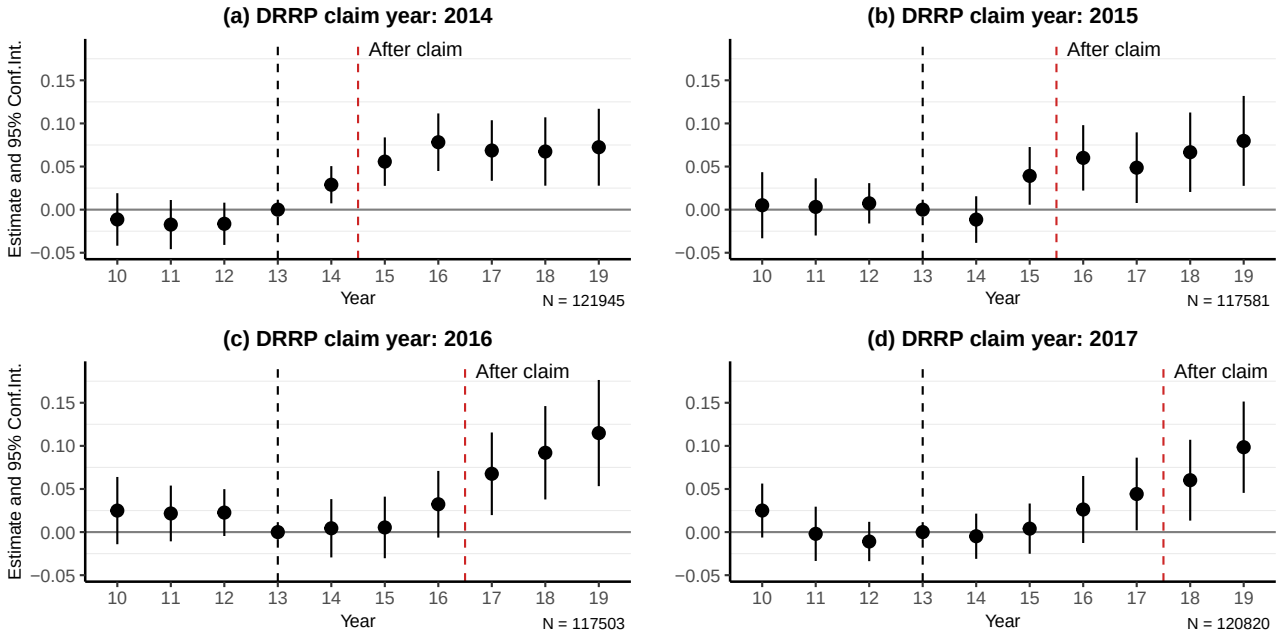
Notes: This figure plots the β_k coefficients estimated with (1). Blue dots depict point estimates for total debt (i.e., the total amount of credit in good standing) and yellow dots for secured debt (i.e., the total amount of credit in good standing that is backed-up by collateral). Both outcome variables are measured at the end of the year and using a logarithmic transformation. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.

the external financing costs by lowering the effective cost of capital through the use of low-cost retained earnings, making borrowing relatively more attractive for treated firms.

To present the full picture of firm's financing decisions following the take-up of the DRRP, we also analyze the impact on equity financing in Figure 10. Equity financing can be advantageous for firms since there is no repayment obligation. However, a big drawback of issuing equity is that it requires giving up ownership or voting rights in return for capital. While most firms use a combination of debt and equity financing, those seeking to retain full control of their business often prefer debt financing. Following the use of the DRRP, we find that equity financing also increases for treated firms compared to the group of control firms, especially in the years following the tax credit claim. The effects, however, are much lower in magnitude than the effect on debt financing. Equity financing increases between 5% and 10% following the take-up of the DRRP. Treated firms, after spending a large portion of their retained earnings to invest, diversify their external financing sources by relying more on both debt and equity financing moving forward. Nevertheless, the difference in the magnitude of the estimated effects seems to indicate a preference of these small

and medium-sized firms towards debt financing.

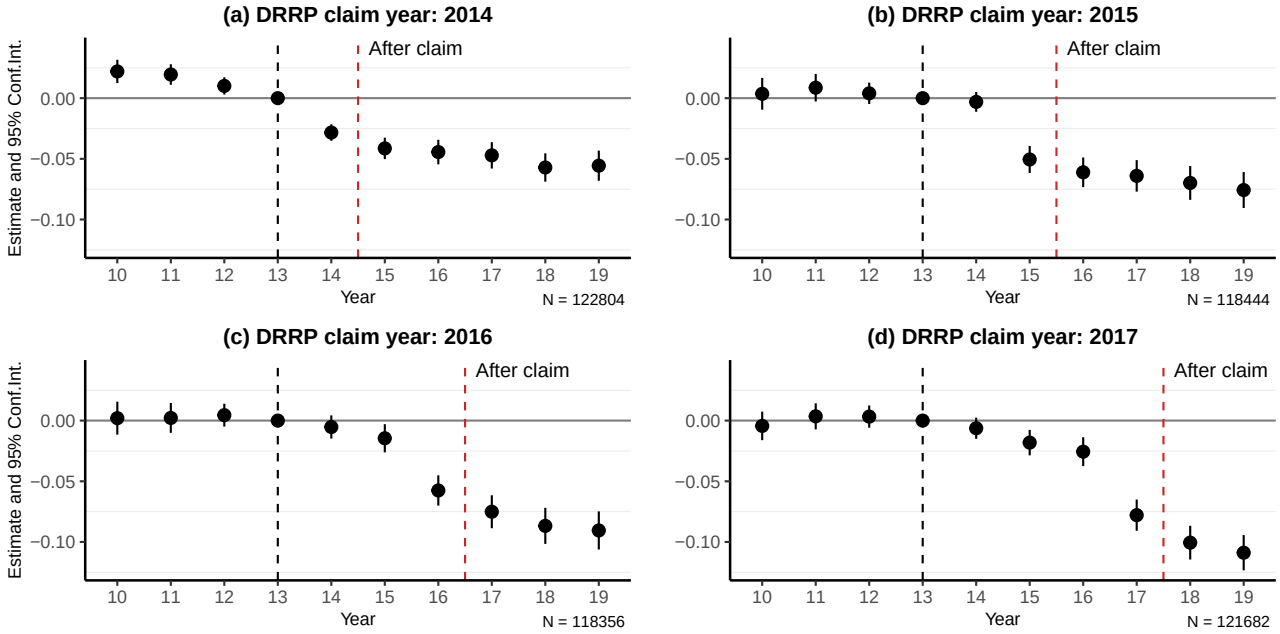
Figure 10: Equity financing



Notes: This figure plots the β_k coefficients estimated with (1). The outcome variable is measured using a logarithmic transformation. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. The black vertical dashed line marks the year before the policy's implementation and the red line separates the claim year from the investment period.

Despite not being aligned with the policy's stated goal of reducing firm indebtedness, the increase in external financing might not necessarily be a bad indicator for firms. Additional funding can speed up firm growth and provide access to new business opportunities. As shown in Figure 11, the liabilities-to-assets ratio decreases between 2 and 10 percentage points following the tax claim. This suggests that while both assets and liabilities are growing, assets are growing faster than liabilities. We interpret this result as a positive effect of the DRRP, whereby firms improved their balance sheets and were able to grow on a more financially stable footing. Consistent with this interpretation, evidence of subsequent business expansion is shown in Figure A.3 in the Appendix. After the claim, during the investment period and the subsequent years, we find a small but positive increase in the total number of establishments for DRRP users relative to firms in the control group.

Figure 11: Liabilities-to-assets



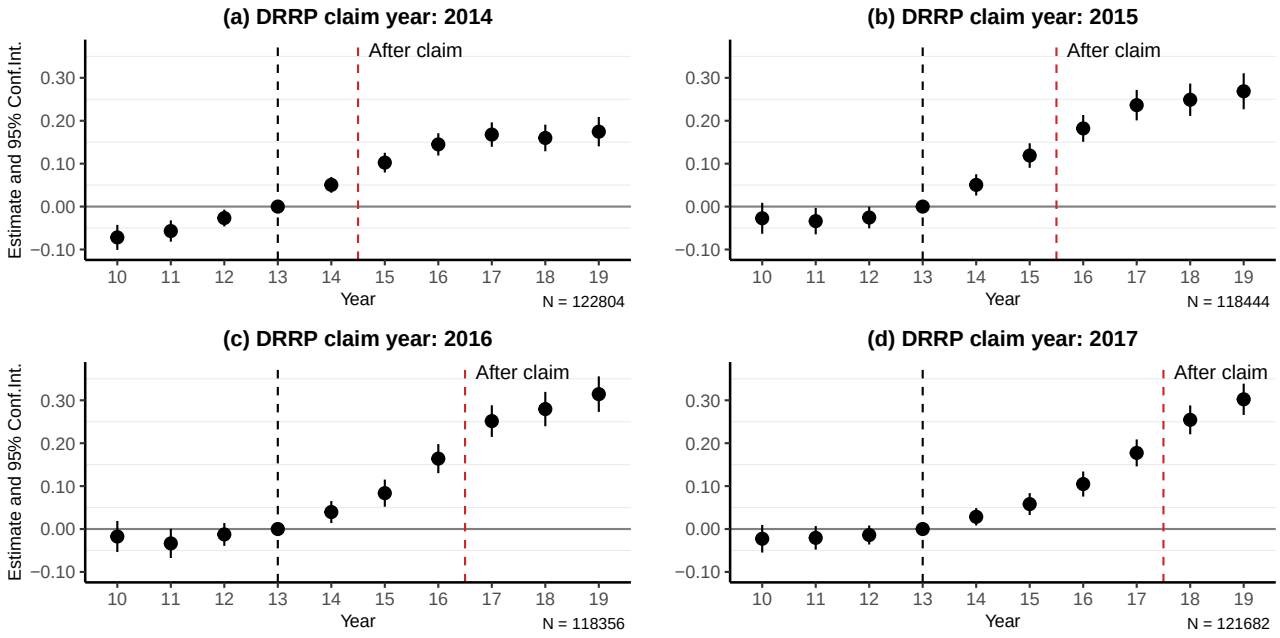
Notes: This figure plots the β_k coefficients estimated with (1). The outcome variable is calculated as total liabilities over total assets. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. The black vertical dashed line marks the year before the policy's implementation and the red line separates the claim year from the investment period.

5.3 Indirect Impact on Labor Composition

Lastly, we turn to the labor composition effect of DRRP-funded investments. The elasticity of substitution between labor and capital has been widely discussed in the literature around the intersection of economic growth, labor markets, and public finance (Arrow et al., 1961; Klump et al., 2012). Generally, this literature seeks to determine whether labor and capital are gross substitutes or gross complements, with empirical evidence generally supporting the latter (Pol, 2004; Klump et al., 2007; Herrendorf et al., 2015; Mućk, 2017; Oberfield and Raval, 2021). In the field of public finance, understanding the trade-off between labor and capital – particularly in response to changes in their relative input prices – is crucial for assessing how corporate taxes and tax incentives affect capital formation (Chirinko, 2002). While our goal is not to formally estimate an elasticity of substitution, this discussion encouraged us to document how employment and wages react to the DRRP, which explicitly targets investment in tangible fixed assets.

Figure 12 presents the results for firm size (measured by the number of employees across all establishments) and Figure 13 for average real wages. The small-to-medium sized firms claiming

Figure 12: Number of employees

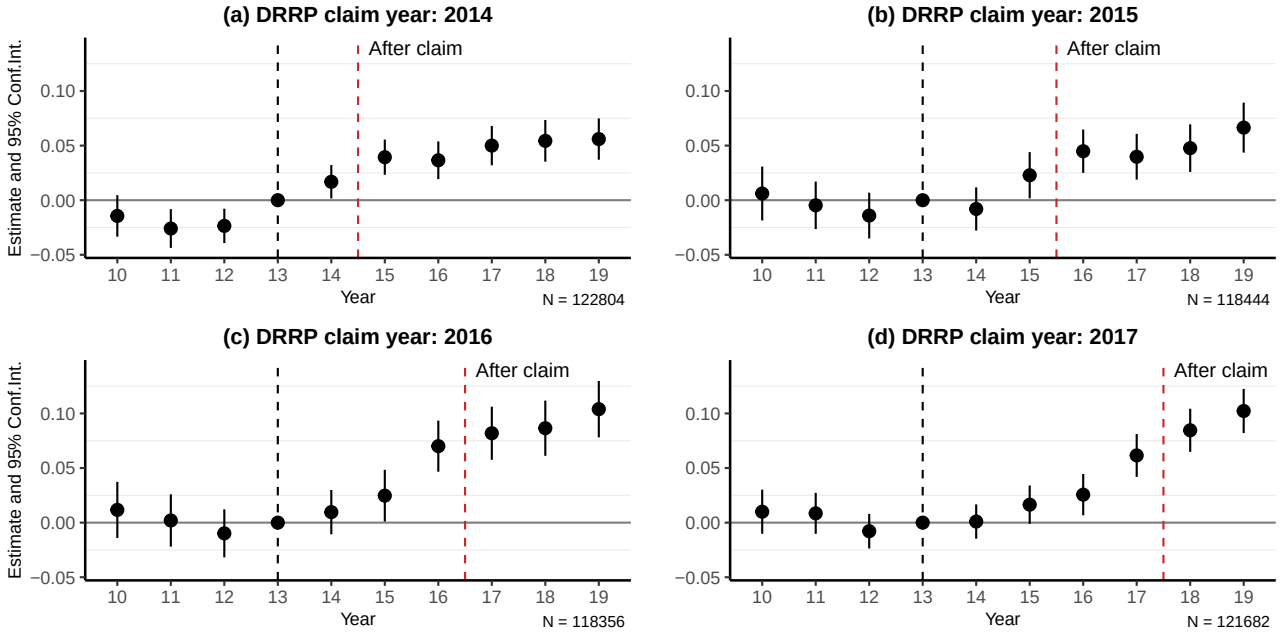


Notes: This figure plots the β_k coefficients estimated with (1). The outcome variable is measured using a logarithmic transformation. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. The black vertical dashed line marks the year before the policy's implementation and the red line separates the claim year from the investment period.

the DRRP expand their total number of employees between 5-30% over time. This increase in employment, along with the investment in tangible fixed assets, is aligned with the idea that capital and labor might be complementary. While these results give insight on the firm size growth of treated firms relative to untreated firms, they must be interpreted carefully for two reasons. First, we find evidence of significant anticipation effects even before the tax credit claim for all groups of treated firms. Second, early-treated firms claiming the DRRP for the first time in 2014 have imperfect pre-trends prior to the introduction of the policy. Once again, these results seem to suggest that the DRRP might have been used by firms that were already expanding and that would probably have invested regardless of the availability of this tax credit. Our results also show a rise in average real wages up to 10%, a positive effect that stabilizes in the years following the investment.

Even with overall employment and wages increasing as shown, the explicit goal of the DRRP was to encourage firms to invest in growth-oriented assets that improve their production processes or expand capacity. One concern is that new technological advances can disproportionately benefit

Figure 13: Average real wages



Notes: This figure plots the β_k coefficients estimated with (1). The outcome variable is measured using a logarithmic transformation. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. The black vertical dashed line marks the year before the policy's implementation and the red line separates the claim year from the investment period.

certain workers in detriment of others (Berman et al., 1998; Autor et al., 2003). For example, treated firms might change their labor composition in favor of highly educated or high-skilled employees under skill-biased technological change (Acemoglu, 2002; Aghion, 2002; Card and DiNardo, 2002).

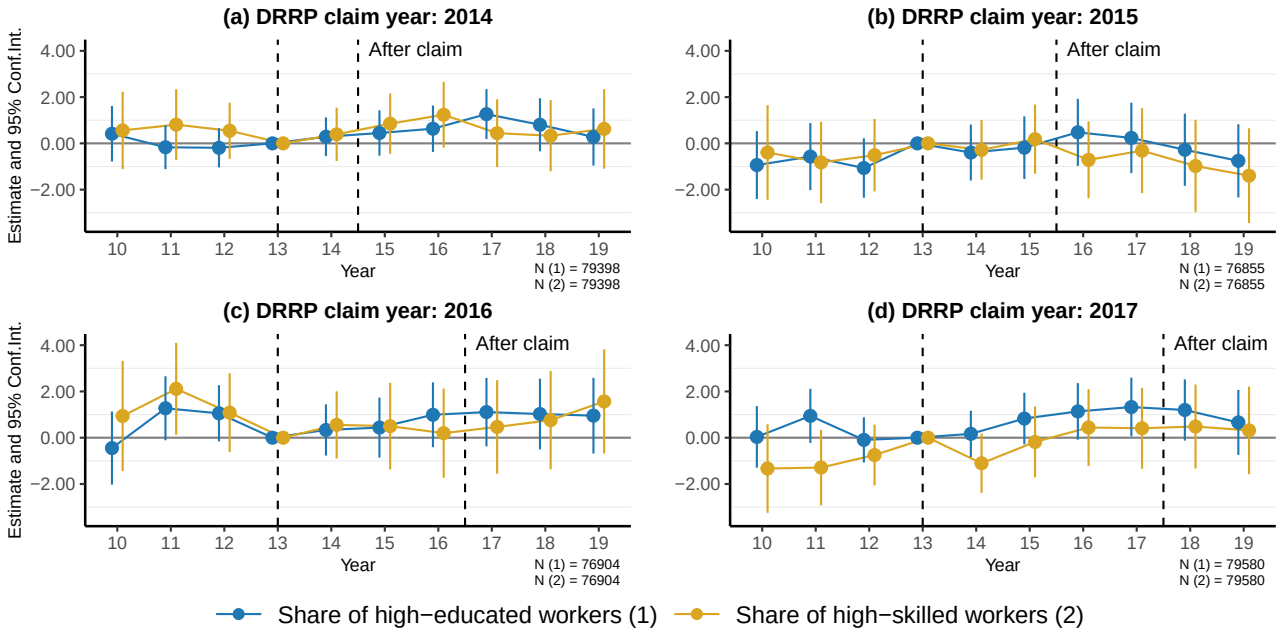
We analyze the impact of the DRRP on the share of highly educated workers, shown in Figure 14 in blue, and find no significant changes in the educational composition of the workforce following the take-up of the tax credit.[16] Similarly, the share of high-skilled workers (in yellow) remains constant throughout the period under analysis.[17] Overall, the investments performed through the use of the DRRP did not shift firms to a higher share of educated/skilled labor.

On the other hand, Figure 15 shows an increase in the share of temporary workers for later-treated firms. The effects vary between 1 and 4 percentage points more temporary workers. The increasing workforce among treated firms seem to have been partly filled through slightly higher temporary

[16] We define a worker as highly educated if he/she has a university degree.

[17] Following the International Standard Classification of Occupations (ISCO), we define legislators, senior officials and managers, professionals, technicians and associate professionals, skilled agricultural and fishery workers, and craft and related trades workers as high-skilled workers.

Figure 14: Share of high-educated workers and share of high-skilled workers

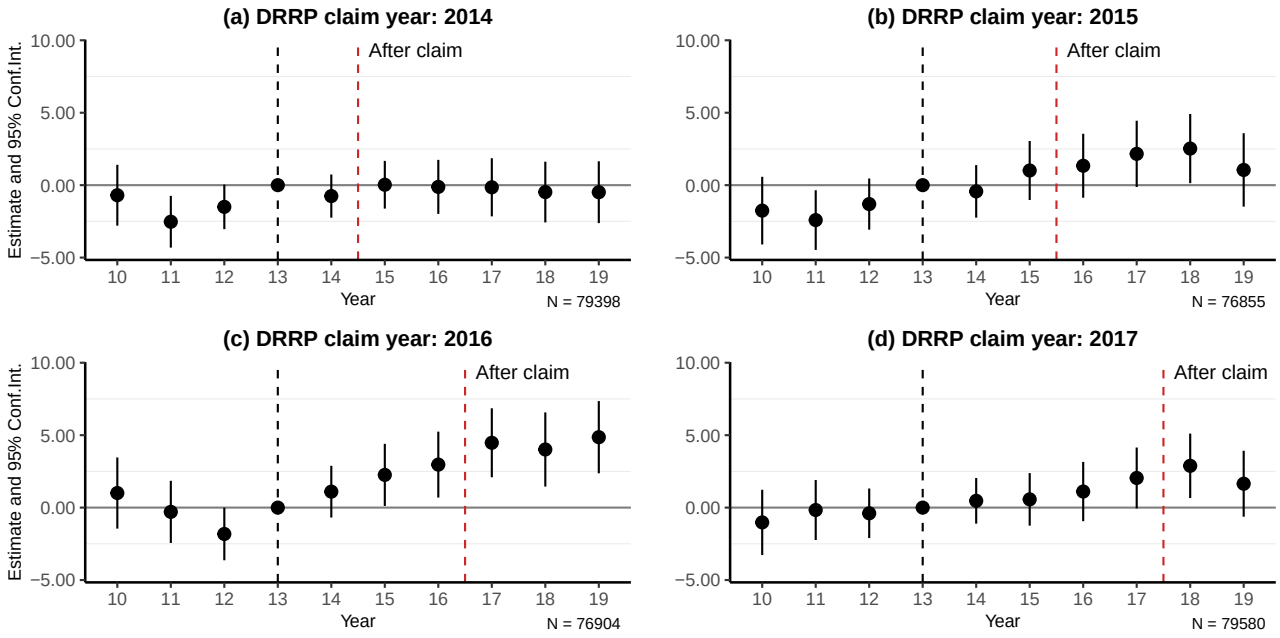


Notes: This figure plots the β_k coefficients estimated with (1). Blue dots depict point estimates for the share of high-educated workers and yellow dots for the share of high-skilled workers. Both outcome variables are measured as a percentage. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.

employment rather than permanent employment. This is not surprising in the Portuguese context. Due to the high levels of protection in Portuguese employment law, temporary employment has been historically very prevalent in Portugal. Over our time period, temporary employment varied between 20.5% and 22.8% of all Portuguese employees, well above the OECD average between 11.8% and 12.8% (OECD, 2014). These results are further corroborated when we look at the average age of the workers, which falls over time for firms using the DRRP relative to the control group (Figure A.4). Temporary employment is highest among the young – around 60-70% of workers below 25 years old are employed with temporary work contracts (Rodrigues et al., 2022). By increasing their share of temporary workers, firms ultimately integrate younger workers into their workforce.[18]

[18]Nunes et al. (2023) show that young and temporary workers were the two groups of workers that transitioned more into unemployment during the COVID-19 pandemic due to the dual nature of the Portuguese labor market.

Figure 15: Share of temporary workers



Notes: This figure plots the β_k coefficients estimated with (1). The outcome variable is measured as a percentage. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. The black vertical dashed line marks the year before the policy's implementation and the red line separates the claim year from the investment period.

6 Heterogeneity and Sensitivity

The previous section presented the effect of the DRRP for all firms, focusing on the year firms first claimed the DRRP. However, as mentioned in Section 3.6, treated firms could be divided into two categories – one-time users and repeated users. Thus, we next explore the difference in effects between one-time and repeated users of the DRRP. Further, as we undertake several data cleaning steps, we perform sensitivity checks to ensure the results remain robust to alternative filtering. We also test the robustness of our results to alternative specifications.

6.1 One-time vs repeated users

Firms could only claim DRRP once per year when filling their tax return, but there was no overall restriction on the number of claims they could make across years, as long as each claim related to a differentiated investment.

We present the results for all outcomes in our analysis in Appendix C. 38% of treated firms claim

the DRRP only once (2,161 firms), while 62% are repeated claimants (3,479 firms).[19] The two main outcomes affected by the DRRP – reserves and investment – continue to respond as expected. As briefly mentioned in Section 5.1, following the initial uptick, reserves as a share of pre-tax profits quickly fall back to pre-treatment levels after the tax claim for one-time users. The effect remains positive and significant over time for repeated users, as these firms continue to retain earnings for their subsequent claims. Similarly, the tangible fixed assets investment rate spikes upward in the year after the claim for one-time users and immediately returns to pre-treatment levels. For the remaining outcomes on financing decisions, total number of establishments, and labor composition, the estimated effects are generally aligned for both groups of treated firms, but tend to be more muted for one-time users, especially after the two-year investment period.

The two types of firms may respond differently for several reasons. The use of tax incentives entails various costs, the most evident being administrative and compliance costs associated with the required documentation and bureaucratic procedures. Understanding the legislation and assessing the benefits of a particular policy might also require additional help from professionals, such as accountants or consultants, adding to the overall financial cost. As such, the benefits of a tax incentive have to be weighted against the costs associated with its use. After claiming the DRRP for the first time, some firms may realize that the process is too complex, that their profits are insufficient to sustain adequate levels of retained earnings to continue investing, or that the benefits simply do not outweigh the costs, leading them to not claim the incentive again. In contrast, firms that claim the DRRP more than once are clearly those that experience a net benefit from using this policy. Repeated users may also plan their investments strategically around the use of tax incentives or invest in more productive opportunities than one-time users. Even if we cannot precisely distinguish between these mechanisms, the results highlight the importance of considering the responses of the two groups of firms separately.

[19] Although we restrict our analysis to firms that claimed the tax credit between 2014 and 2017, we define whether a firm is a one-time or repeated user based on the full period that the DRRP was available – 2014-2022. Thus, if a firm claimed only once between 2014 and 2017 but then claimed again after 2017, we consider the firm to be a repeated user. Given that the DRRP ended in 2022 and we have information on all claims, this provides for a more accurate measure of the total number of claims.

6.2 Sensitivity Checks

We complement our analysis in Section 5 by providing a series of sensitivity checks, delegating the full results to Appendix D.

To test the sensitivity of the results to our data cleaning procedure, we remove a wider set of outliers of the key variables at the 5th and 95th percentiles, instead of the 1st and 99th percentiles used in the baseline regressions. While the magnitude of the effects decreases sightly in some cases due to the removal of more extreme values, the results remain robust.

Finally, we check the validity of our results using a different control group for each group of treated firms. Instead of defining our control group as all the firms that claimed tax incentives other than the DRRP at any point between 2010 and 2019, we restrict the control group to firms that claimed other tax incentives in the same year firms first claim the DRRP. For example, when analyzing the impact for firms that first claimed the DRRP in 2014, we compare them only with firms using other tax incentives in the same year. In this scenario, the control group is no longer constant across all groups of treated firms, such that the comparability of treated and control firms might increase even further. This change decreases the sample size significantly, increasing the size of the standard errors. While some of the previous findings are no longer significant, the magnitude of the results remain generally unchanged.

7 Conclusion

This paper provides an analysis of the Deduction of Retained and Reinvested Profits (DRRP), a corporate tax incentive to induce the self-financing of investment introduced by the Portuguese government as a recovery measure in the aftermath of the global financial crisis. This tax credit allowed micro, small and medium-sized enterprises to deduct 10% of retained profits from their tax bill, if these were specifically set aside to be reinvested in tangible fixed assets. Using firm-level administrative data, we follow firms between 2010 and 2019 to understand the impact of using the DRRP on reserves, investment, financing decisions, and the workforce composition.

Our results show that the DRRP was effective in increasing reserves and the tangible fixed assets investment rate, despite evidence of strong anticipatory behavior for firms claiming the tax credit later. Firms mainly increase their investment on buildings and basic equipment. Contrary to the expectation that this policy would incentivize firms to substitute external sources of financing with internal funds, credit data reveals that firms using the DRRP became even more indebted following the tax credit claim. This effect is driven by an increase in secured debt, indicating that firms used the acquired tangible fixed assets as collateral to secure additional external funding. From a policy perspective, this unanticipated effect raises important questions about the design of the tax credit. By failing to anticipate firm's responses, the government may have unintentionally created conditions that favored further debt accumulation rather than promoting deleveraging as intended. To the best of our knowledge, no formal evaluation of the DRRP was conducted while the program was available; thus, these results underscore the importance of actively monitoring fiscal incentives to ensure the accomplishment of the intended outcomes.

Additional analyses show that treated firms expand their businesses, with the DRRP sparking positive effects on the total number of establishments, employment, and real wages. Following the investments, the workforce composition does not change in favor of highly educated or high-skilled workers, reducing the concerns that this policy induced skill-biased technology changes. We find, however, an increase in the share of temporary employment, which is aligned with the strong duality of the Portuguese labor market.

Finally, we show that the estimated effects are generally driven by firms that claim the tax credit multiple times. While we can't precisely identify the reasons why some firms only use the DRRP once, these results highlight the importance of separately exploring the different groups of treated firms. The policy's effectiveness might be limited if firms do not rely more on the DRRP because they find the process too complex, the accumulation of retained earnings too costly, or conclude that the benefits do not outweigh the additional administrative or financial burden caused by the tax credit. Even though the DRRP ended in 2022, policymakers should seek to understand the practical challenges faced by firms and take these into consideration when designing new tax incentives or adjusting the current ones.

References

Acemoglu, Daron, "Technical Change, Inequality, and the Labor Market," *Journal of Economic Literature*, 2002, *40* (1), 7–72.

Aghion, Philippe, "Schumpeterian Growth Theory and the Dynamics of Income Inequality," *Econometrica*, 2002, *70* (3), 855–882.

Agrawal, Ajay, Carlos Rosell, and Timothy Simcoe, "Tax Credits and Small Firm R&D Spending," *American Economic Journal: Economic Policy*, 2020, *12* (2), 1–21.

Alstadsæter, Annette, Martin Jacob, and Roni Michaely, "Do dividend taxes affect corporate investment?," *Journal of Public Economics*, 2017, *151*, 74–83.

Arrow, K. J., H. B. Chenery, B. S. Minhas, and R. M. Solow, "Capital-Labor Substitution and Economic Efficiency," *The Review of Economics and Statistics*, 1961, *43* (3), 225–250.

Assembleia da República Portuguesa, "Lei n. 83-C/2013, de 31 de dezembro," 2013. `https://diariodarepublica.pt/dr/detalhe/lei/83-c-2013-164404`.

Autor, David H., Frank Levy, and Richard J. Murnane, "The Skill Content of Recent Technological Change: An Empirical Exploration," *The Quarterly Journal of Economics*, 2003, *118* (4), 1279–1333.

Bachas, Pierre, Anne Brockmeyer, Roel Dom, and Camille Marine Semelet, "Effective Tax Rates, Firm Size and the Global Minimum Tax," Policy Research Working Paper Series 11090, The World Bank 2025.

Basto, Rita Bessone, Ana Martins, and Guida Nogueira, "The Impact of R&D tax incentives in Portugal," GEE Papers 0158, Gabinete de Estratégia e Estudos, Ministério da Economia 2021.

Berman, Eli, John Bound, and Stephen Machin, "Implications of Skill-Biased Technological Change: International Evidence," *The Quarterly Journal of Economics*, 1998, *113* (4), 1245–1279.

Bernard, Anna, Rahim Lila, and Joana Silva, "Employment versus Efficiency: Which Firms Should R&D Tax Credits Target?," GEE Papers 0176, Gabinete de Estratégia e Estudos, Ministério da Economia 2023.

Besanko, David and Anjan V. Thakor, "Collateral and Rationing: Sorting Equilibria in Monopolistic and Competitive Credit Markets," *International Economic Review*, 1987, *28* (3), 671–689.

Bester, Helmut, "Screening vs. Rationing in Credit Markets with Imperfect Information," *The American Economic Review*, 1985, *75* (4), 850–855.

Blattner, Laura, Luísa Farinha, and Francisca Rebelo, "Debt or Demand: Which Holds Investment Back? Evidence from an Investment Tax Credit," Working paper series 3689, Stanford GSB 2017.

Boadway, Robin and Neil Bruce, "A general proposition on the design of a neutral business tax," *Journal of Public Economics*, 1984, *24* (2), 231–239.

Bøler, Esther Ann, Andreas Moxnes, and Karen Helene Ulltveit-Moe, "R&D, International Sourcing, and the Joint Impact on Firm Performance," *American Economic Review*, 2015, *105* (12), 3704–39.

Bond, Stephen and Costas Meghir, "Dynamic Investment Models and the Firm's Financial Policy," *The Review of Economic Studies*, 1994, *61* (2), 197–222.

_ **and John Van Reenen**, "Microeconometric models of investment and employment," *Handbook of econometrics*, 2007, *6*, 4417–4498.

Boot, Arnoud W. A., Anjan V. Thakor, and Gregory F. Udell, "Secured Lending and Default Risk: Equilibrium Analysis, Policy Implications and Empirical Results," *The Economic Journal*, 1991, *101* (406), 458–472.

Borisova, Ginka and James R. Brown, "R&D sensitivity to asset sale proceeds: New evidence on financing constraints and intangible investment," *Journal of Banking Finance*, 2013, *37* (1), 159–173.

Bronzini, Raffaello, Guido de Blasio, Guido Pellegrini, and Alessandro Scognamiglio, "The effect of investment tax credit: Evidence from an atypical programme in Italy," Temi di discussione (Economic working papers) 661, Bank of Italy, Economic Research and International Relations Area 2008.

Cappelen, Adne, Arvid Raknerud, and Marina Rybalka, "The effects of R&D tax credits on patenting and innovations," *Research Policy*, 2012, *41* (2), 334–345.

Card, David and John E. DiNardo, "Skill-Biased Technological Change and Rising Wage Inequality: Some Problems and Puzzles," *Journal of Labor Economics*, 2002, *20* (4), 733–783.

Chirinko, Robert S., "Corporate Taxation, Capital Formation, and the Substitution Elasticity between Labor and Capital," *National Tax Journal*, 2002, *55* (2), 339–355.

Chiu, Wan-Chien, Chih-Wei Wang, and Juan Ignacio Peña, "Does the source of debt financing affect default risk?," *Review of Financial Economics*, 2017.

Dechezleprêtre, Antoine, Elias Einiö, Ralf Martin, Kieu-Trang Nguyen, and John Van Reenen, "Do Tax Incentives Increase Firm Innovation? An RD Design for R&D, Patents, and Spillovers," *American Economic Journal: Economic Policy*, 2023, *15* (4), 486–521.

Edmans, Alex and William Mann, "Financing Through Asset Sales," *Management Science*, 2019, *65* (7), 3043–3060.

Eichfelder, Sebastian and Kerstin Schneider, "How do tax incentives affect business investment? Evidence from German bonus depreciation," *arqus Discussion Paper*, 2018, (231).

_ , Martin Jacob, and Kerstin Schneider, "Do tax incentives affect investment quality?," *Journal of Corporate Finance*, 2023, *80*, 102403.

European Commission, "European Semester: Country Specific Recommendation/Commission Recommendation – Portugal," 2018. Accessed: April 4, 2025.

Farinha, Luísa and Pedro Prego, "Investment Decisions and Financial Standing of Portuguese Firms – recent evidence," *Economic Bulletin and Financial Stability Report Articles*, 2013.

Fazzari, Steven, R. Glenn Hubbard, and Bruce Petersen, "Investment, Financing Decisions, and Tax Policy," *The American Economic Review*, 1988, *78* (2), 200–205.

Gebauer, Stefan, Ralph Setzer, and Andreas Westphal, "Corporate debt and investment: a firm analysis for stressed euro area countries," *European Central Bank Working Paper Series*, 2017, (2101).

Grupo de Trabalho para o Estudo dos Benefícios Fiscais, *Os Benefícios Fiscais em Portugal - Conceitos, metodologia e prática*, Cadernos de Ciência e Técnica Fiscal n.º 217, 2019.

Hassett, Kevin and R. Hubbard, "Tax Policy and Business Investment," *Handbook of Public Economics*, 12 2002, *3*, 1293–1343.

Hebous, Shafik and Martin Ruf, "Evaluating the effects of ACE systems on multinational debt financing and investment," *Journal of Public Economics*, 2017, *156*, 131–149.

Hennessy, Christopher A. and Toni M. Whited, "How Costly Is External Financing? Evidence from a Structural Estimation," *The Journal of Finance*, 2007, *62* (4), 1705–1745.

Herrendorf, Berthold, Christopher Herrington, and Ákos Valentinyi, "Sectoral Technology and Structural Transformation," *American Economic Journal: Macroeconomics*, 2015, *7* (4), 104–33.

Hosono, Kaoru, Masaki Hotei, and Daisuke Miyakawa, "Causal effects of a tax incentive on SME capital investment," *Small Business Economics*, 2023, *61* (2), 539–557.

Hsieh, Chang-Tai and Jonathan A. Parker, "Taxes and Growth in a Financially Underdeveloped Country: Evidence from the Chilean Investment Boom," *National Bureau of Economic Research Working Papers*, 2006, (12104).

Jia, Junxue and Guangrong Ma, "Do R&D tax incentives work? Firm-level evidence from China," *China Economic Review*, 2017, *46*, 50–66.

Jiménez, Gabriel, Vicente Salas, and Jesús Saurina, "Determinants of collateral," *Journal of Financial Economics*, 2006, *81* (2), 255–281.

King, Mervyn A., "Taxation and the Cost of Capital12," *The Review of Economic Studies*, 1974, *41* (1), 21–35.

Klemm, Alexander, "Allowances for Corporate Equity in Practice," *IMF Working Papers*, 2006, *06* (259), 1.

Klump, Rainer, Peter McAdam, and Alpo Willman, "Factor Substitution and Factor-Augmenting Technical Progress in the United States: A Normalized Supply-Side System Approach," *The Review of Economics and Statistics*, 2007, *89* (1), 183–192.

_ , _ , and _ , "The Normalized CES Production Function: Theory and Empirics," *Journal of Economic Surveys*, 2012, *26* (5), 769–799.

Krusell, Per, Lee E. Ohanian, José-Víctor Ríos-Rull, and Giovanni L. Violante, "Capital-Skill Complementarity and Inequality: A Macroeconomic Analysis," *Econometrica*, 2000, *68* (5), 1029–1053.

Ladinska, Elina, Marielle Non, and Bas Straathof, "More R&D with tax incentives? A meta-analysis," *CPB Netherlands Bureau for Economic Policy Analysis Discussion Paper*, 2015, (309).

Lerche, Adrian, "Investment Tax Credits and the Response of Firms," Discussion paper series 15668, IZA Institute of Labor Economics 2022.

Melnik, Walter and Andrew Smyth, "R&D tax credits and innovation," *Journal of Public Economics*, 2024, *236*, 105157.

Ministério das Finanças, "Decreto-Lei n. 162/2014, de 31 de outubro," 2014. https://diariodarepublica.pt/dr/detalhe/decreto-lei/162-2014-58683382.

Mitchell, Jessica, Giuseppina Testa, Miguel Sanchez Martinez, Paul N Cunningham, and Katarzyna Szkuta, "Tax incentives for R&D: supporting innovative scale-ups?," *Research Evaluation*, 2019, *29* (2), 121–134.

Modigliani, Franco and Merton H. Miller, "The Cost of Capital, Corporation Finance and the Theory of Investment," *The American Economic Review*, 1958, *48* (3), 261–297.

Mućk, Jakub, "Elasticity of substitution between labor and capital: robust evidence from developed economies," NBP Working Papers 271, Narodowy Bank Polski 2017.

Nunes, Carolina, Bruno P. Carvalho, João Pereira dos Santos, Susana Peralta, and José Tavares, "Failing Young and Temporary Workers? The Impact of a Disruptive Crisis on a Dual Labour Market," *The B.E. Journal of Economic Analysis & Policy*, 2023, *23* (2), 349–395.

Oberfield, Ezra and Devesh Raval, "Micro Data and Macro Technology," *Econometrica*, 2021, *89* (2), 703–732.

OECD, "Temporary employment, % of dependent employment," 2014. Accessed: 3 Apr. 2025.

OECD, *OECD Economic Surveys: Portugal 2017*, Paris: OECD Publishing, 2017.

Ohrn, Eric, "The effect of tax incentives on U.S. manufacturing: Evidence from state accelerated depreciation policies," *Journal of Public Economics*, 2019, *180*, 104084.

Pol, Antràs, "Is the U.S. Aggregate Production Function Cobb-Douglas? New Estimates of the Elasticity of Substitution," *The B.E. Journal of Macroeconomics*, 2004, *4* (1), 1–36.

Rodrigues, Margarida, Fátima Suleman, Paulo Marques, and Pedro Videira, *Livro Branco: Mais e Melhores Empregos para os Jovens 2022*, 1 ed., Fundação Joéé Neves, Observatório do Emprego Jovem, Organização Internacional do Trabalho, 2022.

Roth, Jonathan, "Pretest with Caution: Event-Study Estimates after Testing for Parallel Trends," *American Economic Review: Insights*, 2022, *4* (3), 305–322.

_ , Pedro H.C. Sant'Anna, Alyssa Bilinski, and John Poe, "What's trending in difference-in-differences? A synthesis of the recent econometrics literature," *Journal of Econometrics*, 2023, *235* (2), 2218–2244.

Ruano, Francisco, *Análise aos Benefícios Fiscais dos Sujeitos Passivos de IRC: 2020-2023*, Conselho das Finanças Públicas - Publicação Ocasional n.º 01/2025, 2025.

Stiglitz, Joseph E., "Taxation, corporate financial policy, and the cost of capital," *Journal of Public Economics*, 1973, *2* (1), 1–34.

Tavakoli, Amirhossein, "R&D Expenditures, Productivity, and Rent-Sharing: Evidence from an R&D Tax Credit," *Mimeo*, 2024.

Tian, Binbin, Baixue Yu, Shi Chen, and Jingjing Ye, "Tax incentive, R&D investment and firm innovation: Evidence from China," *Journal of Asian Economics*, 2020, *71*, 101245.

U-TAX, *Relatório de Avaliação da Despesa Fiscal em Portugal*, Unidade Técnica de Avaliação de Políticas Tributárias e Aduaneiras, 2025.

Yagan, Danny, "Capital Tax Reform and the Real Economy: The Effects of the 2003 Dividend Tax Cut," *American Economic Review*, December 2015, *105* (12), 3531–63.

Zwick, Eric and James Mahon, "Tax Policy and Heterogeneous Investment Behavior," *American Economic Review*, 2017, *107* (1), 217–48.

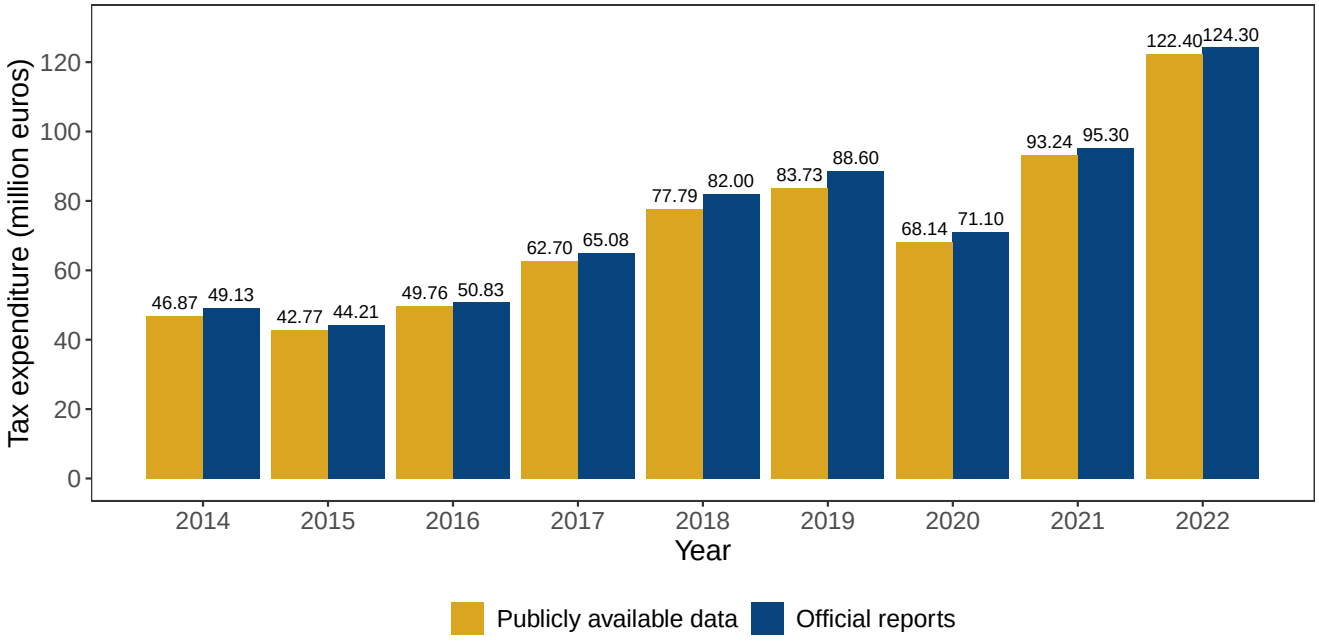
Appendix

A Additional tables and figures

Table A.1: Tax incentive schemes acronyms

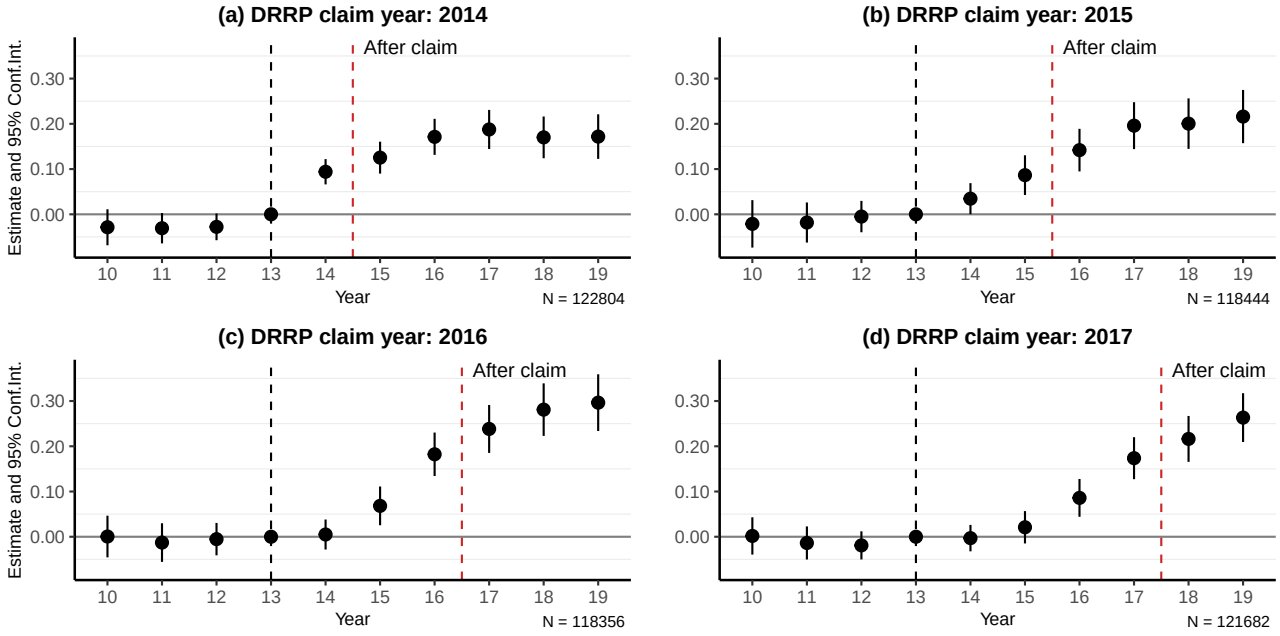
Acronym	Meaning (in Portuguese)
RFAI	Regime Fiscal de Apoio ao Investimento
SIFIDE	Sistema de Incentivos Fiscais à I&D Empresarial
CFEI I	Crédito fiscal extraordinário ao investimento
BFCIP	Benefícios Fiscais Contratuais ao Investimento

Figure A.1: DRRP tax expenditure, 2014-2022



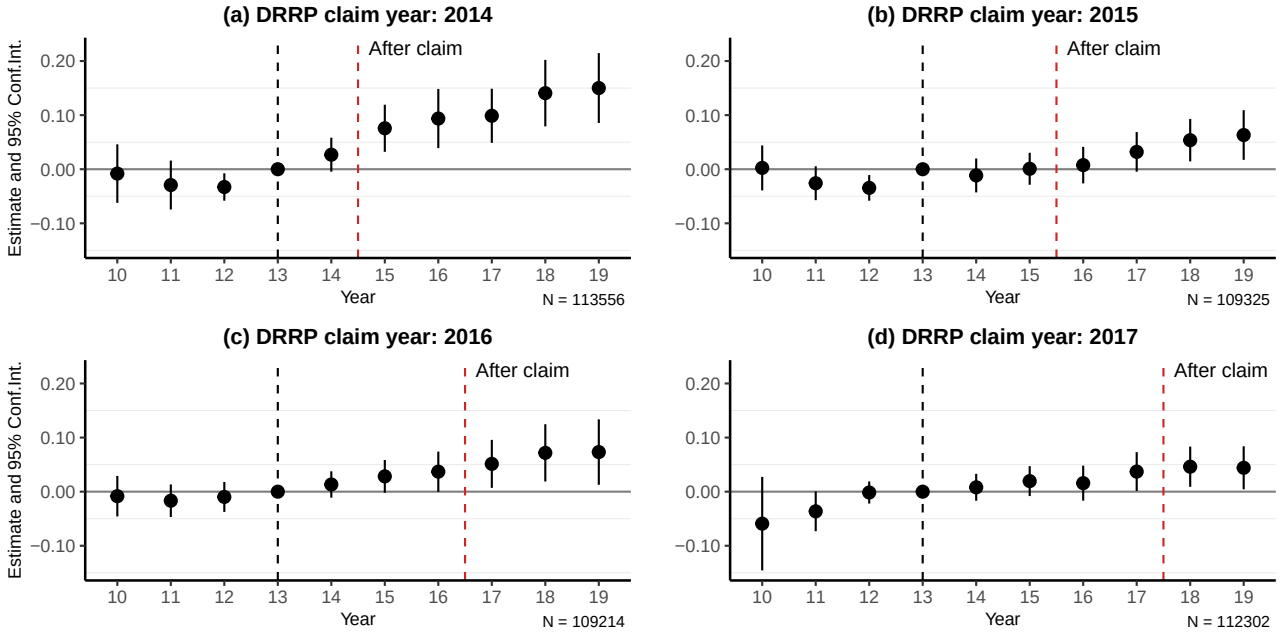
Notes: This figure plots the total DRRP tax expenditure captured in the tax authority's publicly available list of tax incentives users (in yellow) and the total DRRP tax expenditure according to the official reports (in blue) between 2014 and 2022. *Source:* Portuguese tax authority, Relatórios da Despesa Fiscal (2020-2022), and Grupo de Trabalho para o Estudo dos Benefícios Fiscais (2019).

Figure A.2: Liabilities



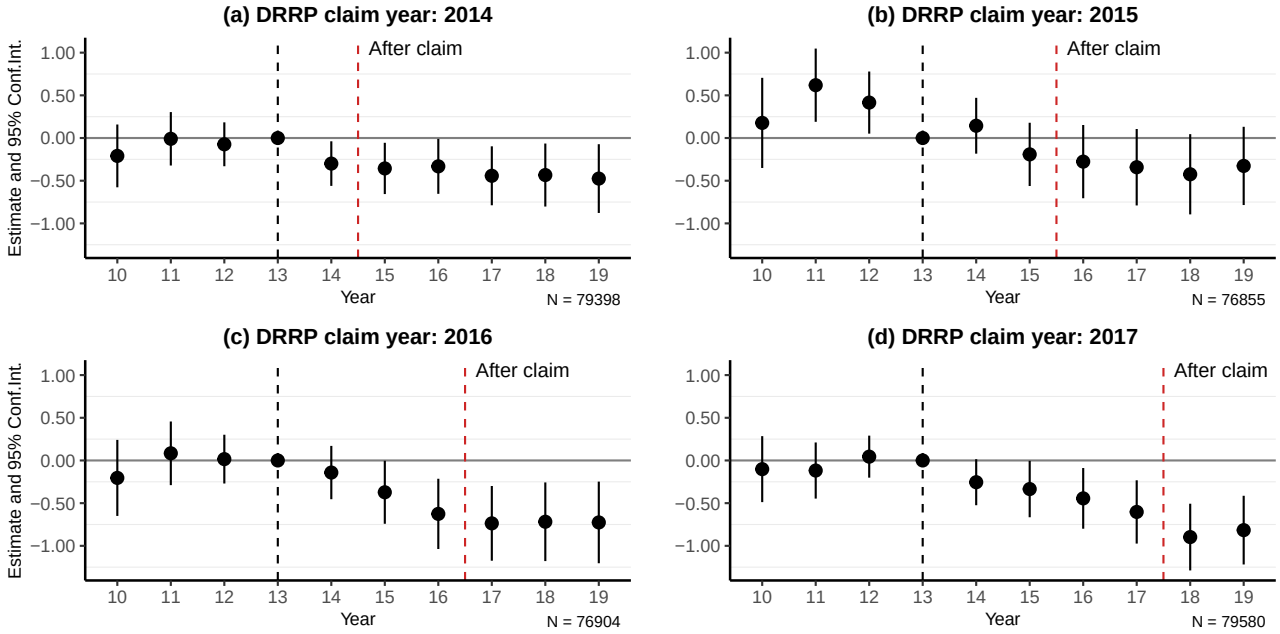
Notes: This figure plots the β_k coefficients estimated with (1). The outcome variable is measured using a logarithmic transformation. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. The black vertical dashed line marks the year before the policy's implementation and the red line separates the claim year from the investment period.

Figure A.3: Total number of establishments



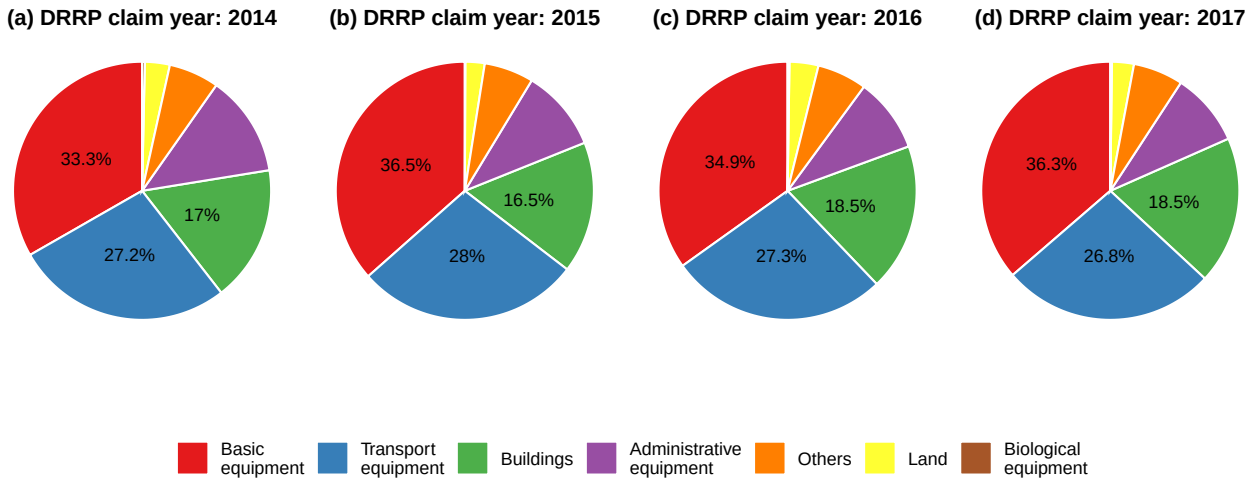
Notes: This figure plots the β_k coefficients estimated with (1). The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. The black vertical dashed line marks the year before the policy's implementation and the red line separates the claim year from the investment period.

Figure A.4: Average worker's age



Notes: This figure plots the β_k coefficients estimated with (1). The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. The black vertical dashed line marks the year before the policy's implementation and the red line separates the claim year from the investment period.

Figure A.5: Composition of investment spending by tangible fixed asset type



Notes: This figure plots the share of total investment spending in tangible fixed assets by asset type for treated firms in the two years following the DRRP claim (i.e., the mandatory investment period after the tax credit claim). Basic equipment includes machinery and tools used for the production of goods or provision of services; administrative equipment covers office supplies, furniture, hardware, and similar; biological equipment comprises livestock and plants.

B Descriptive statistics

Table B.1: Descriptive statistics (2010-2019)

Treated		Mean	Median	SD	P1	P99	Obs.
Reserves	(% EBT)	25.00	0.00	38.00	-54.00	102.00	44,991
Investment rate	(%)	8.00	2.00	14.00	0.00	69.00	43,424
Nr. of establishments		1.33	1.00	1.51	1.00	7.00	42,057
Debt	('000s €)	367.19	83.05	996.42	0.00	4,151.15	37,204
Secured debt	('000s €)	306.27	64.41	844.27	0.00	3,518.27	37,204
Equity financing	('000s €)	155.86	25.00	508.59	0.50	2224.75	45,102
Liabilities	('000s €)	864.69	324.51	1,715.16	13.12	8,557.50	45,102
Liabilities-to-assets	(%)	56.00	58.00	25.00	6.00	115.00	45,102
Employees		15.28	8.00	37.76	1.00	110.00	45,102
Avg. real wages	('000s €)	16.50	15.07	7.13	5.48	41.17	45,102
Share of high-educated	(%)	17.00	0.00	27.00	0.00	1.00	32,521
Share of high-skill	(%)	47.00	50.00	38.00	0.00	1.00	32,521
Share of temporary	(%)	25.00	14.00	30.00	0.00	1.00	32,521
Worker's age		39.15	39.00	6.85	24.00	57.00	32,521
Control		Mean	Median	SD	P1	P99	Obs.
Reserves	(% EBT)	13.00	0.00	34.00	-67.00	100.00	107,834
Investment rate	(%)	5.00	1.00	11.00	0.00	58.00	106,388
Nr. of establishments		1.34	1.00	1.60	1.00	7.00	100,585
Debt	('000s €)	439.40	58.95	1,262.96	0.00	6,527.41	88,642
Secured debt	('000s €)	351.15	41.10	1,037.91	0.00	5,148.07	88,642
Equity financing	('000s €)	270.29	30.00	1428.88	0.32	4237.50	109,046
Liabilities	('000s €)	1,181.44	282.03	2,610.83	7.58	14,241.18	109,046
Liabilities-to-assets	(%)	53.00	54.00	29.00	4.00	127.00	109,046
Employees		16.08	7.00	26.05	1.00	140.00	109,046
Avg. real wages	('000s €)	17.92	15.27	9.86	5.00	55.13	109,046
Share of high-educated	(%)	21.00	0.00	31.00	0.00	100.00	70,054
Share of high-skill	(%)	48.00	50.00	40.00	0.00	100.00	70,054
Share of temporary	(%)	22.00	5.00	29.00	0.00	100.00	70,054
Worker's age		40.01	39.78	7.52	24.00	60.00	70,054

Notes: This table presents the descriptive statistics for firms in the treated and control groups across the full period under analysis (2010-2019). The investment rate refers to the tangible fixed assets investment rate, which is computed as the ratio of investment in tangible fixed assets to total assets in year t-1.

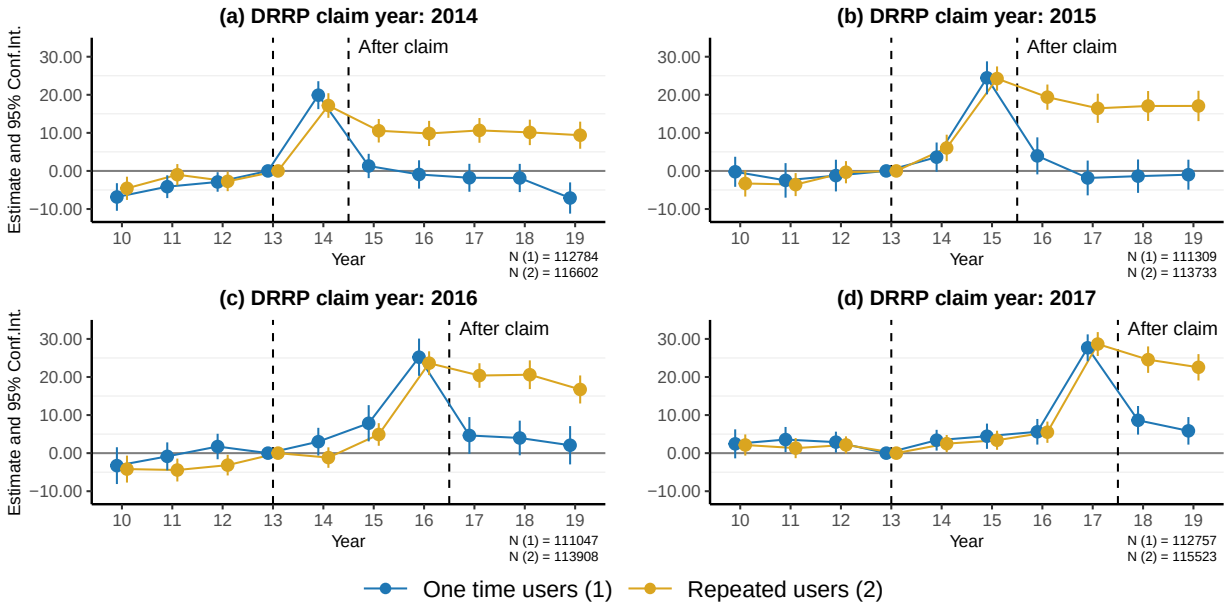
Table B.2: Descriptive statistics: one-time users and repeated users (2010-2019)

One-time users		Mean	Median	SD	P1	P99	Obs.
Reserves	(% EBT)	19.00	0.00	36.00	-56.00	100.00	16,561
Investment rate	(%)	7.00	2.00	13.00	0.00	69.00	15,917
Nr. of establishments		1.25	1.00	1.16	1.00	5.00	15,247
Debt	('000s €)	279.20	57.48	796.38	0.00	3,585.67	13,239
Secured debt	('000s €)	229.29	44.44	654.65	0.00	3,070.76	13,239
Equity financing	('000s €)	128.94	20.00	440.08	0.50	2000.00	16,634
Liabilities	('000s €)	703.00	243.40	1,542.14	10.75	7,871.96	16,634
Liabilities-to-assets	(%)	56.00	57.00	27.00	6.00	122.00	16,634
Employees		12.51	7.00	18.91	1.00	94.00	16,634
Avg. real wages	('000s €)	16.27	14.60	7.56	4.99	43.14	16,634
Share of high-educated	(%)	17.00	0.00	28.00	0.00	100.00	12,314
Share of high-skill	(%)	46.00	43.00	40.00	0.00	100.00	12,314
Share of temporary	(%)	26.00	12.00	31.00	0.00	100.00	12,314
Worker's age		39.62	39.41	7.16	23.50	58.00	12,314
Repeated users		Mean	Median	SD	P1	P99	Obs.
Reserves	(% EBT)	28.00	0.00	39.00	-53.00	107.00	28,430
Investment rate	(%)	8.00	3.00	14.00	0.00	69.00	27,507
Nr. of establishments		1.37	1.00	1.67	1.00	8.00	26,810
Debt	('000s €)	415.80	102.30	1,088.29	0.00	4,459.67	23,965
Secured debt	('000s €)	348.80	78.94	929.92	0.00	3,780.04	23,965
Equity financing	('000s €)	171.59	35.00	544.04	0.50	2400.00	28,468
Liabilities	('000s €)	959.17	379.51	1,801.94	15.28	9,213.33	28,468
Liabilities-to-assets	(%)	56.00	58.00	24.00	7.00	108.00	28,468
Employees		16.90	9.00	45.20	1.00	116.00	28,468
Avg. real wages	('000s €)	16.63	15.32	6.86	5.81	39.98	28,468
Share of high-educated	(%)	16.00	0.00	26.00	0.00	100.00	20,207
Share of high-skill	(%)	48.00	50.00	38.00	0.00	100.00	20,207
Share of temporary	(%)	25.00	17.00	29.00	0.00	100.00	20,207
Worker's age		38.87	38.75	6.64	24.00	56.66	20,207

Notes: This table presents the descriptive statistics across the full period under analysis (2010-2019) for firms in the treated group, splitting between one-time users (i.e., firms claiming the tax credit only once) and repeated users (i.e., firms claiming multiple times). The investment rate refers to the tangible fixed assets investment rate, which is computed as the ratio of investment in tangible fixed assets to total assets in year t-1.

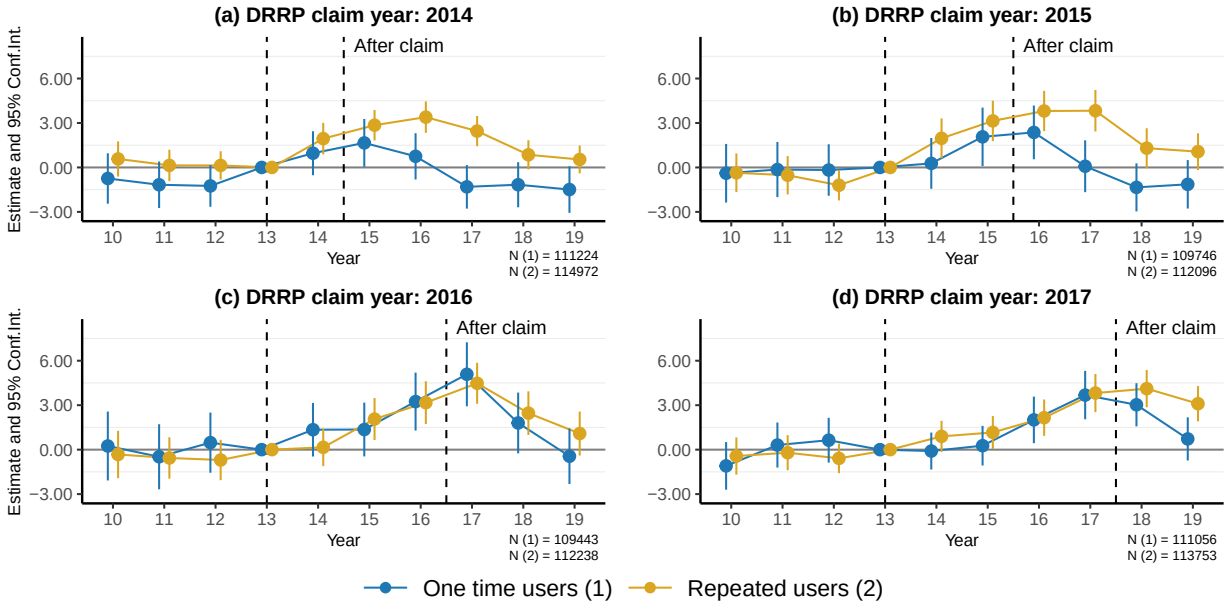
C Heterogeneity

Figure C.1: Reserves (share of pre-tax profits)



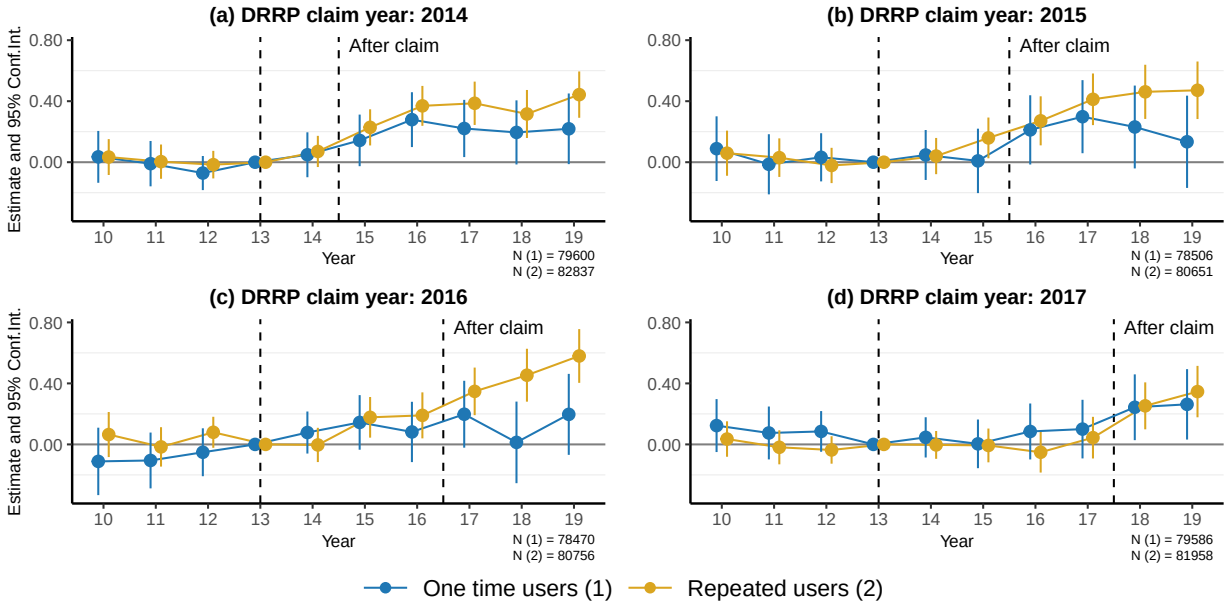
Notes: This figure plots the β_k coefficients estimated with (1). The outcome variable is measured as a percentage. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. Blue dots depict point estimates for one-time users (i.e., firms claiming the tax credit only once) and yellow dots for repeated users (i.e., firms claiming the tax credit multiple times). The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.

Figure C.2: Tangible fixed assets investment rate



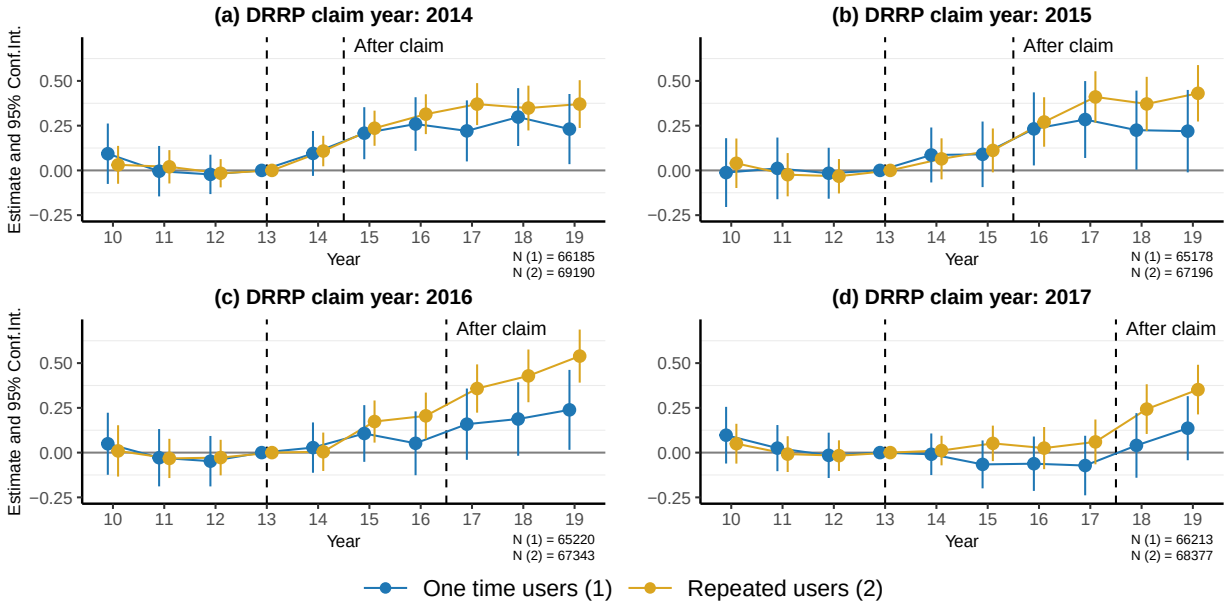
Notes: This figure plots the β_k coefficients estimated with (1). The outcome variable is the percentage ratio of investment in tangible fixed assets to total assets in year t-1. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. Blue dots depict point estimates for one-time users (i.e., firms claiming the tax credit only once) and yellow dots for repeated users (i.e., firms claiming the tax credit multiple times). The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.

Figure C.3: Total debt



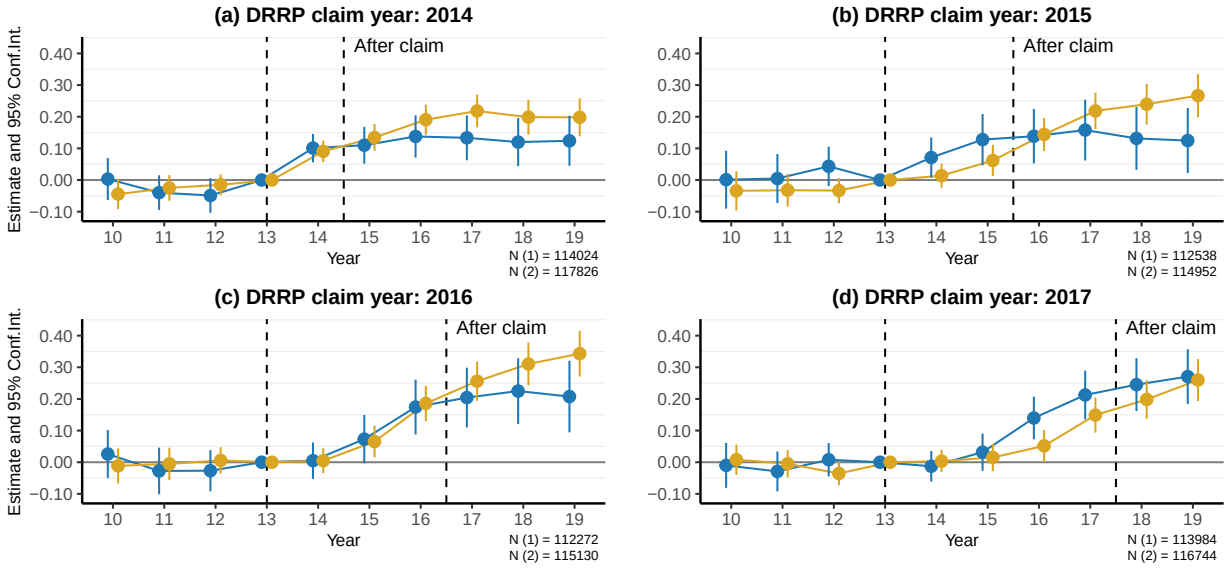
Notes: This figure plots the β_k coefficients estimated with (1). The outcome variable is measured using a logarithmic transformation and represents the total amount of credit in good standing at the end of the year. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. Blue dots depict point estimates for one-time users (i.e., firms claiming the tax credit only once) and yellow dots for repeated users (i.e., firms claiming the tax credit multiple times). The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.

Figure C.4: Secured debt



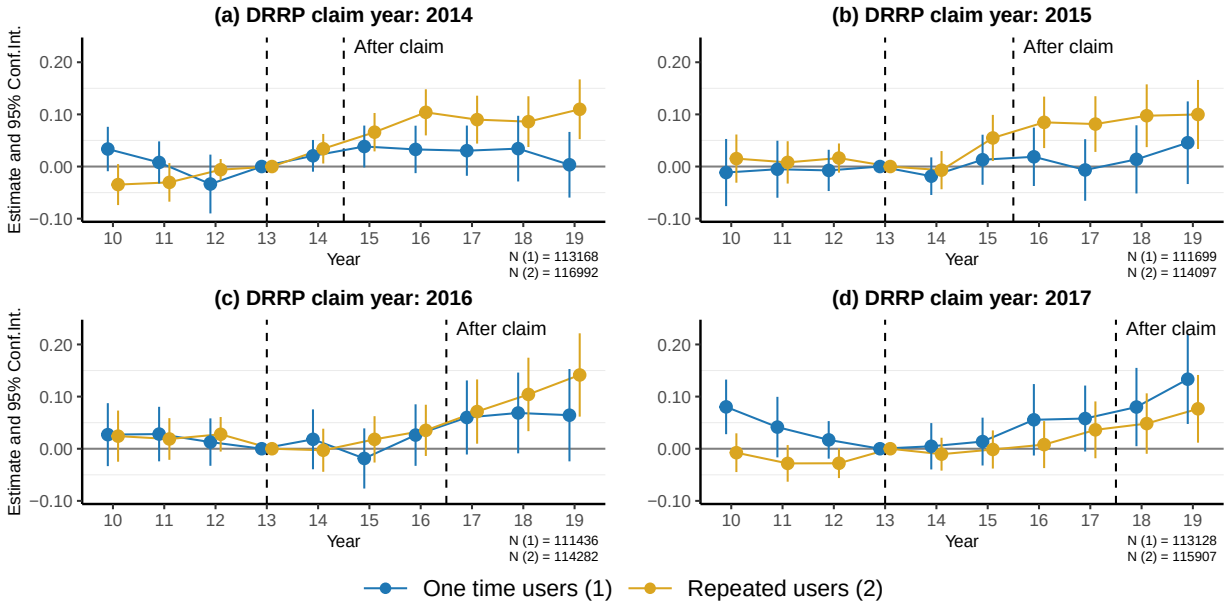
Notes: This figure plots the β_k coefficients estimated with (1). The outcome variable is measured using a logarithmic transformation and represents the total amount of credit in good standing that is backed-up by collateral. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. Blue dots depict point estimates for one-time users (i.e., firms claiming the tax credit only once) and yellow dots for repeated users (i.e., firms claiming the tax credit multiple times). The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.

Figure C.5: Total liabilities



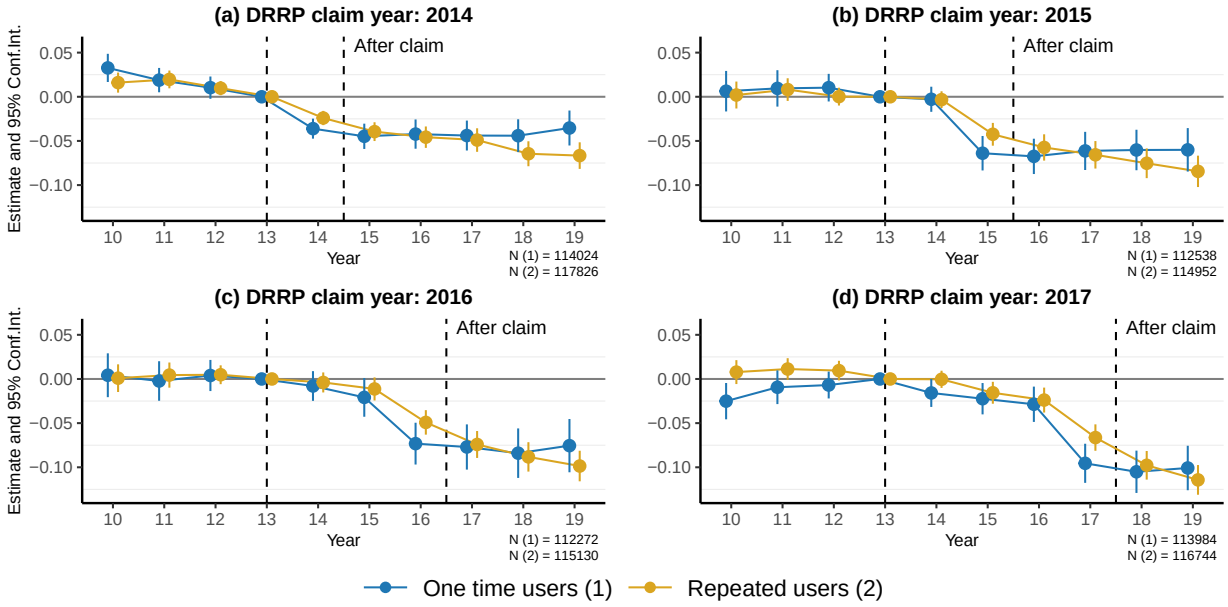
Notes: This figure plots the β_k coefficients estimated with (1). The outcome variable is measured using a logarithmic transformation. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. Blue dots depict point estimates for one-time users (i.e., firms claiming the tax credit only once) and yellow dots for repeated users (i.e., firms claiming the tax credit multiple times). The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.

Figure C.6: Equity financing



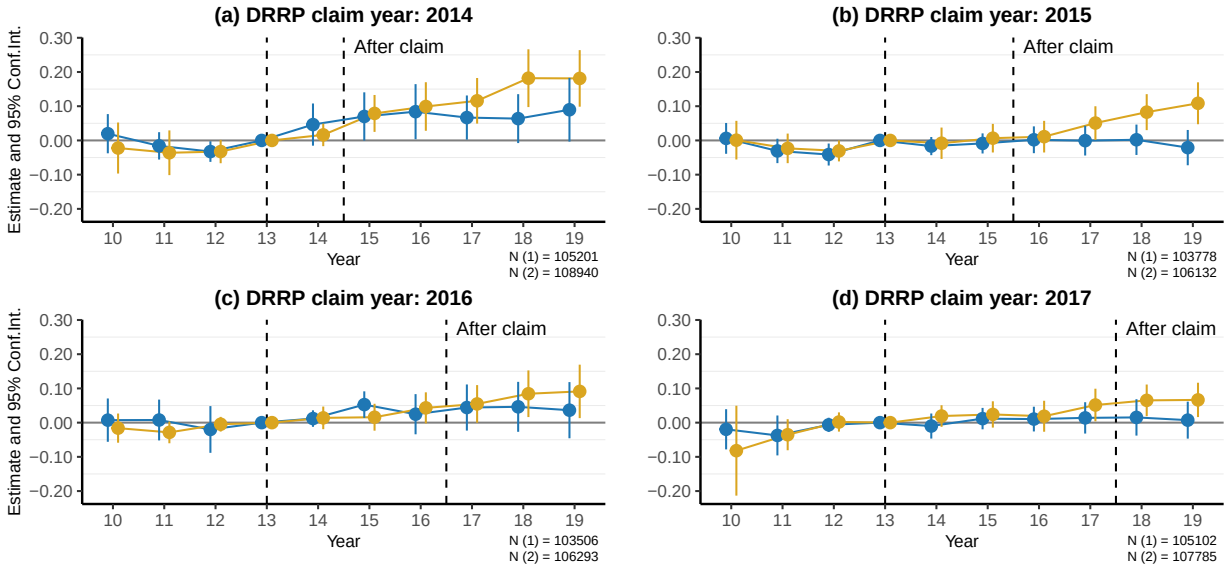
Notes: This figure plots the β_k coefficients estimated with (1). The outcome variable is measured using a logarithmic transformation. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. Blue dots depict point estimates for one-time users (i.e., firms claiming the tax credit only once) and yellow dots for repeated users (i.e., firms claiming the tax credit multiple times). The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.

Figure C.7: Liabilities-to-assets



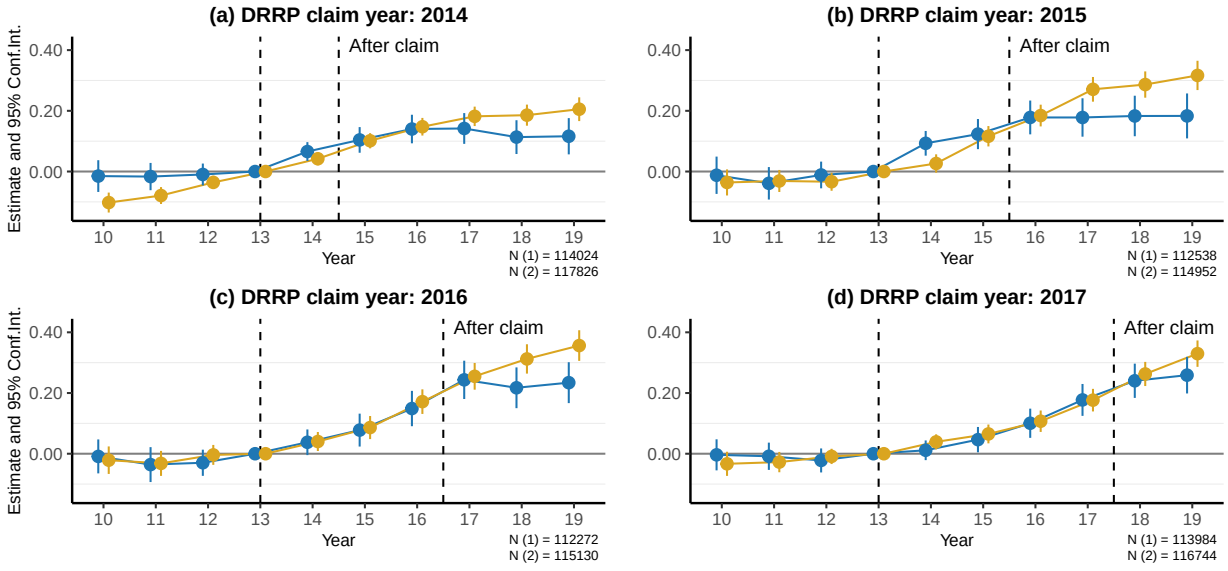
Notes: This figure plots the β_k coefficients estimated with (1). The outcome variable is calculated as total liabilities over total assets. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. Blue dots depict point estimates for one-time users (i.e., firms claiming the tax credit only once) and yellow dots for repeated users (i.e., firms claiming the tax credit multiple times). The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.

Figure C.8: Number of establishments



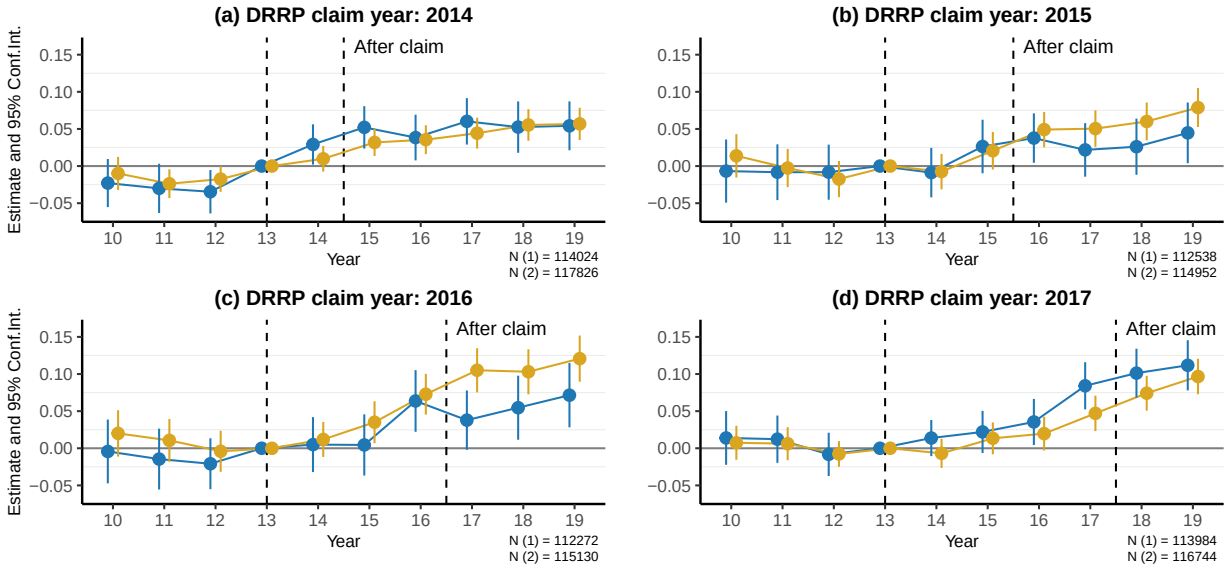
Notes: This figure plots the β_k coefficients estimated with (1). The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. Blue dots depict point estimates for one-time users (i.e., firms claiming the tax credit only once) and yellow dots for repeated users (i.e., firms claiming the tax credit multiple times). The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.

Figure C.9: Number of employees



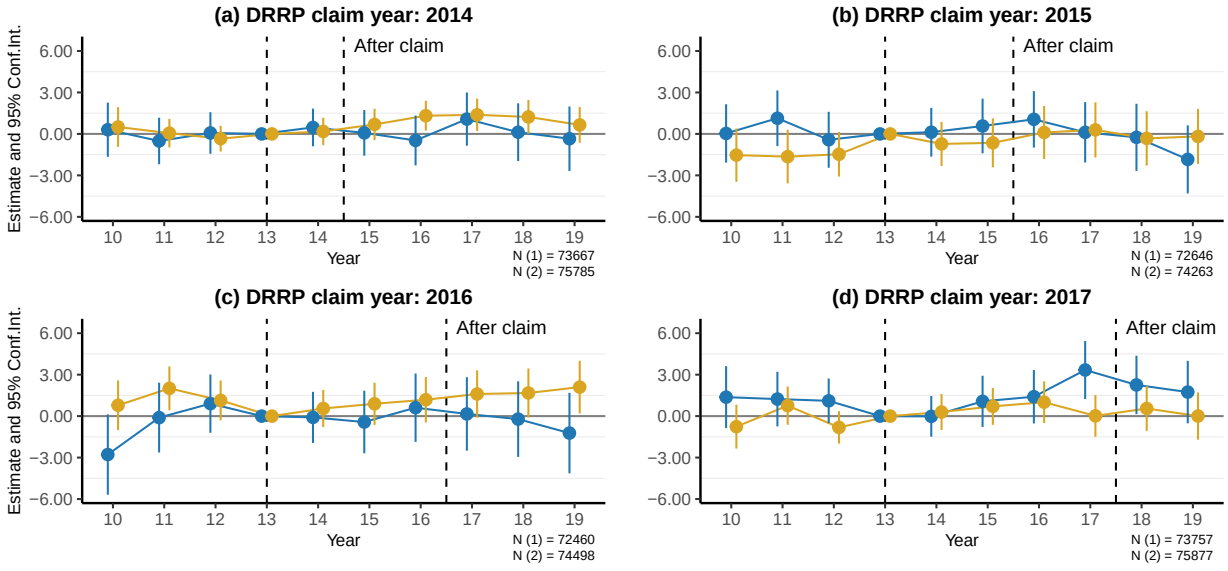
Notes: This figure plots the β_k coefficients estimated with (1). The outcome variable is measured using a logarithmic transformation. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. Blue dots depict point estimates for one-time users (i.e., firms claiming the tax credit only once) and yellow dots for repeated users (i.e., firms claiming the tax credit multiple times). The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.

Figure C.10: Average real wages



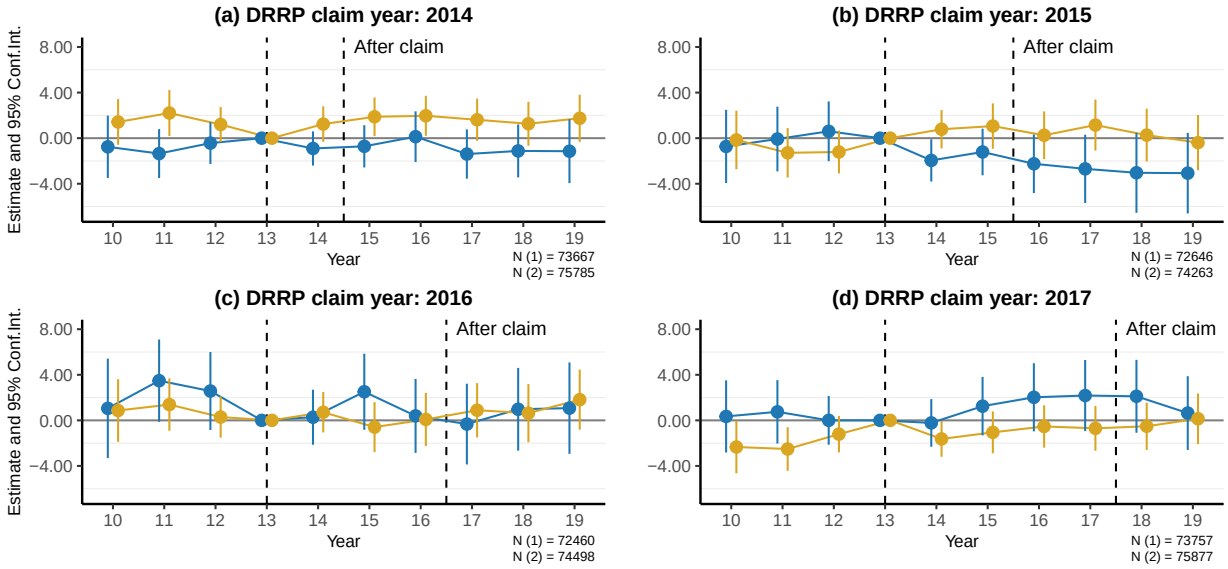
Notes: This figure plots the β_k coefficients estimated with (1). The outcome variable is measured using a logarithmic transformation. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. Blue dots depict point estimates for one-time users (i.e., firms claiming the tax credit only once) and yellow dots for repeated users (i.e., firms claiming the tax credit multiple times). The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.

Figure C.11: Share of high-educated workers



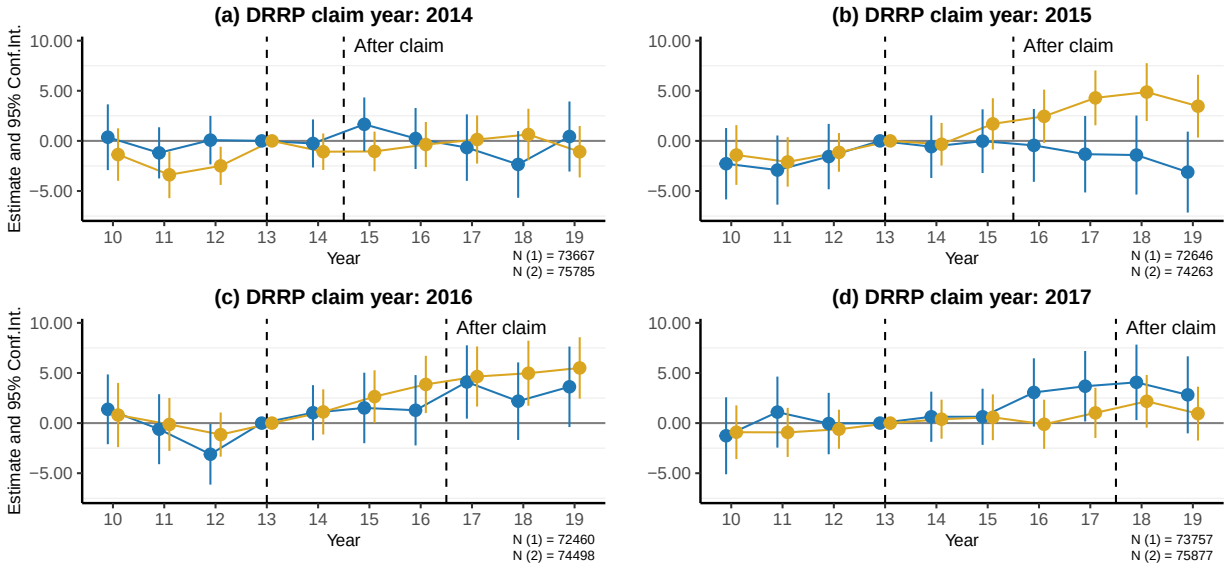
Notes: This figure plots the β_k coefficients estimated with (1). The outcome variable is measured as a percentage. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. Blue dots depict point estimates for one-time users (i.e., firms claiming the tax credit only once) and yellow dots for repeated users (i.e., firms claiming the tax credit multiple times). The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.

Figure C.12: Share of high-skill workers



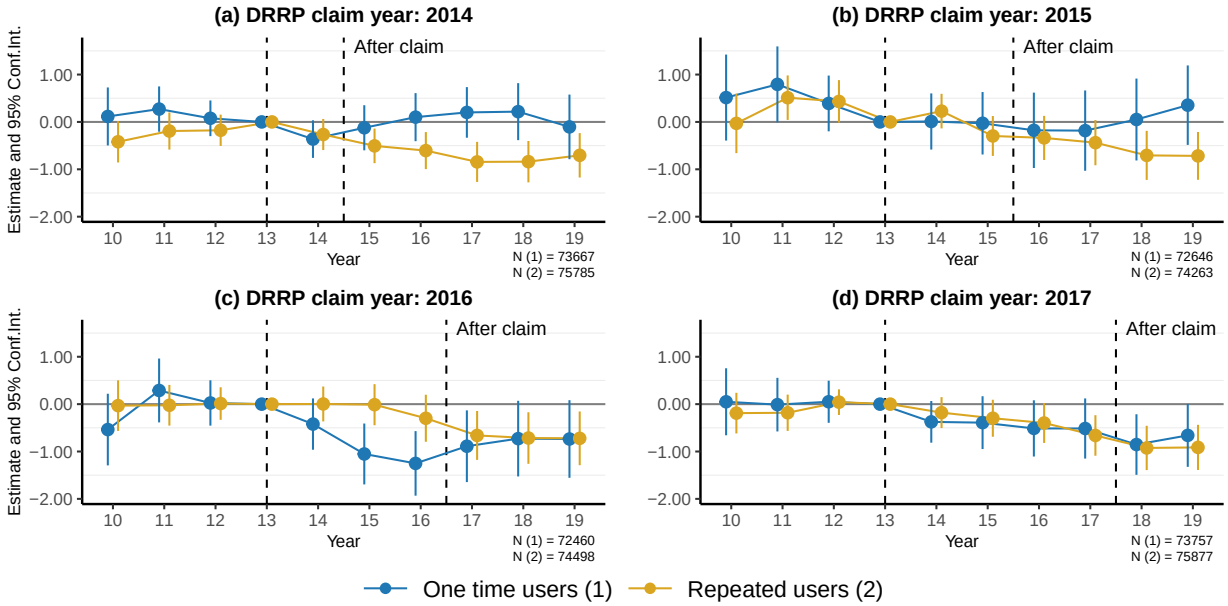
Notes: This figure plots the β_k coefficients estimated with (1). The outcome variable is measured as a percentage. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. Blue dots depict point estimates for one-time users (i.e., firms claiming the tax credit only once) and yellow dots for repeated users (i.e., firms claiming the tax credit multiple times). The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.

Figure C.13: Share of temporary workers



Notes: This figure plots the β_k coefficients estimated with (1). The outcome variable is measured as a percentage. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. Blue dots depict point estimates for one-time users (i.e., firms claiming the tax credit only once) and yellow dots for repeated users (i.e., firms claiming the tax credit multiple times). The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.

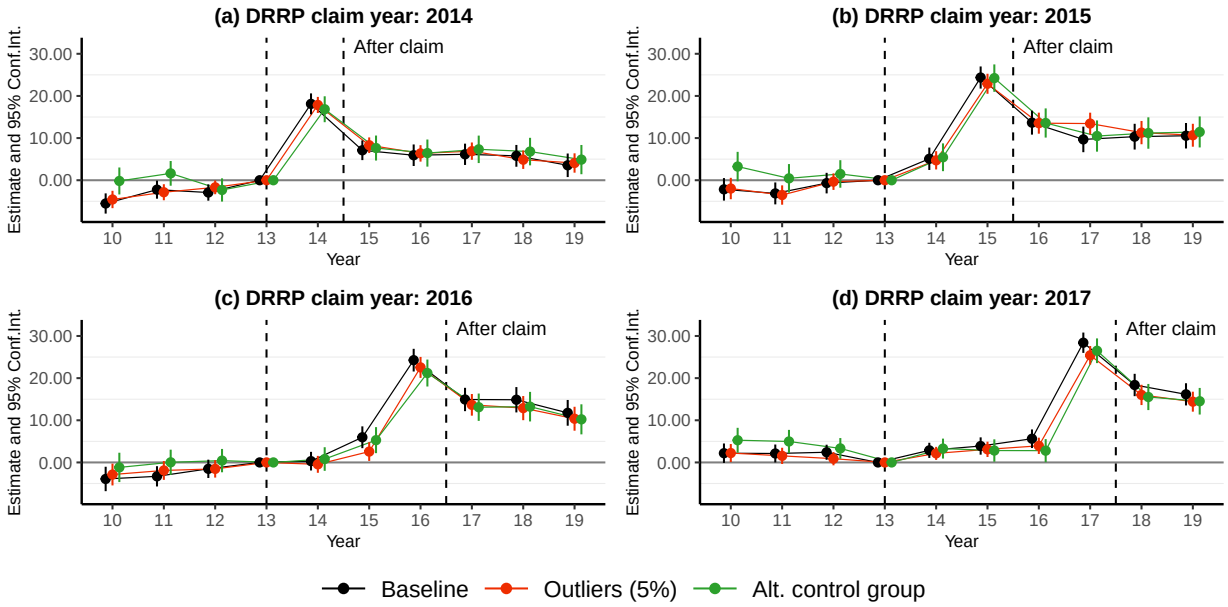
Figure C.14: Average worker's age



Notes: This figure plots the β_k coefficients estimated with (1). The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. Blue dots depict point estimates for one-time users (i.e., firms claiming the tax credit only once) and yellow dots for repeated users (i.e., firms claiming the tax credit multiple times). The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.

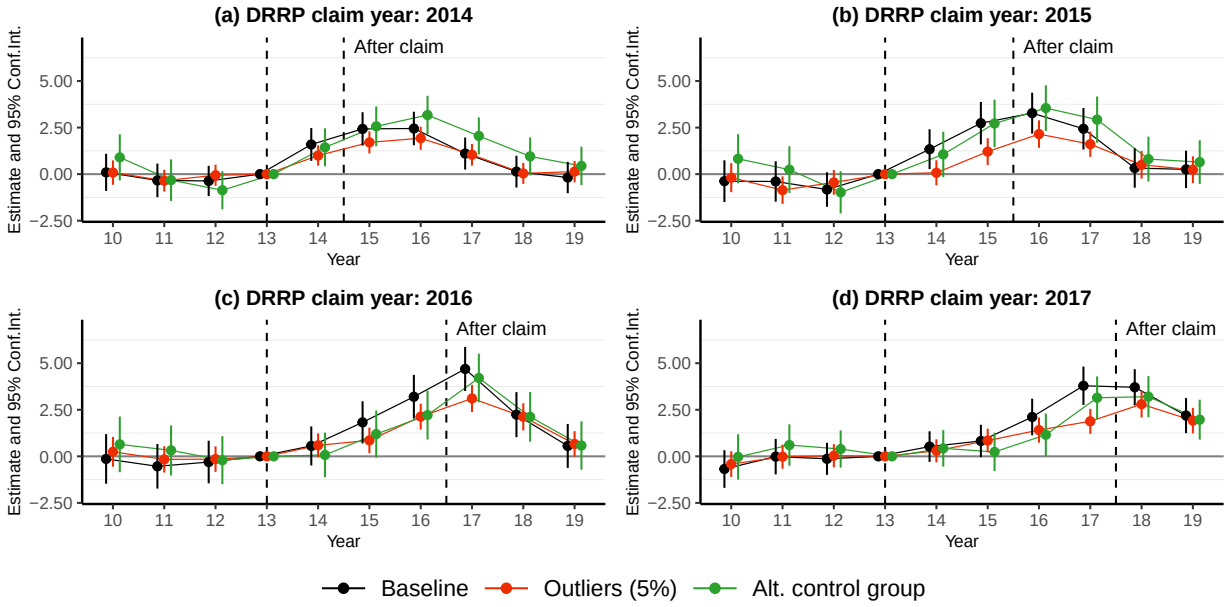
D Sensitivity checks

Figure D.1: Reserves (share of pre-tax profits)



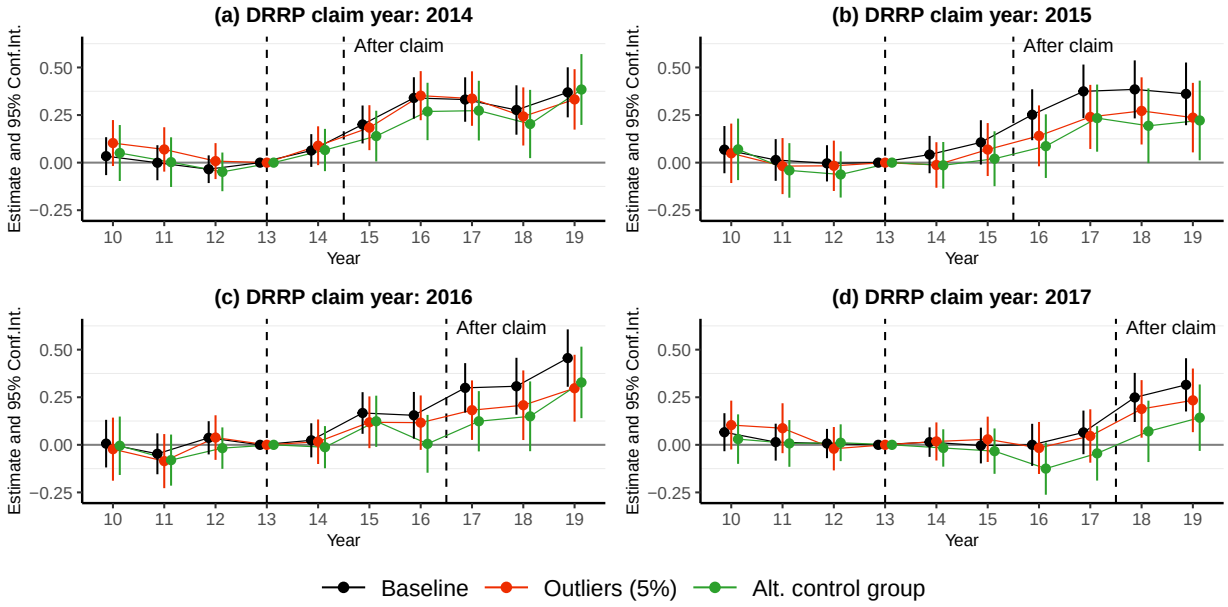
Notes: This figure plots the β_k coefficients estimated with (1), according to the sensitivity checks detailed in Section 6.2. The outcome variable is measured as a percentage. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.

Figure D.2: Tangible fixed assets investment rate



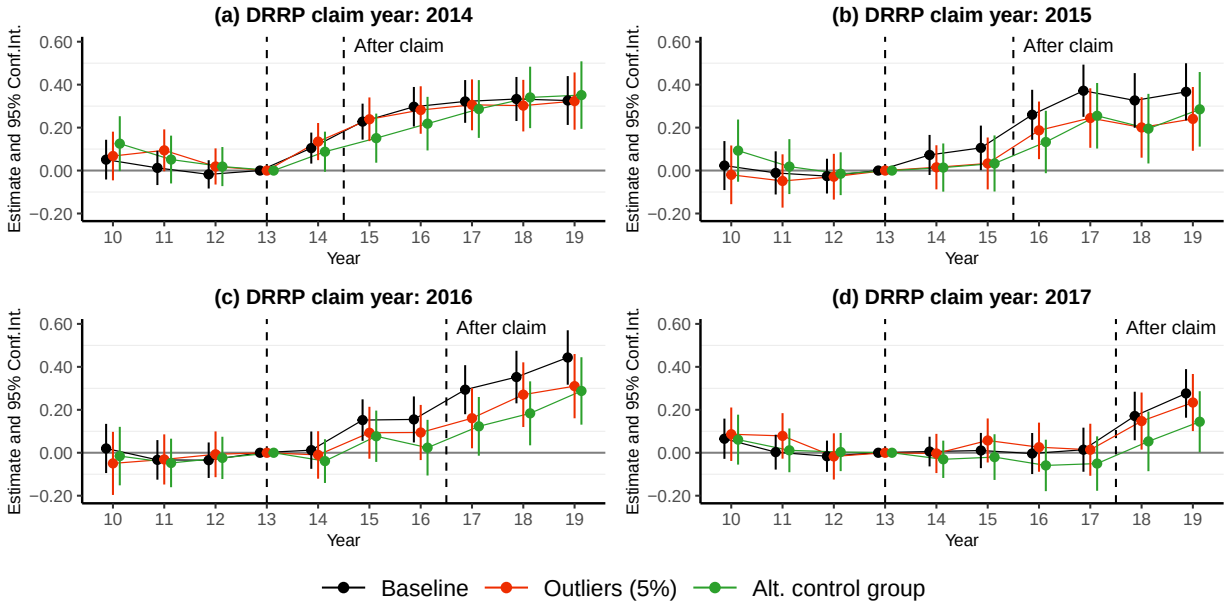
Notes: This figure plots the β_k coefficients estimated with (1), according to the sensitivity checks detailed in Section 6.2. The outcome variable is the percentage ratio of investment in tangible fixed assets to total assets in year t-1. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.

Figure D.3: Total debt



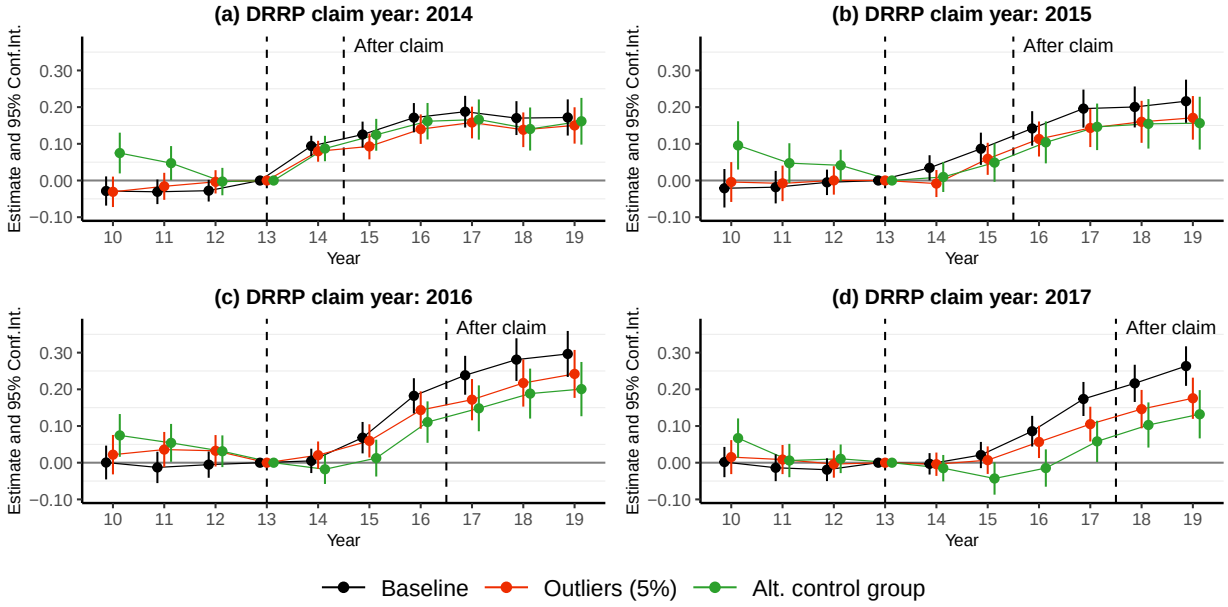
Notes: This figure plots the β_k coefficients estimated with (1), according to the sensitivity checks detailed in Section 6.2. The outcome variable is measured using a logarithmic transformation and represents the total amount of credit in good standing at the end of the year. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.

Figure D.4: Secured debt



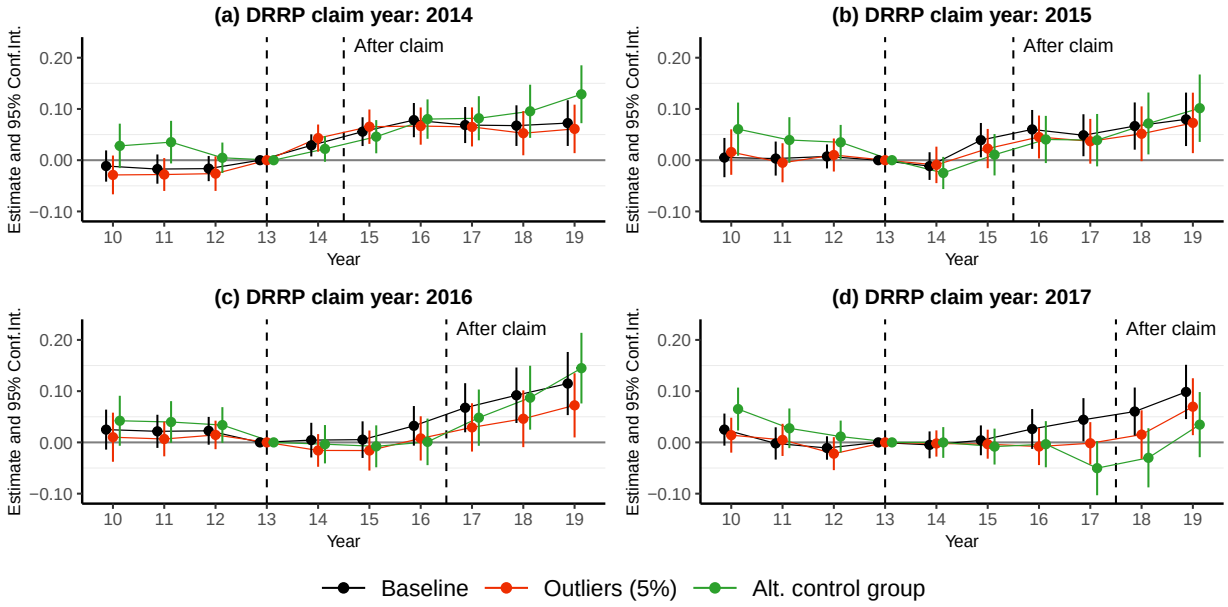
Notes: This figure plots the β_k coefficients estimated with (1), according to the sensitivity checks detailed in Section 6.2. The outcome variable is measured using a logarithmic transformation and represents the total amount of credit in good standing that is backed-up by collateral. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.

Figure D.5: Total liabilities



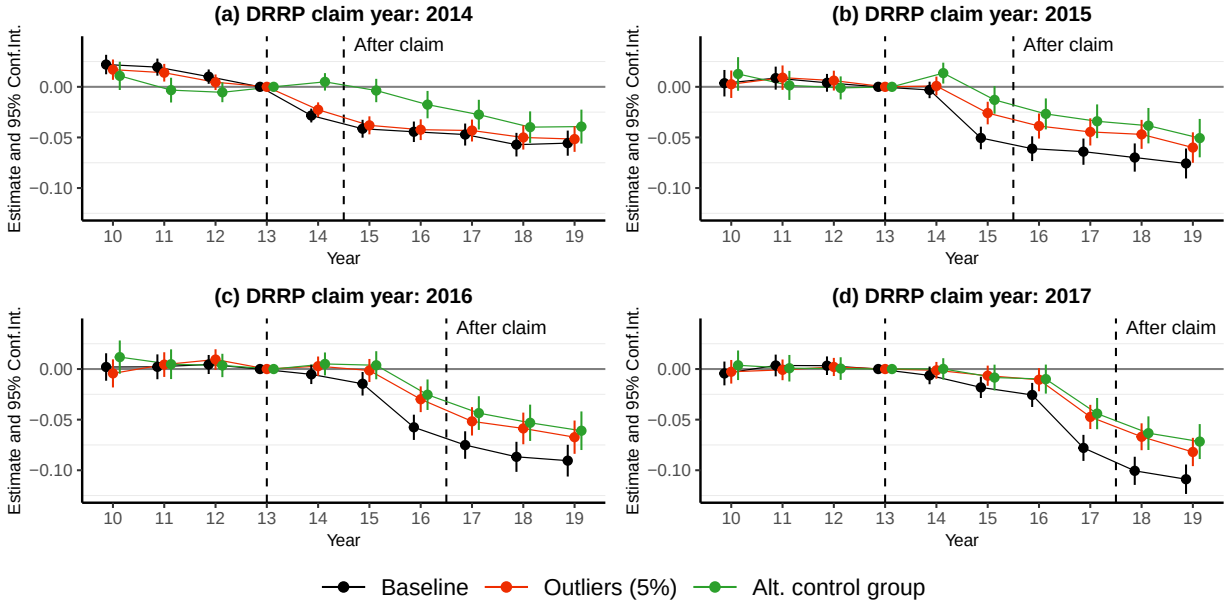
Notes: This figure plots the β_k coefficients estimated with (1), according to the sensitivity checks detailed in Section 6.2. The outcome variable is measured using a logarithmic transformation. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.

Figure D.6: Equity financing



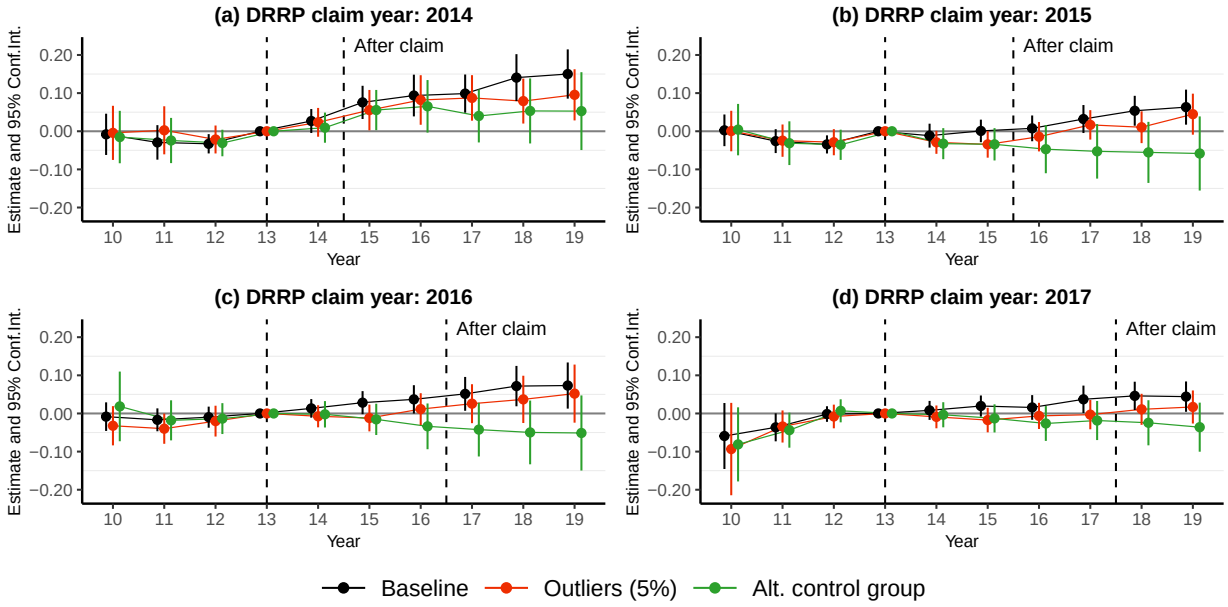
Notes: This figure plots the β_k coefficients estimated with (1), according to the sensitivity checks detailed in Section 6.2. The outcome variable is measured using a logarithmic transformation. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.

Figure D.7: Liabilities-to-assets



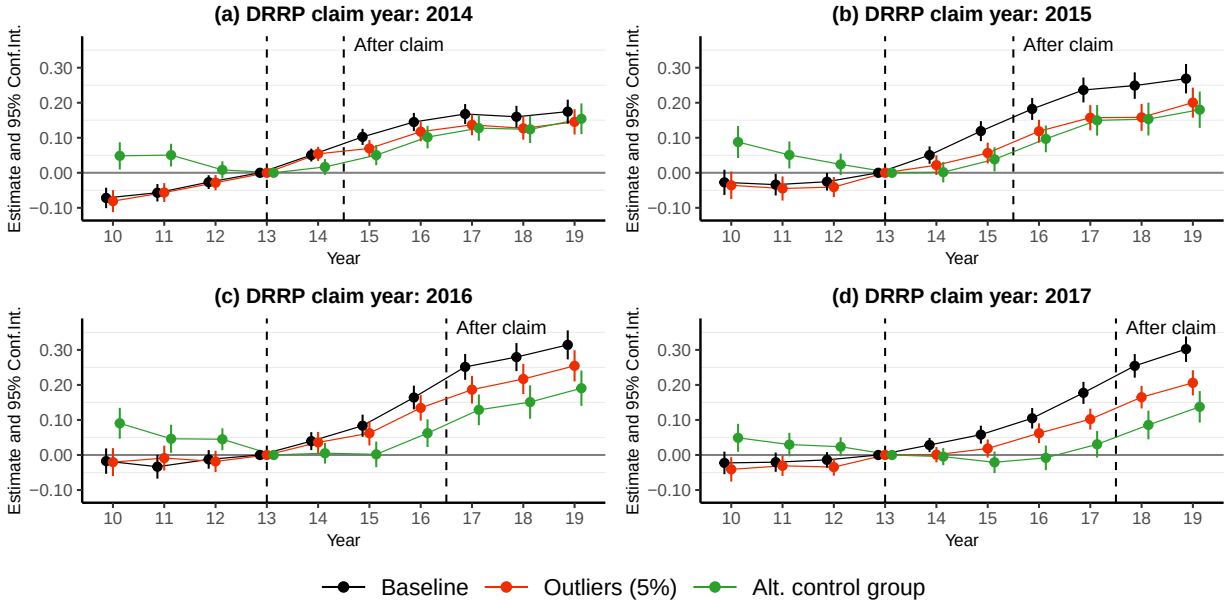
Notes: This figure plots the β_k coefficients estimated with (1), according to the sensitivity checks detailed in Section 6.2. The outcome variable is calculated as total liabilities over total assets. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.

Figure D.8: Number of establishments



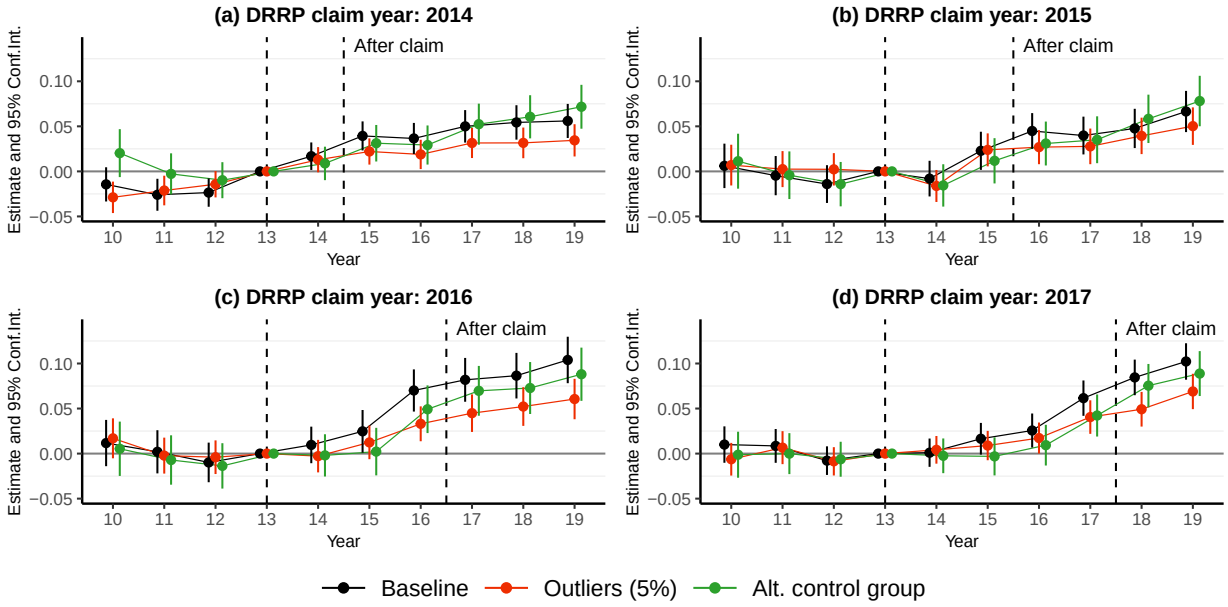
Notes: This figure plots the β_k coefficients estimated with (1), according to the sensitivity checks detailed in Section 6.2. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.

Figure D.9: Number of employees



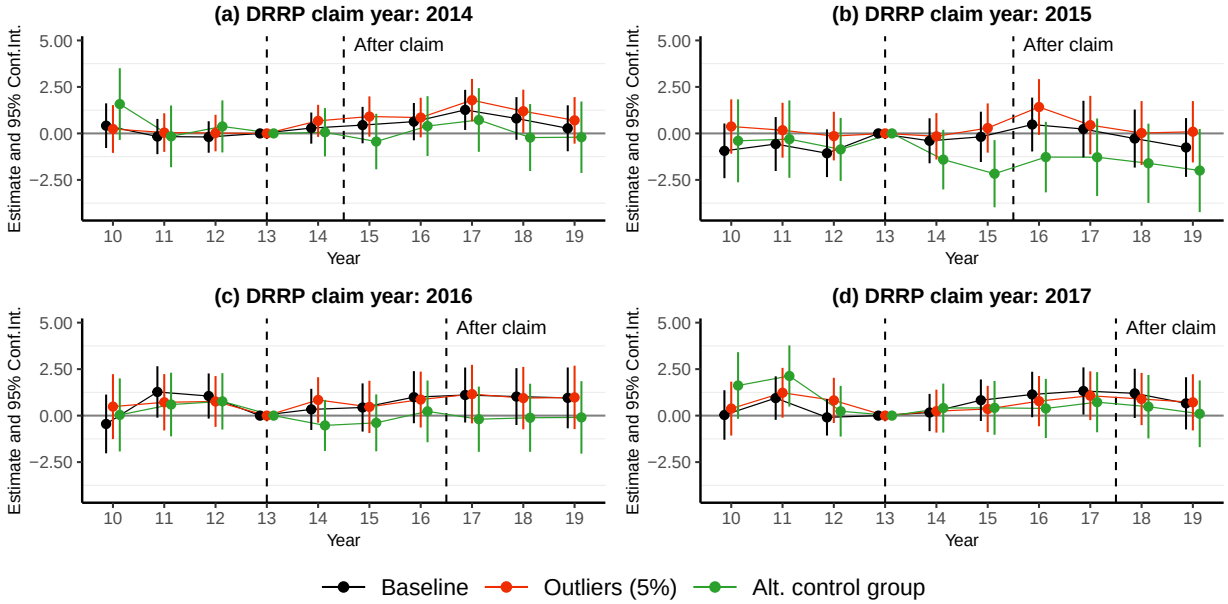
Notes: This figure plots the β_k coefficients estimated with (1), according to the sensitivity checks detailed in Section 6.2. The outcome variable is measured using a logarithmic transformation. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.

Figure D.10: Average real wages



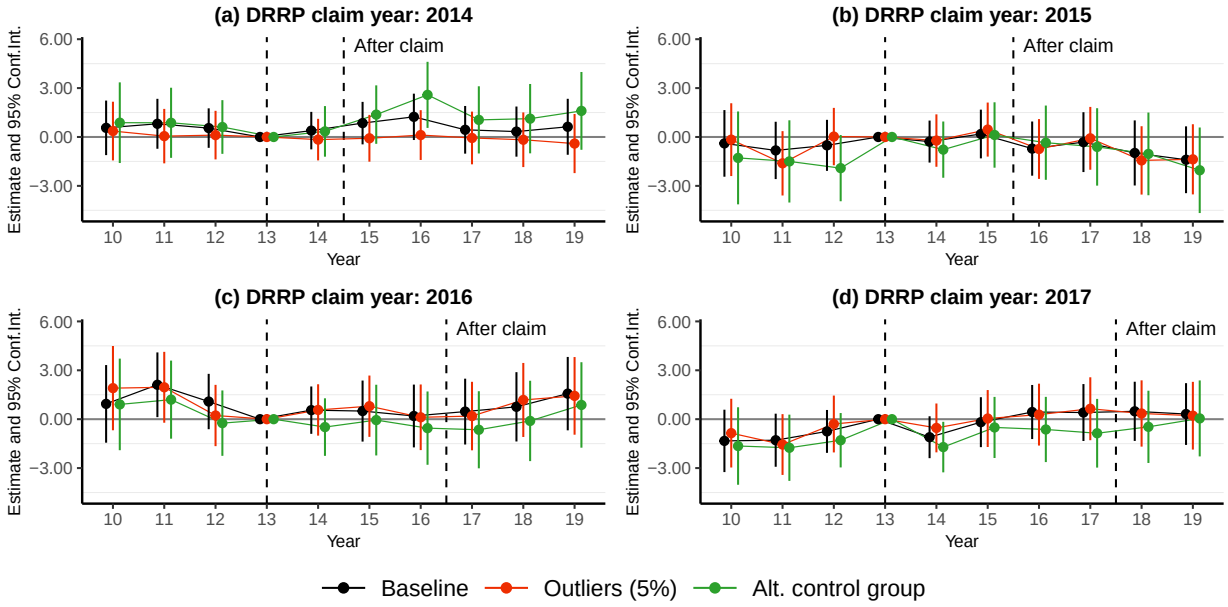
Notes: This figure plots the β_k coefficients estimated with (1), according to the sensitivity checks detailed in Section 6.2. The outcome variable is measured using a logarithmic transformation. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.

Figure D.11: Share of high-educated workers



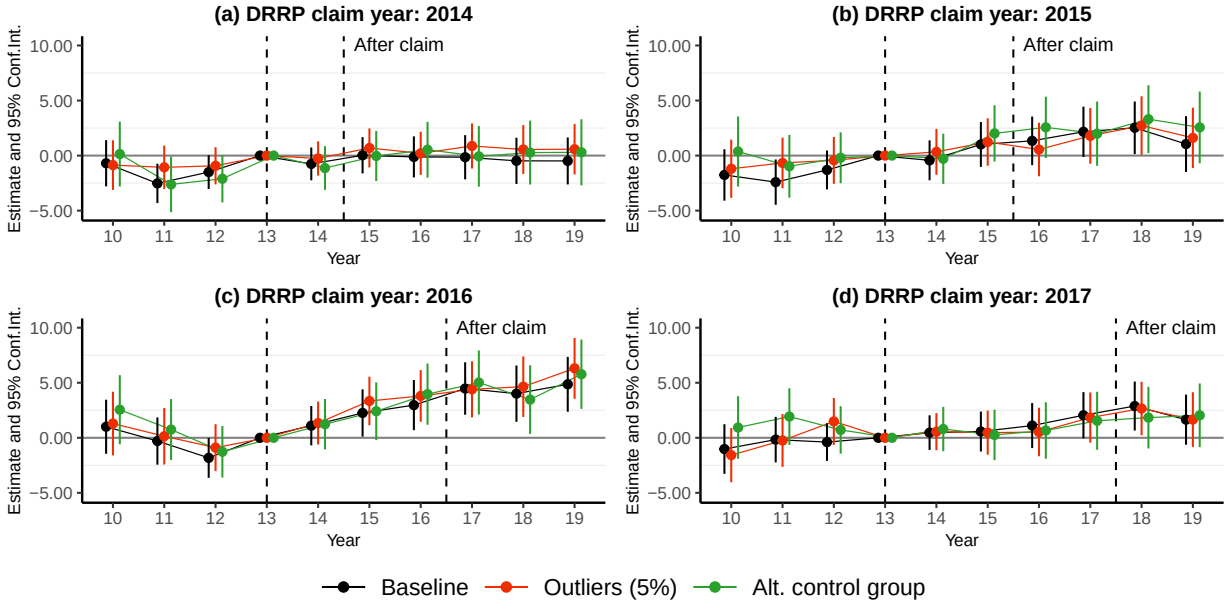
Notes: This figure plots the β_k coefficients estimated with (1), according to the sensitivity checks detailed in Section 6.2. The outcome variable is measured as a percentage. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.

Figure D.12: Share of high-skill workers



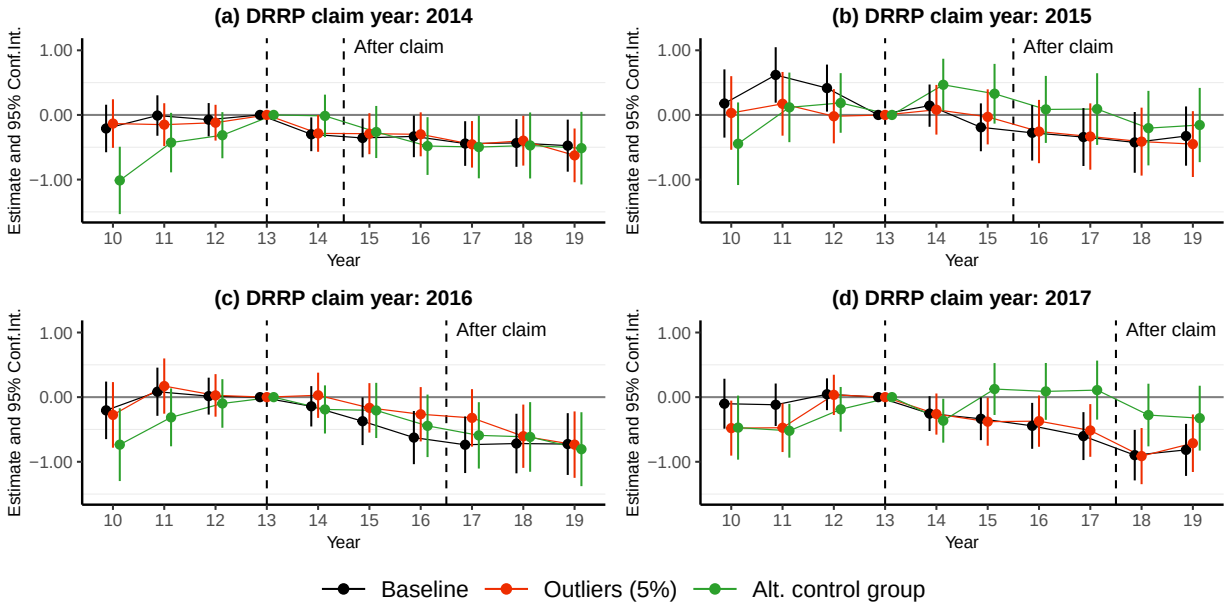
Notes: This figure plots the β_k coefficients estimated with (1), according to the sensitivity checks detailed in Section 6.2. The outcome variable is measured as a percentage. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.

Figure D.13: Share of temporary workers



Notes: This figure plots the β_k coefficients estimated with (1), according to the sensitivity checks detailed in Section 6.2. The outcome variable is measured as a percentage. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.

Figure D.14: Average worker's age



Notes: This figure plots the β_k coefficients estimated with (1), according to the sensitivity checks detailed in Section 6.2. The 95% confidence intervals are calculated using standard errors clustered at the firm level. Each panel displays the treatment effects according to the first year treated firms claim the tax credit. The first vertical dashed line marks the year before the policy's implementation and the second line separates the claim year from the investment period.