Sailing through troubled waters: Evidence from support discontinuities to firms in times of crisis*

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Abstract

We estimate the causal effect of APOIAR, a targeted COVID-19 support initiative, on firm survival and performance. Using sharp and fuzzy regression discontinuity designs and three administrative datasets, we find that eligible firms experienced a short-term profitability increase in 2021, with €1 of support raising net income by €0.658. These effects did not persist into 2022, and we observe no significant changes in turnover or cost reduction, suggesting the profitability gains were mechanically driven by the subsidy. The funds were particularly used by ex-ante less productive, more indebted firms with limited liquidity.

JEL codes: H25, H32, D22, L20.

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1 Introduction

The COVID-19 pandemic triggered an unprecedented economic shock, prompting governments around the world to implement immediate policies to shield workers and firms. In responding to the crisis, policymakers faced a central dilemma: Should support prioritize workers directly or focus on preserving the (match with) firms that employ them? The United States and Europe pursued markedly different approaches (Giupponi et al., 2022). While in the U.S., the focus was on increasing the scope and generosity of unemployment insurance, European nations invested in the preservation of worker-firm matches through short-time work schemes to reduce job separations and the loss of firm-specific human capital (Cahuc, 2024).

Although these measures stabilized employment and mitigated mass layoffs (Chetty et al., 2024), they were highly heterogeneous in sectors (Bloom et al., 2023; Archanskaia et al., 2023) and often failed to address the distinct challenges facing small businesses and entrepreneurs (Bartik et al., 2020a; Humphries et al., 2020; Alekseev et al., 2023; Fairlie et al., 2023). Small firms are typically owned by a few individuals whose standards of living are often closely related to their businesses (Kim et al., 2025). Many of these owners (and their families) are not paid formal salaries, and thus remained excluded from labor-centric programs, despite grappling with fixed costs such as rents and utilities. To bridge this gap, several countries introduced complementary firm-focused policies that provided non-repayable financial support to businesses to minimize the destruction of productive capacity and employment – but were they really effective?[1] The answer may well depend on whether the design of these programs trades off between timeliness, targeting, and economic incidence (Autor et al., 2022a).

In this paper, we identify the causal effects of a targeted instrument put forward by the Portuguese government to support firms in sectors particularly hit by the confinement measures, the APOIAR Program.[2] This consisted of a generous €1.2 billion non-repayable cash-flow grant to firms that experienced revenue losses equal to or higher than 25% with respect to their pre-pandemic levels. The median support for micro and small firm was €12,500 and €68,750, respectively. Importantly, this eligibility threshold did not overlap with access to other support programs that were executed before or after. This feature allows us to implement a Regression Discontinuity Design (RDD) to assess differences around the APOIAR threshold. We use both sharp and fuzzy approaches to estimate intention-to-treat (ITT) and treatment-on-the treated (ToT) parameters of interest (Cattaneo and Titiunik, 2022). Moreover, we provide evidence that firms were unable to manipulate the threshold to secure access since they had already reported their sales to the Tax Authority before the announcement of the program. We also show that other determinants of firm performance were continuous around the threshold.

We combine data from three administrative databases that cover the universe of Portuguese

[1] In the context of economic recovery measures, countries like Germany and Italy implemented initiatives involving direct grants to small and medium-sized enterprises (SMEs) and self-employed individuals.

[2] As a small open economy that is highly dependent on tourism and was therefore highly affected by the pandemic, with debt to GDP levels above 100%, Portugal provides an interesting setting to study these issues.

private firms. First, we rely on invoice data on monthly sales (the *E-Fatura Emitentes* database), as reported to the Tax Authority and made available by Statistics Portugal specifically to this project, to estimate the running variable, i.e., revenue losses between 2019 and 2020. We link this information with the list of Approved Projects of the APOIAR Program, which provides a list of beneficiary firms and the amount of support in euros. Finally, we test the causal effect of the APOIAR on a series of firm survival, performance, and labor market outcomes using detailed balance sheet and profit and loss statement data (the *Sistema de Contas Integradas das Empresas* database). We focus on micro and small firms to avoid anticipation effects.

The main findings can be summarized as follows. First, we establish a significant jump in the probability of being treated for firms with more than 25% drop in sales when comparing them with firms slightly above this cutoff. We discuss the fact that, although the APOIAR was conducted through a simple on-line application process, not all eligible firms applied.

Second, we do not find effects on the probability of bankruptcy for firms that received support in 2021 and 2022. At least in the short-run, and considering firms close to the RDD threshold, the program has not succeeded in boosting survival – despite this being the main policy justification for its implementation.

Third, we find that eligible firms experienced a short-term increase in net income in 2021 of, on average, more than €3,500 for treated firms. Per €1,000 of support, €658 were not spent at the end of the year and were then translated into higher reported profits. However, these effects did not persist until 2022. Furthermore, they do not appear to be driven by revenue growth or cost reduction, suggesting that the increase in profitability was mainly due to the subsidy itself and did not contribute to structural changes in the firm. Our results show that firms allocated part of the support for rental payments and to invest in the supply of office services, including modest purchases in digitization services. We do not find any significant effects of the policy on labor market outcomes.

Lastly, we show that our average results hide substantial heterogeneity with respect to pre-pandemic conditions at the firm level. While ex-ante less productive, with less cash-on-hand, and more indebted firms spent the full amount of the APOIAR grant, the observed effects on net income are concentrated on "stronger" firms.

These results are important for policy. The idea that recessions can have cleansing effects by encouraging resources to be reallocated to higher productivity firms is old in economics (Schumpeter, 1939), but it is also known that even firms with good fundamentals can fail in crises such as the one caused by the pandemic. One concern with government policies in times of crisis is that they could fund lower-productivity zombie firms and thus offset reallocation gains (Acharya et al., 2022; Elenev et al., 2022; Hoshi et al., 2023; Merikül and Paulus, 2024). Using firm-level data on small and medium sized (SMEs) enterprises in 11 European countries, Gourinchas et al. (2025) find that cash grants and pandemic loans save many "viable" SMEs and also save some "weaker" firms. However, the high cost of these policies is due to the vast majority of funds disbursed being channeled to "stronger" firms that do not need support. Our findings are consistent with these conclusions.

Our paper contributes to several strands of the literature. First, our paper complements an extensive literature studying the effects of the paycheck protection program (PPP) in the U.S., a loan forgivable on the condition that recipient firms maintained employment and wages at close to pre-crisis levels in the two to six months following the receipt (Humphries et al., 2020; Li and Strahan, 2021; Autor et al., 2022b,a; Chodorow-Reich et al., 2022; Granja et al., 2022; Duchin et al., 2022; Agarwal et al., 2024; Bartik et al., 2020b). The PPP, as Autor et al. (2022a) pointed out, was essentially untargeted in 2020, with 93% of small businesses ultimately receiving one or more loans. Another institutional difference from APOIAR was that the PPP loans were guaranteed by the federal government but administered by banks, allowing for pre-existing connections between businesses and these private financial intermediaries to influence which firms would benefit from the program (Bartik et al., 2020b). These characteristics yield causal estimations challenging. To deal with these concerns, this literature has employed a range of strategies: some papers instrument eligibility based on firm size (since only firms with fewer than 500 employees were generally eligible), others rely on arguably exogenous short-term differences between regions and firms in the timing of first-draw loans, and others using the fact that individual banks varied in their approval rates. Our results are qualitatively similar to those of Granja et al. (2022), who concluded that the employment effects of the program were small compared to its size and that many firms used the loans/ grants to make non-payroll fixed payments and build savings buffers, which can account for small employment effects and likely reflect precautionary motives in the face of uncertainty.

Evidence from other regions is more limited. Konings et al. (2023) evaluated the effects of COVID-19 rescue policies in Flanders (Belgium). They relied on a difference-in-differences strategy, comparing treated companies with those that applied for support but did not receive it – either due to insufficient information during the application process, being registered in other regions of Belgium, or operating in untreated sectors. Key institutional differences are that public support targeted firms with turnover drops above 60% (vs. 2019), and that initial aid was quickly deployed in Q2 2020 alongside other government measures like furlough schemes and financial instruments. They argue that subsidies reduced firm failures and increased productivity, with effects vanishing after a few quarters. Smart et al. (2025) evaluates the employment effects of the Canada Emergency Wage Subsidy, a pandemic-era program that provided payroll subsidies. Using data on applicants and RD designs that exploited different marginal effects of higher subsidy rates, the authors found that the program had modest effects on employment. Identification is based on the assumption that firms did not manipulate their reported revenue drops to qualify for higher incremental subsidies. However, they document evidence of bunching. Although the authors attempted to mitigate this through "donut" RD and difference-in-RD approaches, these methods may not fully eliminate bias from endogenous strategic behavior selection or manipulation.

Our paper adopts a different strategy to identify the causal effects of a government support program implemented during a severe crisis. The program targeted firms in sectors that were particularly affected, and we compare firms that, due to plausibly random factors, were marginally eligible for support with those that narrowly missed the eligibility cutoff and were therefore not

entitled to receive the grant. Importantly, these funds were announced and distributed more than nine months after the pandemic outbreak, mitigating the possibility that other government policies could confound our estimates. This contrasts with other studies examining the impacts of government support schemes introduced in the early weeks of the pandemic, which were implemented alongside numerous other policies, including state-guaranteed loans and the expansion of wage and unemployment subsidies. Moreover, we estimate both the ITT and the ToT parameters, which are both relevant for policy evaluation, unlike other studies that focus only on firms that chose to apply for grants. In addition, we use comprehensive administrative accounting data, combined with the amount of incentives that each firm received, and cover the entire universe of private firms in a country that was severely impacted by the pandemic shock.

Second, our work complements recent findings from the literature on short-time work (Kopp and Siegenthaler, 2021; Giupponi and Landais, 2023; Cahuc, 2024; Brinkmann et al., 2024). We examine a policy that was implemented on top of a subsidized paid furlough scheme, by providing compensation for other fixed costs and specifically considering entrepreneurs with no formal employment status. The APOIAR program used different eligibility criteria. In any case, we present empirical evidence suggesting that this earlier scheme is unlikely to confound our results.

Finally, this article adds to the literature using RDD for the evaluation of the effects of public policies on firms (Bronzini and Iachini, 2014; De Blasio et al., 2018; Bonfim et al., 2023; Dechezleprêtre et al., 2023; Santoleri et al., 2024; Bajgar and Srholec, 2025). Bonfim et al. (2023) analyze the effects of a government credit certification program in Portugal to explore how these initiatives impact firms' borrowing costs, investment, and employment during economic downturns and recoveries. The authors find that eligible firms borrowed more and at lower rates than non-eligible firms, allowing them to increase investment and employment during crises. We contribute to this literature by presenting both ITT and ToT estimates, as we have access to individual data on recipients and the amounts they were granted.

The article is organized as follows. Section 2 describes the APOIAR program. Section 3 explains the empirical strategy and the main data sources. We present the baseline results in Section 4 and robustness in Section 5. Finally, Section 6 concludes.

2 Institutional background

In 2020, the Portuguese economy suffered a severe economic contraction of 8.3% in GDP, making it one of the most affected in the European Union, which saw economic activity drop by, on average, 5.6%. As one of the pillars of the economy, tourism in Portugal was heavily affected by the COVID-19 pandemic (Batalha et al., 2022; Carvalho et al., 2022). The number of non-resident tourist arrivals to Portugal decreased by 73.7% compared to 2019 (after growing 7.9% in that year).

To mitigate the economic impact, the Portuguese government implemented several measures in March and April 2020. The most important consisted of a moratorium on debt payments, state-guaranteed loans, deferred tax payments, and wage subsidies – namely, a subsidized paid furlough

scheme under which workers were temporarily laid off, but were still paid 1/3 of the subsidized wages by firms (Nunes et al., 2023). Analyzing the impact of these measures, Kozeniauskas et al. (2022) show that high-productivity firms were less likely to rely on government support, while exit rates among lower-productivity firms did not increase. Custódio et al. (2024) find that the provision of simplified information in a randomized controlled trial significantly increased the take-up of the wage subsidies, but had no effect on credit line applications.

Later in 2020, recognizing the need to provide liquidity to micro and small firms to keep them afloat and to retain productive capacity, the Portuguese government announced and launched the APOIAR program in November. The program was designed to provide non-repayable financial assistance to firms adversely affected by the COVID-19 pandemic, particularly in sectors such as tourism, hospitality, and retail. Companies were required to be free of debts to the tax authority and social security. In addition, they were prohibited from laying off workers or distributing dividends in the two months after receiving the grant.

The eligibility criteria evolved over time, and we consider this variation in eligibility in our identification strategy. In November 2020, only micro- and small enterprises, as defined by Eurostat rules, qualified for the program. The treated sectors of activity were defined in *Portaria-271-A-2020* of November, 24 and applications opened on November, 25. At this time, companies were entitled to receive APOIAR support if they had reported to the Tax Authority a turnover decline of at least 25%, measured as the year-on-year variation for the first three quarters of 2020 compared to the same period in 2019. Eligible firms received non-repayable compensation equal to 20% of their revenue loss, with limits set according to company size.

In January 2021, in response to a new lockdown imposed on January 15, the government announced updated rules and a budget increase for the APOIAR program. The new requirement, while keeping the 25% threshold, was adjusted to consider the entire year of 2020 with respect to 2019 and support was extended to larger companies (medium firms and firms with an annual turnover of less than €50 million) and to self-employed *(Empresários em Nome Individual)*, as expressed in *Portaria n.º 15-B/2021* of January, 15.[3] In addition, payment limits were also substantially increased. Taking all the amendments into account, the median support for micro and small firm was €12,500 and €68,750, respectively. A business qualifying for the maximum amounts could receive over €200,000 in incentives – an amount that could be doubled as a result of the additional support introduced in APOIAR for rental payments.

The application process was simple, with online submission and tracking. Importantly, the cutoffs were specific to this policy. The remaining policies, implemented months before APOIAR, had different eligibility criteria. The simplified lay-off, for example, required a sharp drop in turnover of at least 40% in the month prior to the request compared to the average of the two previous months or compared to the same period in the previous year. The tax deferral required a drop in turnover of at least 20% compared to the three months before the month in which the obligation occurred,

[3]In March 2021, the program was extended to cover other economic activities which were part of the value chains of the tourism sector, such as bakery, pastry, and the manufacture of pyrotechnic items. We do not consider these sectors to avoid possible anticipation effects.

in relation to the same period in the previous year.

The financing of the APOIAR Program was made with structural European funds, with a small share coming from national resources (3%). At the end of 2020, 40,949 applications were submitted (39.1% of the total submissions). Despite the short period of time (about a month), 31,698 contracts were signed (32.4%) and the approved incentives amount to €325,037 thousand (27.1%). Considering the full program, the average incentive was close to €12,000. According to monitoring data as of August 2023, the APOIAR Program received a total of 104,804 applications, resulting in 97,799 signed contracts after accounting for cancellations, which included 2,780 withdrawals and 1,447 contract terminations (Martins and Rebelo, 2023). Micro-enterprises were those that submitted the highest number of applications (corresponding to 88.2% of total applications). The remaining 11.8% combine companies of other sizes: 9.6% from small companies, 1.6% by medium-sized, and 0.6% concerned large companies. The tourism sector had the highest number of applications (47.5%), followed by the retail and trade sector (28.5%). At the regional level, the North region was the one with the highest number of applications (38.5%). Lisbon was the region with the second highest weight (28.9%) while the Alentejo region was the one with the fewest applications (4.5%). In terms of incentives paid, Lisbon was the region that received the most support (37.9%), followed by the North (31.4%). We present the regional dispersion of the support in Figure A1 in the Appendix.

3 Empirical strategy

3.1 Data and summary statistics

We link three administrative datasets covering the universe of Portuguese private firms to analyze the causal effects of the APOIAR program on survival, performance, and labor market outcomes. We give an overview below.

Invoice data (the *E-Fatura Emitentes* database). This data set, made available by Statistics Portugal specifically for this project, collects information on aggregate monthly sales per seller for 2019 and 2020. *E-Fatura* is an electronic invoicing software system adopted by the Portuguese government in 2013 to combat value-added tax (VAT) fraud. It is mandatory for all individuals or legal entities with a headquarters, stable establishment, or tax domicile in Portugal. As reported to the Tax Authority, the data generated in this platform cover all business-to-business transactions. In addition, it includes a large share of final consumption transactions, thanks to government incentives that encourage consumers to act as tax auditors by requesting an invoice with their taxpayer number at the time of purchase.[4] In summary, *E-Fatura* captures around 75% of net-of-VAT consumption reported in the national accounts.

[4]These incentives include weekly public debt lotteries of, at least, €35.000, deductions on personal income tax payments for expenditures on health, education, nursing homes, and general household spending. The government further rebates 15% of the VAT on expenditures on hotels and restaurants, hairdressers, and car and moto repair.

List of Approved Projects of the APOIAR Program. This data set, obtained from COMPETE 2020 (the Portuguese Operational Program for Competitiveness and Internationalization), which acted as the managing authority responsible for the implementation and disbursement of funds to eligible firms, provides the full list of beneficiary firms, as well as the euro amounts of support received.

Business statistics. We use this granular yearly balance sheet and profit and loss statement data (*Sistema de Contas Integradas das Empresas, SCIE*) from 2019 to 2023, obtained from information reported through *Informação Empresarial Simplificada, IES*, a joint project of the Ministry of Finance, Ministry of Justice, Statistics Portugal, and Banco de Portugal.[5] We use data on net income, revenues, expenditures, value added, sales, total assets, two-digit sectors of activity, and headquarter locations (i.e., municipalities). It also provides information on the labor market including the number of employees, the total wage expenditure, and average wages. The participation of the firms in the survey is mandatory and non-compliance is penalized.

Considering these data sources, we make a number of sample restrictions. First, we focus on non-financial private firms that belong to eligible sectors, listed according to *Portaria-271-A-2020* of November, 24. This list includes wholesalers, retailers, and touristic firms such as hotels, restaurants, and cafés. In addition, we exclude not-for-profit and state-owned firms, medium and large firms, startups (defined as firms born in 2019), and companies based in the archipelagos of Madeira or Azores as different eligibility rules apply in those cases. Finally, we do not consider firms with conflicting situations with the fiscal authority or the social security. We also exclude firms with non-positive assets, turnover, equity or employment. We present the sectoral distribution of our sample in Table 1.

[5]This dataset has been used, *inter alia*, to study how the organization of management production impacts revenues and productivity (Caliendo et al., 2020), how exporters adjust wages in response to shocks during the Great Recession (Garin and Silvério, 2024), the impact of a government credit certification program (Bonfim et al., 2023), the effects of a sharp rise in transportation costs (Branco et al., 2023).

Table 1: Distribution of Firms by Main Sector

Main Sector	**Frequency**	**Percent (%)**
Accommodation and Food Services	18,280	17.59
Arts, Entertainment, and Sports	3,415	3.29
Administrative and Support Services	3,146	3.03
Retail and Wholesale Trade	57,426	55.25
Consulting and Technical Services	3,222	3.10
Education	2,154	2.07
Manufacturing Industry	1,769	1.70
Information and Communication	1,780	1.71
Other Services	3,456	3.32
Health and Social Support	9,292	8.94
Total	**103,940**	**100.00**

Our main sample consists of 103,940 firms. To mitigate the influence of outliers, all balance-sheet variables are winsorized at the 2.5% on both tails of the distribution (Santoleri et al., 2024). The summary statistics for 2019, the pre-treatment period, are shown in Table 2.

Table 2: Summary Statistics 2019

	Mean	Std. Dev.	p25	p50	p75	p99	Obs.
Non-subsidized							
Turnover	568869.50	858673.80	87794.00	219426.00	607800.00	3747072.00	56515
Number of employees	4.83	5.20	1.00	3.00	6.00	24.00	56515
Wage expenditure	59402.25	79741.07	11659.00	28397.00	68687.00	376204.00	34591
Average wage	8342.40	4606.99	5170.33	7705.00	10367.00	23252.33	34591
Total assets	481206.90	733262.00	74320.00	187373.00	508783.00	3307012.00	56515
Net Income	22463.59	45479.87	859.00	6826.00	24760.00	198959.00	56515
Office Supplies	975.16	1377.14	97.00	417.00	1220.00	5889.00	56515
Rents	9729.95	17317.65	0.00	3490.00	10800.00	89550.00	56515
Investment in equipment	9403.20	20231.96	0.00	0.00	7154.00	91109.00	56515
Debt to shareholders	146.78	806.76	0.00	0.00	0.00	4868.00	56515
Subsidized							
Turnover	389658.70	648529.20	64630.00	156463.00	397130.00	3747072.00	47425
Number of employees	4.70	5.37	1.00	3.00	6.00	24.00	47425
Wage expenditure	64320.45	84346.28	12459.00	30657.00	76072.00	376204.00	43387
Average wage	8900.76	4924.08	5414.67	8103.00	11226.00	23252.33	43387
Total assets	368945.90	628137.80	54706.00	137912.00	362875.00	3307012.00	47425
Net Income	17023.14	40741.14	317.00	4973.00	19215.00	198959.00	47425
Office Supplies	743.83	1197.13	50.00	270.00	850.00	5889.00	47425
Rents	11676.77	20238.89	0.00	3725.00	12526.00	89550.00	47425
Investment in equipment	7581.04	18272.04	0.00	0.00	3913.00	91109.00	47425
Debt to shareholders	134.48	765.94	0.00	0.00	0.00	4868.00	47425
All							
Turnover	487100.50	775091.90	75866.50	187475.50	499716.00	3747072.00	103940
Number of employees	4.77	5.28	1.00	3.00	6.00	24.00	103940
Wage expenditure	62138.74	82370.93	12087.00	29619.50	72623.00	376204.00	77978
Average wage	8653.07	4794.01	5301.22	7911.50	10839.50	23525.33	77978
Total assets	429985.20	689561.70	64395.50	163344.00	437876.00	3307012.00	103940
Net Income	19981.26	43466.32	584.00	5901.00	22049.50	198959.00	103940
Office Supplies	869.61	1303.20	72.00	343.00	1049.00	5889.00	103940
Rents	10618.23	18732.23	0.00	3600.00	11760.00	89550.00	103940
Investment in equipment	8571.80	19383.49	0.00	0.00	5500.00	91109.00	103940
Debt to shareholders	141.17	788.41	0.00	0.00	0.00	4868.00	103940

3.2 Identification

Estimation. We estimate the causal effect of the APOIAR program on firm-level outcomes using a Regression Discontinuity Design (RDD), a quasi-experimental method that requires defining a score or running variable X, a cutoff or threshold c, and a discontinuous treatment assignment rule D (Cattaneo and Titiunik, 2022). In our case, we compare firms that are eligible for the APOIAR program by a small margin with the counterfactual composed by firms "just above the threshold" that are less likely to receive support.

Our definition of the running variable, based on the *E-fatura* data, aims to capture firms that may have qualified to receive support from, at least, one of the APOIAR phases: the first phase of the APOIAR program considers a revenue decline in the first three quarters of 2020 compared to the same period in 2019, while the second considers a revenue decline for the full year of 2020 compared to 2019. Therefore, we compute the running variable X considering the minimum revenue drop observed for each firm between these two periods:

$$X_i = min\{\text{Drop APOIAR phase 1}, \text{Drop APOIAR phase 2}\} \tag{1}$$

In cases where perfect treatment compliance is not achieved, both sharp and fuzzy RDDs offer valuable insights into treatment effects. Sharp RDD provides an estimate of the intention-to-treat (ITT), as it reflects the real-world effectiveness of a policy under typical conditions of implementation. However, when compliance is imperfect, the fuzzy RDD becomes particularly relevant, as it accommodates the scenario where not all individuals adhere to their assigned treatment. The Fuzzy specification focuses specifically on the effects for those who comply with the treatment assignment, the treatment on the treated (TOT) effect.

The **Sharp RDD** assumes that the treatment indicator D is assigned on the basis of a specific rule that links the running variable X with a known and predefined cutoff c and given by:

$$D_i = \begin{cases} 1 & \text{if } X_i < c, \\ 0 & \text{if } X_i \geq c. \end{cases}$$

In practice, this is estimated using a local polynomial regression of the form

$$y_i = \beta D_i + f(X_i) + \epsilon_i \tag{2}$$

where y_{it} is a firm-level outcome measured in 2021 or in 2022, D_i is a binary indicator variable that takes the value 1 if a firm is eligible to receive APOIAR support, $f(X_i)$ are polynomials of the running variable X estimated separately for each side of the threshold c, and ϵ is an error term. When there is only partial take-up of the program, the coefficient of interest β^{sharp} is an ITT estimate.

The **Fuzzy RDD** allows for a probabilistic assignment of treatment, when not all individuals near the threshold comply with the treatment assignment. Estimation typically employs instrumental variable methods in which the running variable acts as the instrumental variable. In other words, the TOT estimate is obtained by scaling up the ITT. Hence, the estimand in a fuzzy RDD takes the form of a ratio of two Sharp RD estimands. In our case, considering that we have access to firm-level data on take-up, we are able to estimate the first stage as in eq. (2) with y_i being the APOIAR support (measured in euros). This allows us to interpret β^{fuzzy} as the effect of receiving one APOIAR euro on firm-level outcomes.

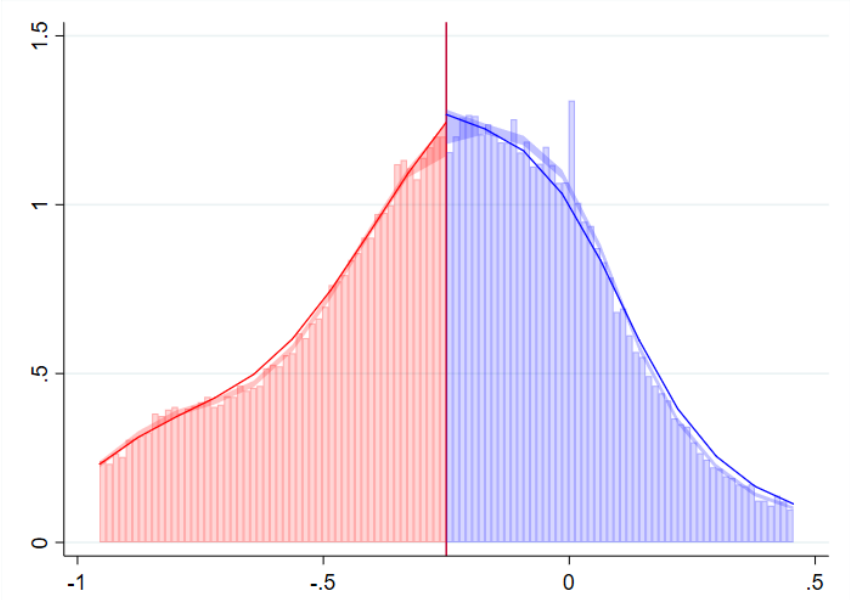
The pertinent literature on regression discontinuity design provides guidance on the choice of

the bandwidth (Imbens and Kalyanaraman, 2012), the local polynomial order to include in the regression (Gelman and Imbens, 2019; Pei et al., 2022), and the inclusion of covariates (Frölich and Huber, 2019; Calonico et al., 2019). In our baseline results, our choice of bandwidth follows Calonico et al. (2014, 2017), known in the literature as the optimal bandwidth. We show results using a polynomial of order two and without any covariates. We show that our results remain robust if we change these conditions in Section 5.

Assumptions. We now discuss and provide empirical evidence in support of the key identifying assumptions hold in this setting: (i) local randomization (near the threshold, units are assumed to be as-if randomly assigned to treatment or control), (ii) the continuity of potential outcomes before the treatment period, and (iii) exclusion of confounding factors (no other variable changes discontinuously at c besides the APOIAR grant). We also discuss the validity of the exclusion restriction in the context of the fuzzy RDD.

First, an underlying assumption in the RDD is that the assignment of firms around the eligibility threshold is as good as random. This implies that companies do not manipulate their financial statements to meet program criteria and receive support. To test this local continuity assumption, McCrary (2008) introduced the concept of manipulation testing. Several authors, such as Cattaneo et al. (2018), have further refined this test. In our study, we examine the distribution of eligibility criteria around the cutoff point using Cattaneo et al. (2018) and Calonico et al. (2017). We present the results of this test in Figure 1 and show that there is no bunching in the distribution of firms with the running variable X calculated according to eq. (1).

Figure 1: Manipulation test



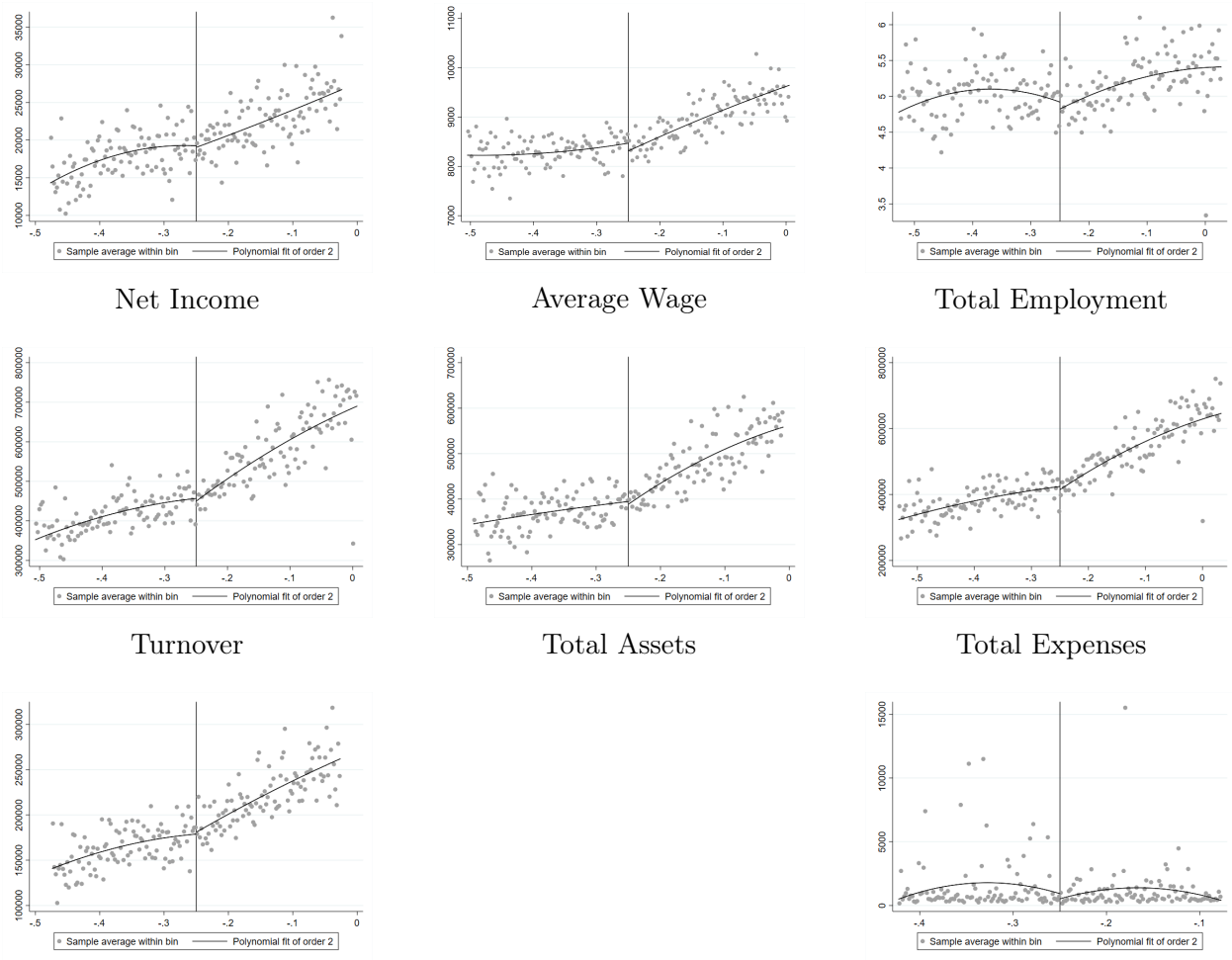
Notes: This figure shows the Cattaneo et al. (2018) density plot around the threshold of eligibility criteria. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%.

This is not a surprising result. Firms had to report sales to the Tax Authority before the announcements of the APOIAR program, so no strategic adjustments are expected from firms as they were not previously informed that the program would take place, extended in early 2021, nor about the cutoff. This was also ensured by the extremely small time lags between announcement

and implementation. In addition, all micro and small companies had to have a certified accountant who files and signs financial reports.

The second assumption requires the continuity of other variables around the APOIAR threshold. Figure 2 provides supporting evidence that this is likely to hold in this setting by showing that the distribution of several outcomes around the APOIAR cutoff point was smooth (and not statistically significant) before the pandemic and the introduction of the program, using data for 2019.

Figure 2: RDD plots – Firm Performance and Labor Market in 2019



Notes: This figure shows fitted lines from sharp RDD plots with a local polynomial of order 2 for firm-level outcomes measured in the pre-treatment period (2019). The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017).

The third condition is also likely to be met in this context. As discussed extensively in Section 2, the APOIAR cutoff was specific to this measure, with no other policies applying the same eligibility criteria. In any case, we leverage the richness of the administrative accounting data to demonstrate that operating subsidies net of the APOIAR grant (which comprise the amounts received through

the wage subsidy furlough scheme and/or European funds directed to firms, including those from the Recovery and Resilience plan) do not exhibit any discontinuity at the APOIAR threshold. In Figure A2 in the Appendix, we sum operating subsidies from 2020 to 2022 and subtract the APOIAR funds, highlighting the absence of a statistically significant effect.

Lastly, we discuss the exclusion restriction in the context of the fuzzy RDD. In simple words, we argue that the causal effect of the APOIAR program on firm-level survival and performance occurs only through the funds that these firms receive. We note that, contrary to other contributions in the literature (Dechezleprêtre et al., 2023), we are not using a binary indicator considering whether each firm received support, but the actual money that each firm received, which is arguably more important for firms. In addition, APOIAR did not have a certification component that could signal the quality that banks or investors could observe (Bonfim et al., 2023), mitigating concerns that other mechanisms could be affecting our results.

To conclude, while it is not possible to completely rule out the hypothesis of sorting on observables around the threshold, all the evidence (both institutional and statistical) provides clear support for the validity of the research design.

4 Results

The first step in our empirical evaluation is to investigate whether all eligible firms have applied to APOIAR and if we indeed observe a sizable monetary influx at the threshold. We then examine the effects of the program on a broad range of firm-level outcomes that cover various aspects of survival, firm performance, expenditure and liabilities, and employment. For each of these categories, we follow the same structure. First, we present a graphical inspection of the discontinuities at the RDD threshold. Second, we interpret both sharp and fuzzy RDD regressions. Finally, we discuss heterogeneity.

4.1 Take-up

We begin by establishing that i) there is a large discontinuity in the probability of being granted support at the APOIAR threshold, and ii) this discontinuity translates into sizable and relevant resources for micro and small firms. To do so, we rely on the data from the list of beneficiaries provided by COMPETE 2020 and use the RDD framework described above. The results are displayed in Figure 3 and are statistically significant and precisely estimated as shown in Table A1 in the Appendix.

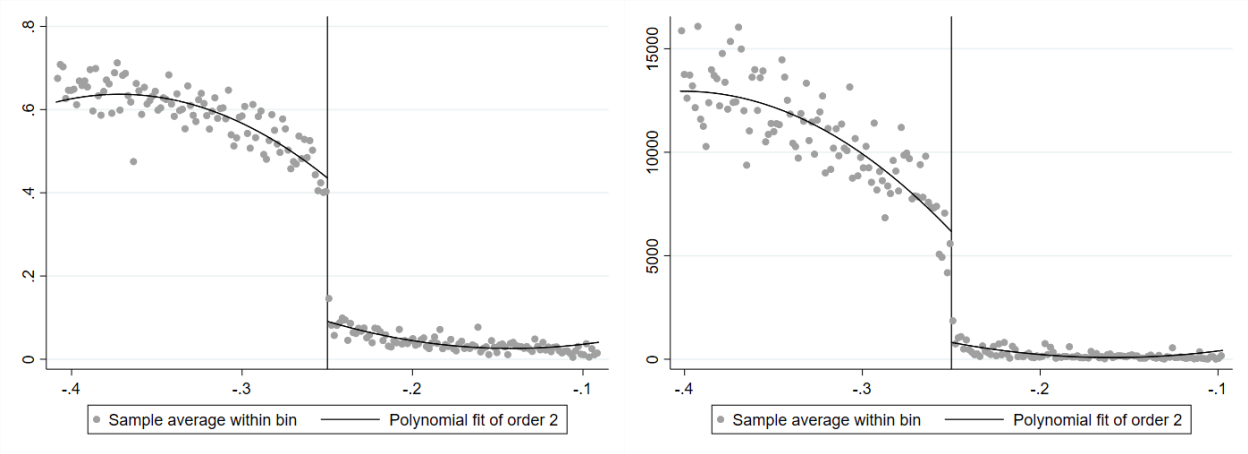
In panel a), we show that the probability of being treated significantly jumps at the threshold of our running variable from close to zero to almost 50%. The probability increases for firms with turnover reductions greater than 25%, but does not converge to 100% for firms with higher relative losses. Therefore, not all firms that are entitled to receive support decide to apply, a fact that is not uncommon in other contexts.[6] In the context of government support programs during the pandemic, Smart et al. (2025) report that only 36% of all active employers applied for the wage subsidy in the summer of 2020 in Canada. Information frictions can be an important mechanism that can explain these low numbers. Humphries et al. (2020) shows that small businesses in the U.S. were less aware of the PPP than larger companies and less likely to apply or applied later.

[6] Bhargava and Manoli (2015) argue that program confusion, informational complexity, and stigma can influence the take-up of government programs. Cui et al. (2022) show that Chinese firms fail to claim benefits on more than 80% of eligible investments. Bonfim et al. (2023) highlight that take-up of a government credit certification program in Portugal was close to 20% in the first years, and increased to approximately 65%.

Our results are also consistent with the findings of Custódio et al. (2024). As in their study, we find that take-up was incomplete despite eligibility and the fact that the APOIAR program was implemented through a simple online application process, reinforcing the idea that well-designed targeted programs may still fail to reach all intended beneficiaries without complementary efforts to reduce informational barriers.

In panel b), we point out that the average ITT incentive, at the cutoff, is €5,270. Note that, considering that the minimum salary in Portugal in 2021 was €665, this amounts to around 8 minimum monthly wages.[7]

Figure 3: RDD plots – Take-up



Probability of being granted support

Incentives in €

Notes: This figure shows fitted lines from sharp RDD plots with a local polynomial of order 2 for firm-level outcomes: take-up (left panel) and for incentives measured in euros (right panel). The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017).

Considering imperfect compliance, and for the remainder of this paper, we present both sharp and fuzzy RDD results. This provides a nuanced understanding of the program's effectiveness by computing the parameter that policy makers can influence (the ITT) and the parameter on those who actually receive the treatment per euro of support (the ToT).

4.2 Probability of bankruptcy

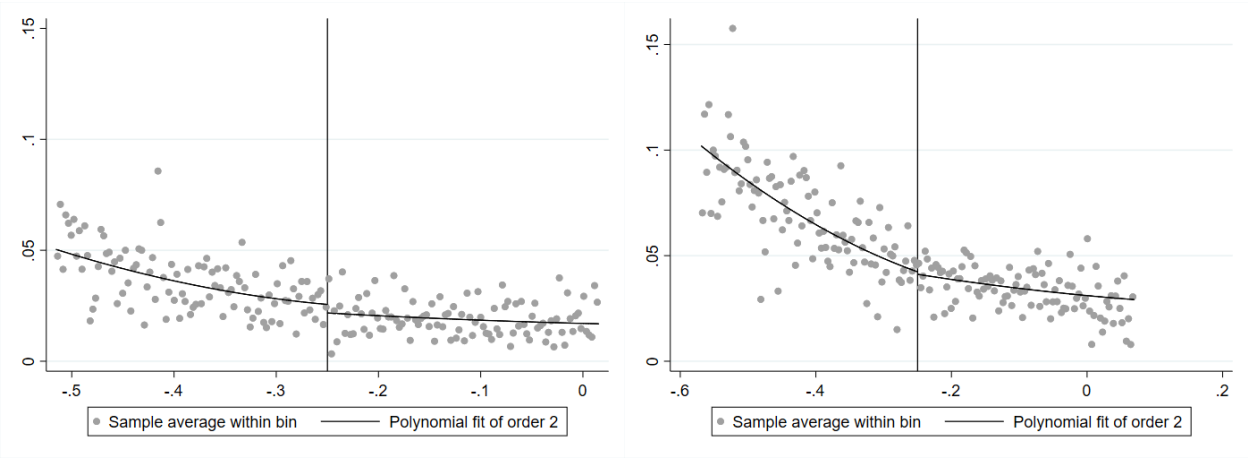
Next, we examine whether APOIAR contributed to keeping businesses afloat during and after the pandemic. We recall that this was one of the main indicators that policy makers advanced to develop the program. As micro and small firms often face frictions in access to external financing, which can be even more acute in times of crisis (Blattner et al., 2023), programs such as APOIAR may be, in theory, a particularly relevant source of liquidity.

The graphical inspection that we present in Figure 4 does not seem to reveal any substantial discontinuity in survival in 2021 and 2022. Although the probability of bankruptcy increased in

[7]We recall that, conditional on receiving support, the median APOIAR grant was €12,500 and €68,750 for micro and small firms, respectively. Given the nature of this program, the most generous benefits were given to firms that experienced larger drops in revenue and are therefore not included in the optimal RDD bandwidth.

2022 compared to the previous year, these graphs suggest that the subsidy did not appear to affect the probability of survival, at least at the RD margin.[8]

Figure 4: RDD plots – Probability of bankruptcy



2021 2022

Notes: This figure shows fitted lines from sharp RDD plots with a local polynomial of order 2 for the firm-level probability of bankruptcy in 2021 (left panel) and in 2022 (right panel). The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017).

We confirm these results by considering both sharp and fuzzy RDD regressions in Table 3. We note that all point estimates are close to zero.

Table 3: Probability of bankruptcy: RDD results

	2021		**2022**	
	Sharp	**Fuzzy**	**Sharp**	**Fuzzy**
Coef.	0.004	0.000	0.001	0.000
Std. Er.	0.004	0.000	0.005	0.000
Obs.left	26,625	24,857	30,016	24,833
Obs.right	32,647	29,612	37,811	29,586
Bandwidth	0.265	0.240	0.319	0.240

Notes: This table reports the ITT and ToT RD estimates for the impact of the APOIAR program on firm-level outcomes. The treatment status variable used to implement the fuzzy RD estimation is the total amount of incentives in euros. All regressions using weighted least squares (with weights given by a triangular kernel function) include a polynomial of order 2 of the distance to threshold. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017). Significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$.

We also examine possible heterogeneous effects and display the results in Section C.1 in the Appendix. More specifically, we focus on subsamples of firms grouped into terciles based on turnover, labor productivity (computed as value added per worker), and indebtedness (computed as liabilities/ assets), all measured in 2019, before the COVID-19 pandemic. In summary, we do not find significant differences at the RDD threshold when we divide our sample according to pre-pandemic performance for both sharp and fuzzy specifications.

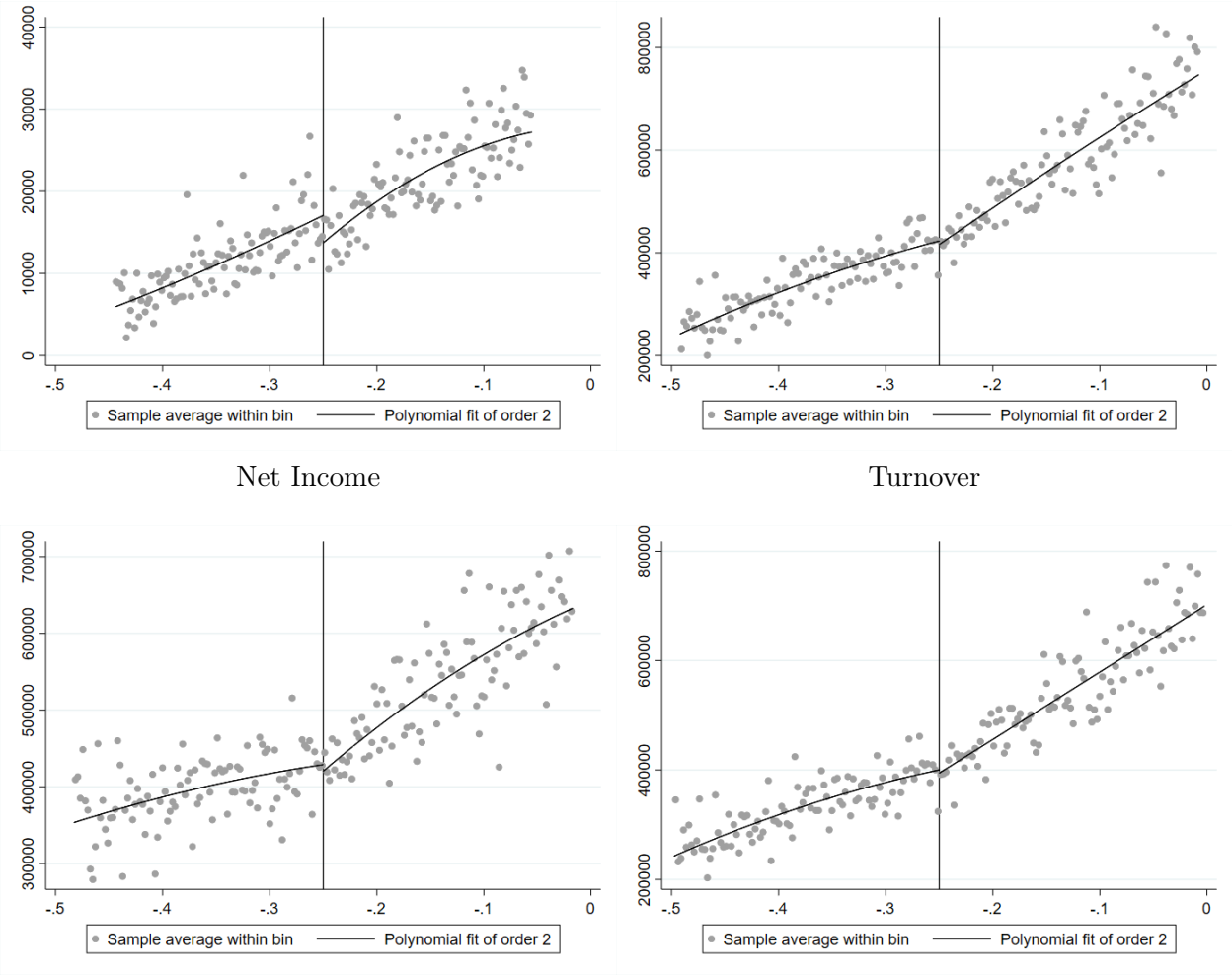
[8] According to Eurostat data, death rates are comparable with those for the the EU 27 average in the wholesale and retail trade, accommodation, and food and beverage service activities.

4.3 Firm Performance

Next, we study the effect of APOIAR on firm performance. We selected standard indicators of firm performance such as net income, a proxy for profits, turnover (sales of goods and services), and total expenses. We also analyze balance sheet variables, namely, total assets and equity.

First, we visually inspect evidence of discontinuities in these variables in Figure 5 for 2021 and in Figure 6 for 2022. We find an observable discontinuity in net income in 2021, but not in 2022. For all the other indicators, we do not find any differences at the the threshold.

Figure 5: RDD plots – Firm Performance in 2021

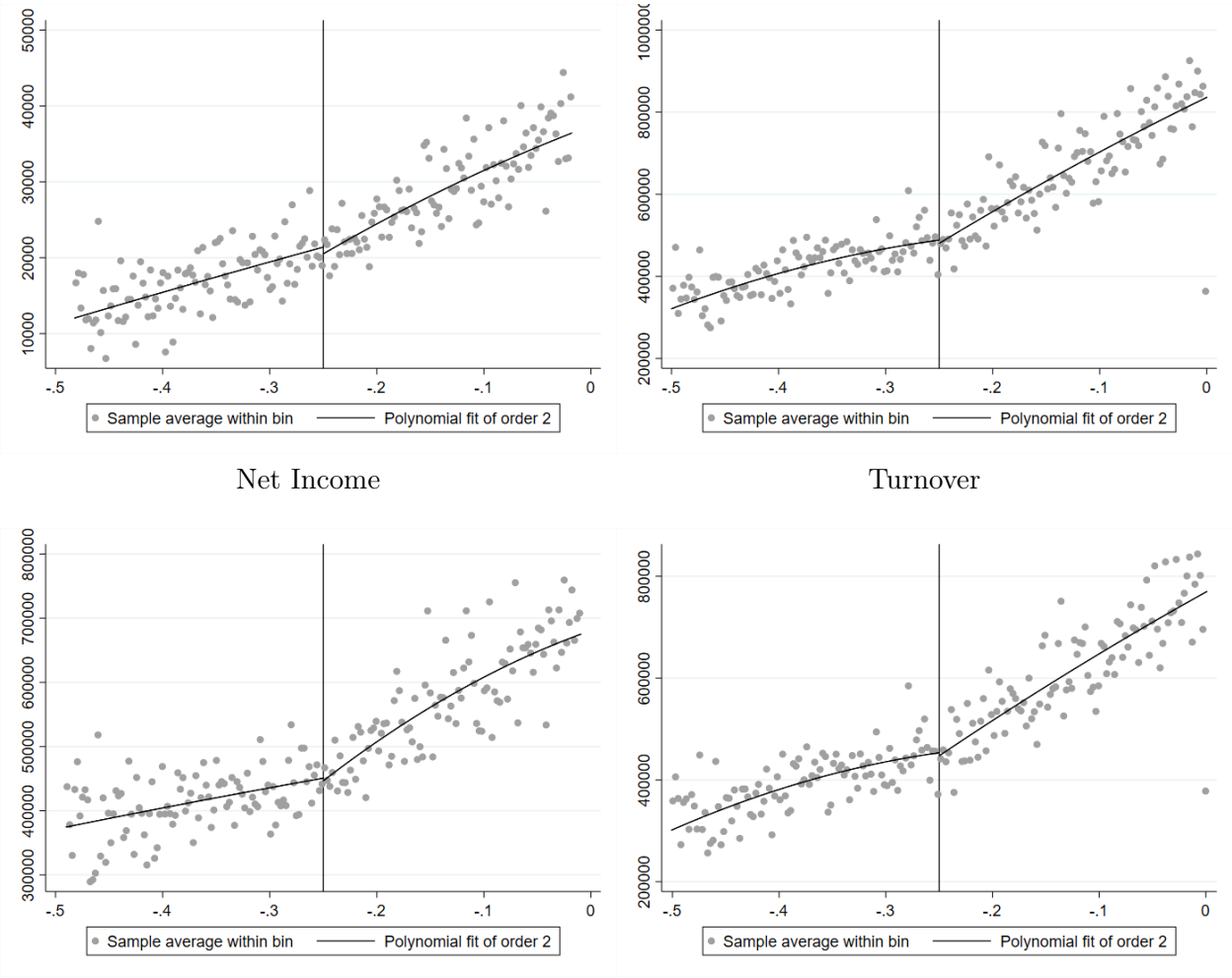


Net Income | Turnover

Total Assets | Total Expenses

Notes: This figure shows fitted lines from sharp RDD plots with a local polynomial of order 2 for firm-level outcomes in 2021. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017).

Figure 6: RDD plots – Firm Performance in 2022



Net Income | Turnover

Total Assets | Total Expenses

Notes: This figure shows fitted lines from sharp RDD plots with a local polynomial of order 2 for firm-level outcomes in 2022. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017).

We confirm these insights by estimating sharp and fuzzy RDD regressions and present the results in Table 4 for 2021. The first two columns illustrate the impact of the program on net income, revealing that eligible firms experienced an average increase of €3,522 relative to non-eligible firms, around the eligibility threshold, in 2021. For each €1,000 of APOIAR funds, eligible firms that applied and received support increase net income by €658. However, in the following columns, we show that, despite positive, no significant differences are observed in turnover or in total expenses, suggesting that the net income surge seems to be a mechanical accounting effect – mainly due to receiving the grant that increases total revenues and, therefore, profits, rather than becoming more competitive or efficient, at least in the short-run. Consistent with this idea, we show that total assets and equity do not seem to be affected by the grant. In other words, we do not find evidence that the grant encouraged investment or reduced debt at the margin.

Table 4: Firm Performance in 2021: RDD results

	Net Income		Turnover		Total Expenses		Total Assets		Equity	
	Sharp	**Fuzzy**	**Sharp**	**Fuzzy**	**Sharp**	**Fuzzy**	**Sharp**	**Fuzzy**	**Sharp**	**Fuzzy**
Coef.	3,522**	0.658**	4,924	2.033	3,522	1.979	6,795	1.895	-1,168.2	0.207
Std. Er.	1,591	0.281	21,679	4.111	20,040	3.865	21,356	3.870	11,034	1.986
Obs.left	21,160	19,542	24,968	20,663	25,358	20,516	24,272	21,218	23,842	21,278
Obs.right	24,259	22,123	29,805	23,603	30,380	23,424	28,739	24,323	28,160	24,434
Bandwidth	0.195	0.176	0.242	0.189	0.248	0.187	0.233	0.195	0.228	0.196

Notes: This table reports the ITT and ToT RD estimates for the impact of the APOIAR program on firm-level outcomes in 2021. The treatment status variable used to implement the fuzzy RD estimation is the total amount of incentives in euros. All regressions using weighted least squares (with weights given by a triangular kernel function) include a polynomial of order 2 of the distance to threshold. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017). Significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$.

Moreover, this effect seems to be short-lived. In Table 5, we show that the effects on net income did not persist in 2022 and, once again, we do not find any differences at the threshold for other standard indicators of firm performance.

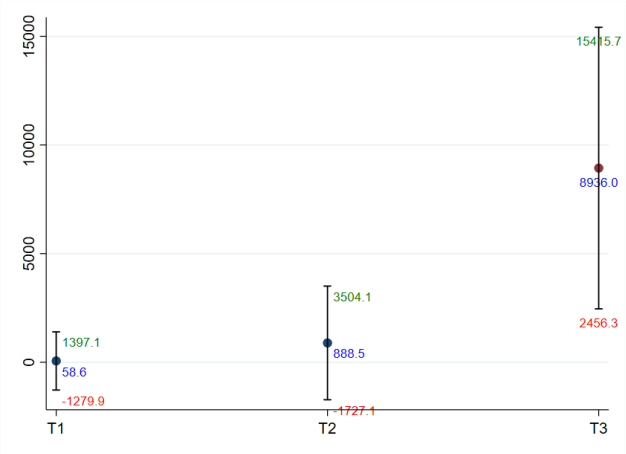
Table 5: Firm Performance in 2022: RDD results

	Net Income		Turnover		Total Expenses		Total Assets		Equity	
	Sharp	**Fuzzy**	**Sharp**	**Fuzzy**	**Sharp**	**Fuzzy**	**Sharp**	**Fuzzy**	**Sharp**	**Fuzzy**
Coef.	846.3	0.183	4,317	2.779	2,488	2.426	3,489	1.188	-3,180.4	-0.340
Std. Er.	1,772	0.321	24,364	4.767	22,484	4.400	22,633	4.037	12,032	2.143
Obs.left	24,216	21,211	25,534	20,221	25,604	20,289	24,861	22,128	24,267	21,958
Obs.right	28,672	24,317	30,946	23,046	31,055	23,134	29,615	25,720	28,733	25,472
Bandwidth	0.232	0.195	0.250	0.184	0.251	0.185	0.241	0.206	0.233	0.204

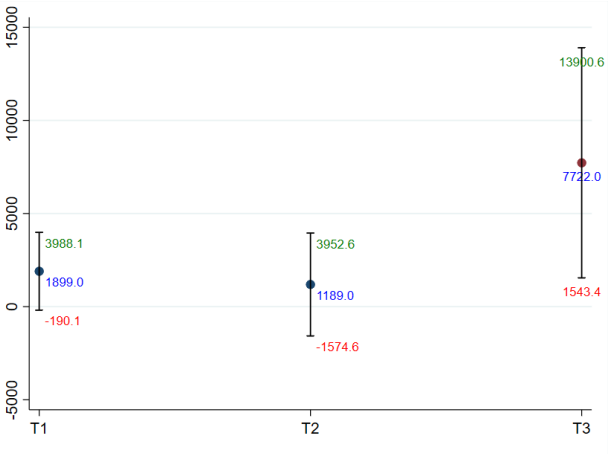
Notes: This table reports the ITT and ToT RD estimates for the impact of the APOIAR program on firm-level outcomes in 2022. The treatment status variable used to implement the fuzzy RD estimation is the total amount of incentives in euros. All regressions using weighted least squares (with weights given by a triangular kernel function) include a polynomial of order 2 of the distance to threshold. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017). Significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$.

We now zoom in on the causal effect of the APOIAR program on net income in 2021 to examine whether these results are heterogeneous with respect to previous performance. We consider sharp RDD results in Figure 7 and fuzzy RDD results in Figure 8. More specifically, the analysis of the heterogeneity of the impact of the subsidy focuses on subsamples of firms grouped into terciles based on turnover, labor productivity, indebtedness ratio, and cash over assets, measured before the COVID-19 pandemic in 2019.

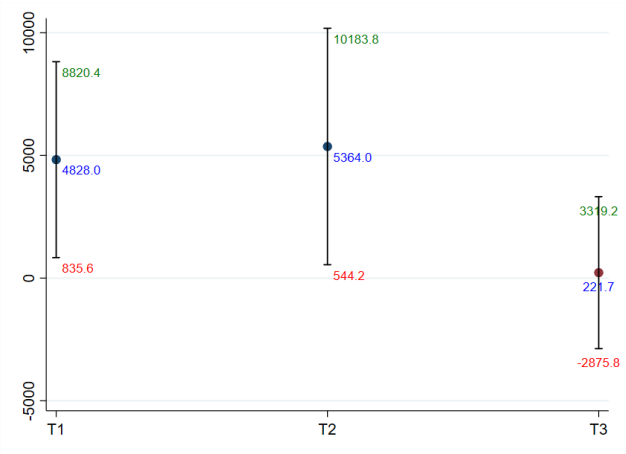
Figure 7: Net income results for 2021 - Sharp



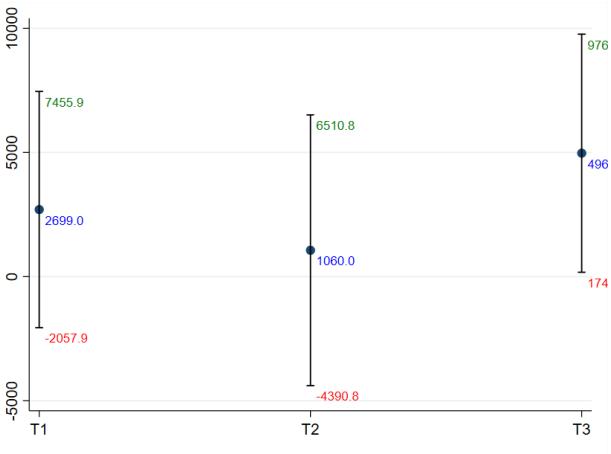
Tercile by turnover



Tercile by productivity



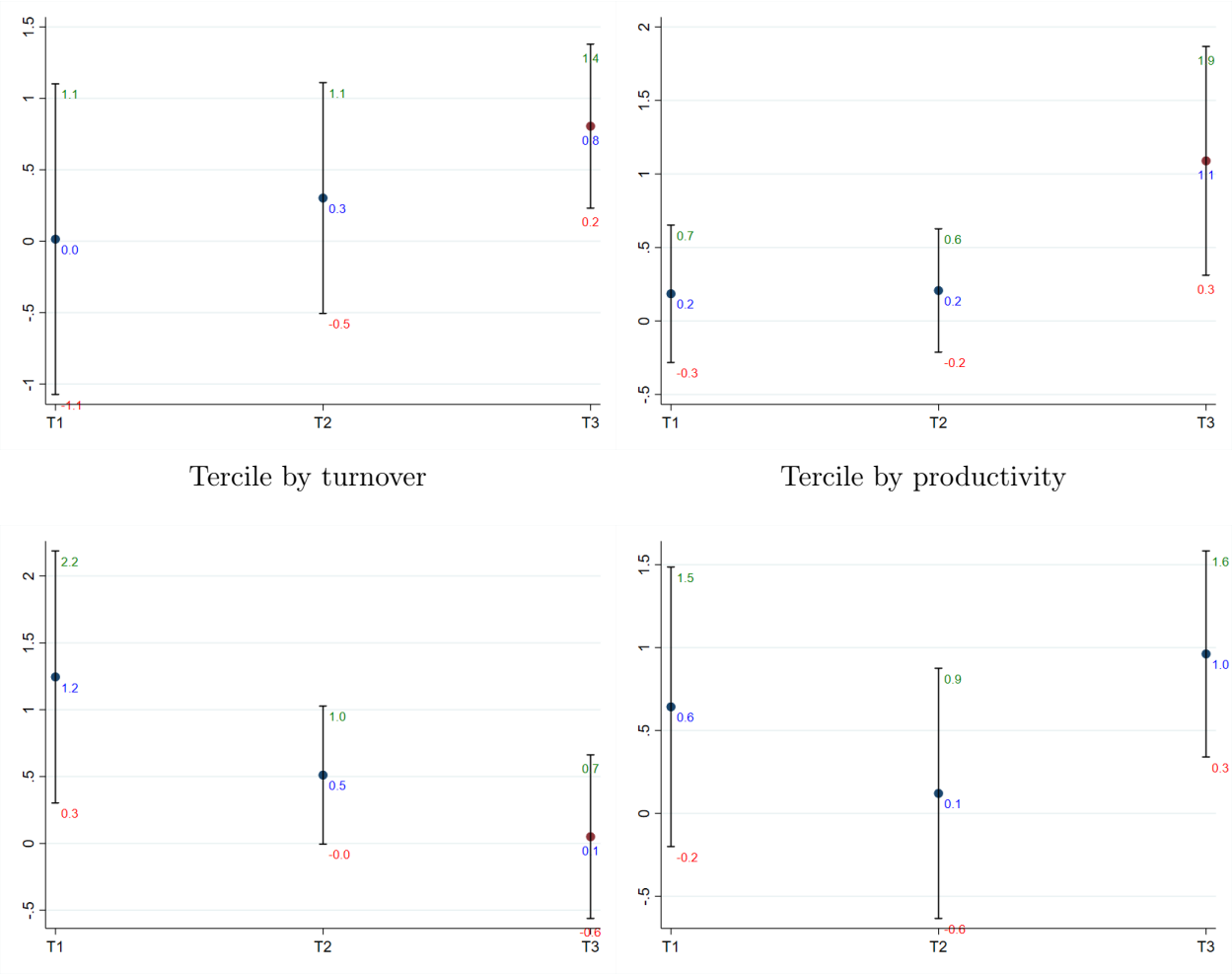
Tercile by indebtedness



Tercile by cash-to-assets

Notes: This figure shows the sharp RDD estimates as estimated before and reports 95% confidence intervals. The universe of firms is divided in terciles according to pre-pandemic characteristics (measured in 2019).

Figure 8: Net income results for 2021 - Fuzzy



Tercile by turnover

Tercile by productivity

Tercile by indebtedness

Tercile by cash-to-assets

Notes: This figure shows the fuzzy RDD estimates as estimated before and reports 95% confidence intervals. The universe of firms is divided in terciles according to pre-pandemic characteristics (measured in 2019).

We find, in both sharp and fuzzy designs, that the bulk of the effects seem to be concentrated in firms with higher ex-ante levels of sales and labor productivity (i.e., those in the last terciles). These firms were arguably more prepared to deal with the adverse effects of the shock and did not spend part of the APOIAR support, therefore increasing net income in 2021.[9] Consistent with these ideas, we show that there is no increase in net income for firms that were more in debt in 2019, but profits increased for firms in the first and second terciles. We also do not observe an increase in net income for firms were ex-ante liquidity concerns were more prevalent.[10] The liquidity provided by the program thus appears to have been particularly important for firms that were already struggling before the pandemic.

We further divide our sample between micro and small firms and present the results in Tables

[9] Granja et al. (2022) show that American firms used part of the PPP grant to build savings buffers, which likely reflect precautionary motives (Almeida et al., 2004).

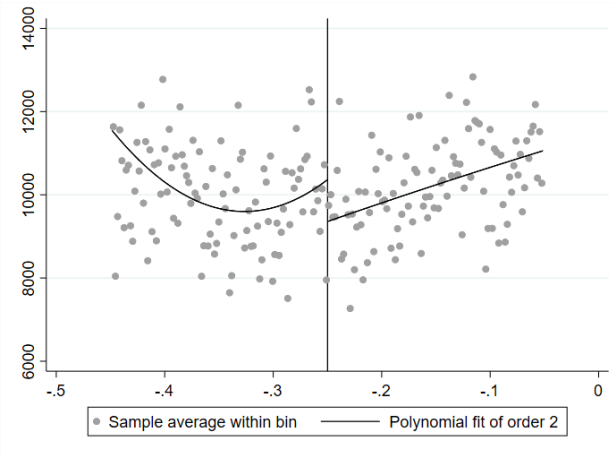
[10] Bartik et al. (2020b) show that businesses with less cash on hand were more likely to apply for PPP loans, but these applications were less likely to be approved.

H3 and H4 in the Appendix, respectively. Although we observe a positive effect on net income for micro firms of, on average, €2,587, the results for small firms, although positive, are not statistically significantly different from zero. This may be explained by the fact that small firms are more capable of absorbing and using grants effectively than micro firms.[11]

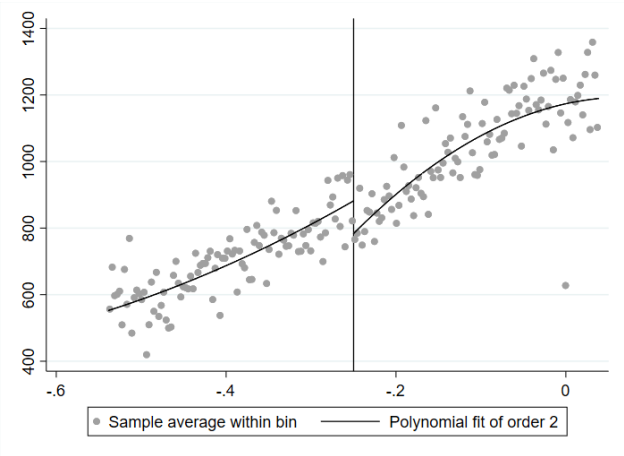
4.4 Expenditure and liabilities

We now take advantage of the detailed balance sheet and profit and loss statement data to shed light on the purposes for which the subsidy may have been allocated. We selected some indicators related to expenditures and liabilities and exhibit the results in Figure 9 for 2021 and Figure 10 for 2022.

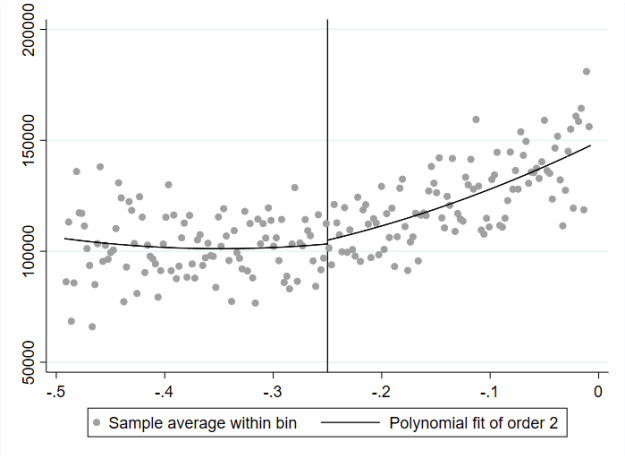
Figure 9: RDD plots – Expenditure and liabilities in 2021



Rents



Office Supplies

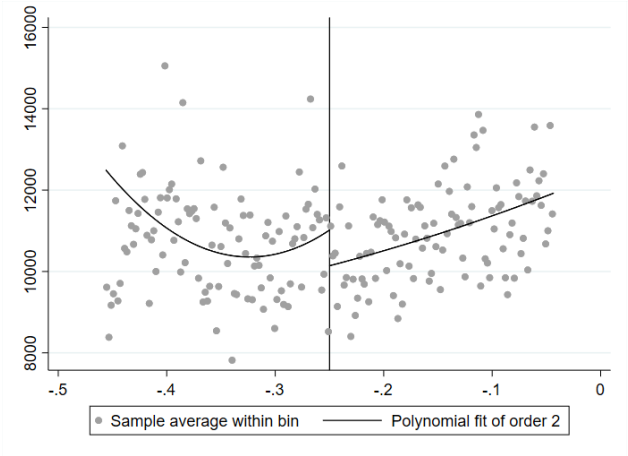


Investment in equipment

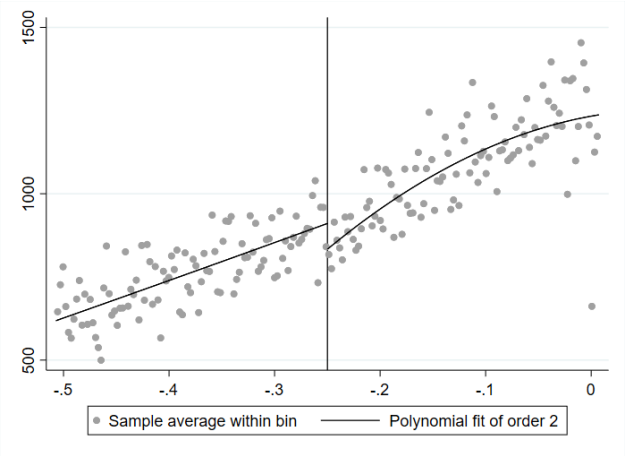
Notes: This figure shows fitted lines from sharp RDD plots with a local polynomial of order 2 for firm-level outcomes in 2021. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017).

[11] Surveys made in July and August 2021 show that financial literacy indicators are higher among small business owners than among microenterprise owners (Banco de Portugal, 2021).

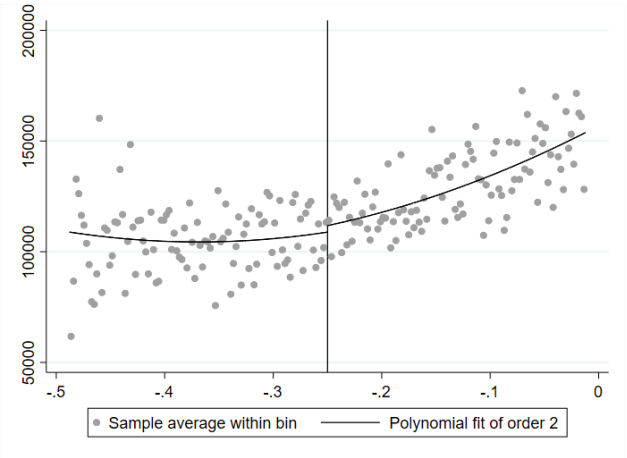
Figure 10: RDD plots – Expenditure and liabilities in 2022



Rents



Office Supplies



Investment in equipment

Notes: This figure shows fitted lines from sharp RDD plots with a local polynomial of order 2 for firm-level outcomes in 2022. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017).

We confirm these results in RDD regressions in Tables 6 for 2021 and 7 for 2022.

Table 6: Firm Liabilities and Expenditure in 2021: RDD results

	Investment in Equipment		Rents		Office Supplies		Liabilities - Shareholders	
	Sharp	**Fuzzy**	**Sharp**	**Fuzzy**	**Sharp**	**Fuzzy**	**Sharp**	**Fuzzy**
Coef.	-101.600	-0.029	1,086**	0.196	96.190***	0.019**	-10.840	-0.002
Std. Er.	506.500	0.096	553.600	0.097	35.530	0.007	10.010	0.002
Obs.left	24,981	21,625	21,488	20,102	28,127	21,774	23,734	22,633
Obs.right	29,821	24,954	24,744	22,923	34,985	25,218	28,014	26,428
Bandwidth	0.242	0.200	0.198	0.183	0.289	0.202	0.226	0.213

Notes: This table reports the ITT and ToT RD estimates for the impact of the APOIAR program on firm-level outcomes in 2021. The treatment status variable used to implement the fuzzy RD estimation is the total amount of incentives in euros. All regressions using weighted least squares (with weights given by a triangular kernel function) include a polynomial of order 2 of the distance to threshold. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017). Significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$.

Table 7: Firm Liabilities and Expenditure in 2022: RDD results

	Investment in Equipment		Rents		Office Supplies		Liabilities - Shareholders	
	Sharp	**Fuzzy**	**Sharp**	**Fuzzy**	**Sharp**	**Fuzzy**	**Sharp**	**Fuzzy**
Coef.	933.200	0.183*	944.400	0.179	78.770*	0.016**	-16.620***	-0.003***
Std. Er.	594.600	0.107	607.500	0.108	40.940	0.008	6.408	0.001
Obs.left	25,816	22,608	22,138	20,286	26,045	20,761	22,462	23,943
Obs.right	31,342	26,390	25,730	23,132	31,766	23,740	26,187	28,307
Bandwidth	0.254	0.212	0.206	0.185	0.257	0.190	0.210	0.229

Notes: This table reports the ITT and ToT RD estimates for the impact of the APOIAR program on firm-level outcomes in 2022. The treatment status variable used to implement the fuzzy RD estimation is the total amount of incentives in euros. All regressions using weighted least squares (with weights given by a triangular kernel function) include a polynomial of order 2 of the distance to threshold. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017). Significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$.

We start by pointing out that we do not observe a rise in investment in equipments in 2021 and only a noisy suggestion that spending on this item increased in 2022 in the fuzzy specification. Conditional on receiving support, we calculate a positive effect of €0.183 (per euro of subsidy received). No statistically significant effects are identified for other types of investment. These results are consistent with the increased real option value of postponing investment under uncertainty.[12]

[12] Guceri and Albinowski (2021) show that, in periods of high uncertainty, firms' investment decisions may be less responsive to changes in public policies. Harju et al. (2022) show that small firms' investment was largely unresponsive to a sizable reduction of the corporate income tax in Finland.

Firms eligible to participate in the program spent a sizable portion of the support on rental payments: €1,086 more, on average, than the counterfactual in 2021. These effects, while positive, are not precisely estimated in the fuzzy design and for both the sharp and fuzzy designs in 2022. Note that as early as April 2020, a moratorium regime was established for delays in the payment of rents under non-residential urban lease agreements. Tenants who were eligible due to income losses were allowed to defer rents due during the state of emergency and the following month, repaying the total amount over the next 12 months in monthly installments of at least one-twelfth, in addition to the rent due each month. This measure lasted until June 2021. These results suggest that treated firms were better equipped to honour these fixed costs. It is important to highlight that the variable Rents used in the analysis refers to the accounting registration of rental expenses, not to actual rent payments. As such, the observed treatment effects should be interpreted with caution. The increase in Rents may reflect the reactivation of deferred obligations, possibly triggered by the liquidity relief provided through the APOIAR subsidy. In this context, the effect may be primarily accounting-based—indicating that firms resumed or formalized rental expense recognition.

Spending on Office supplies (External supplies and services – Office supplies) increased both in 2021 and in 2022, with €96.19 more, on average, compared to the counterfactual, with this amount decreasing to €78.77 in 2022. However, this account is relatively broad and may include various types of expenditures. Although we hypothesize that part of this increase may be associated with digitization-related purchases, such as IT peripherals (e.g. printers, scanners, webcams) or home office equipment, this interpretation cannot be confirmed with the available data. These expenses were likely influenced by factors such as the acquisition of digital equipment to support remote work, online sales, and health and safety measures.[13]

Lastly, eligible firms appear to have used the subsidy to reduce debt to shareholders in 2022, with this type of debt decreasing by €16.62, on average, compared with the counterfactual, possibly to repay loans by shareholders during the early stages of the pandemic crisis.

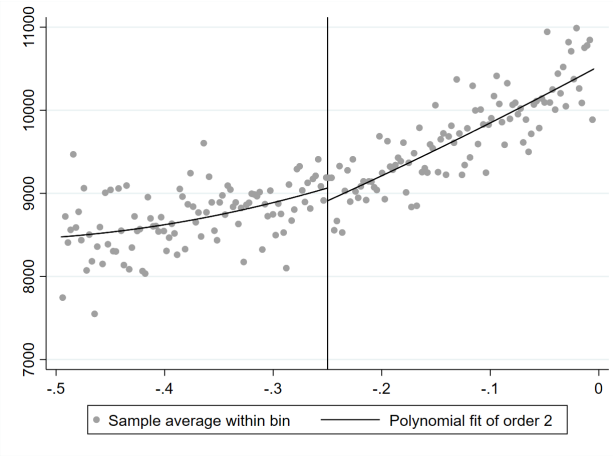
4.5 Labor Market

Lastly, we investigate whether APOIAR had a causal impact on labor market outcomes.[14] We focus our attention on average wages, total employment, total wage bill, and labor productivity (computed as value added per worker). We start by presenting the graphical inspection for potential changes at the threshold in 2021 and 2022 in Figures 11 and 12, respectively.

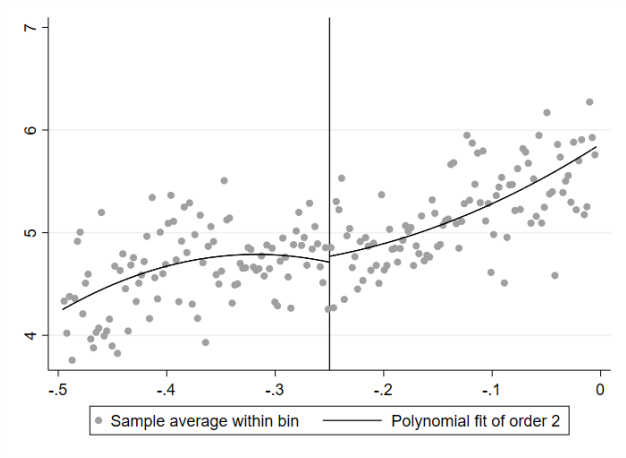
[13] Gaspar et al. (2024) present empirical support for the hypothesis that digital intensity contributed to firm resilience during the COVID-19 shock by enhancing the ability to respond quickly to new conditions by finding new revenue streams or replacing old ones.

[14] For reference, and according to Statistics Portugal, the annual unemployment rate decreased from 6.7% in 2021 to 6.2% in 2022.

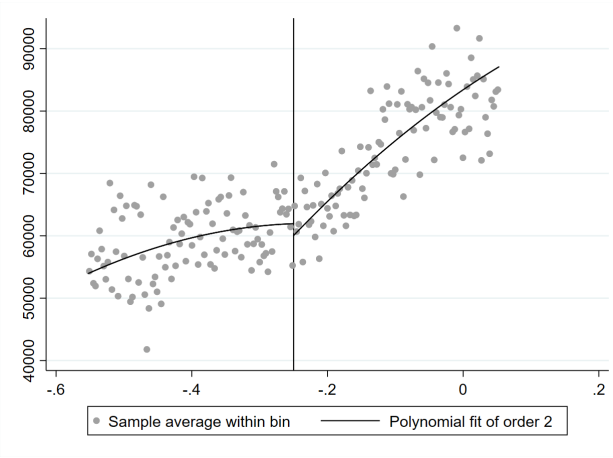
Figure 11: RDD plots – Labor Market in 2021



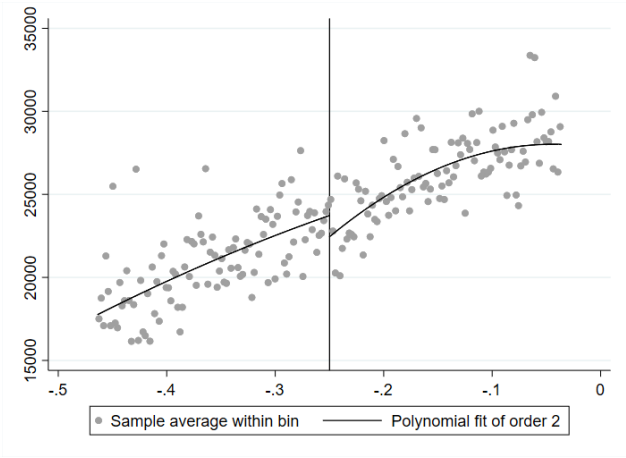
Average Wage



Total Employment



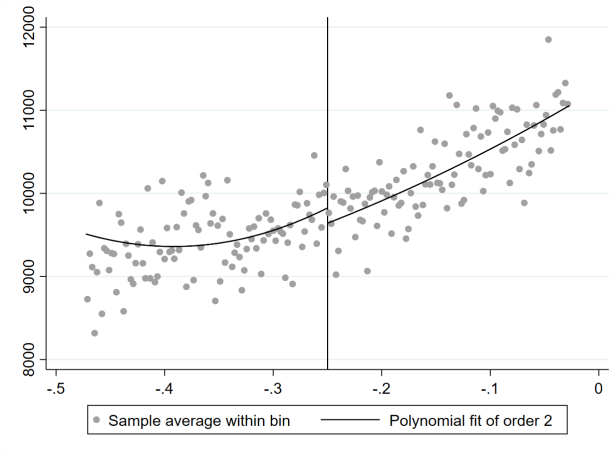
Total wage bill



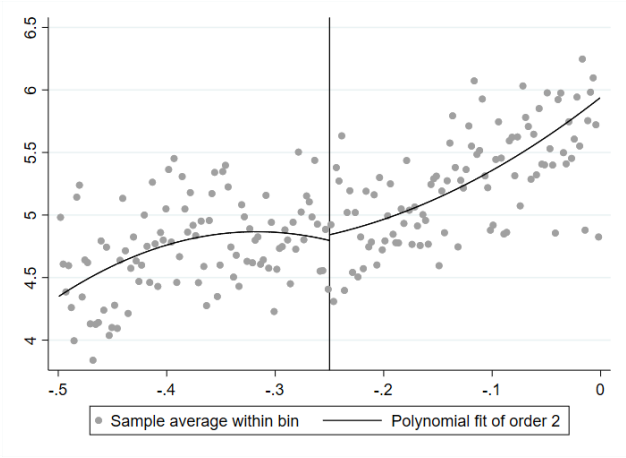
Labor productivity

Notes: This figure shows fitted lines from sharp RDD plots with a local polynomial of order 2 for firm-level outcomes in 2021. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017).

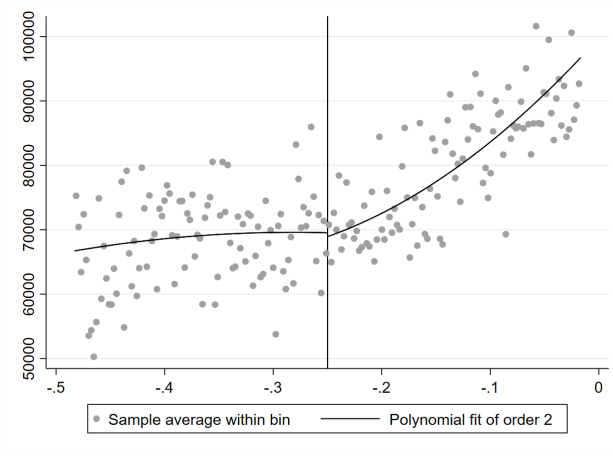
Figure 12: RDD plots – Labor Market in 2022



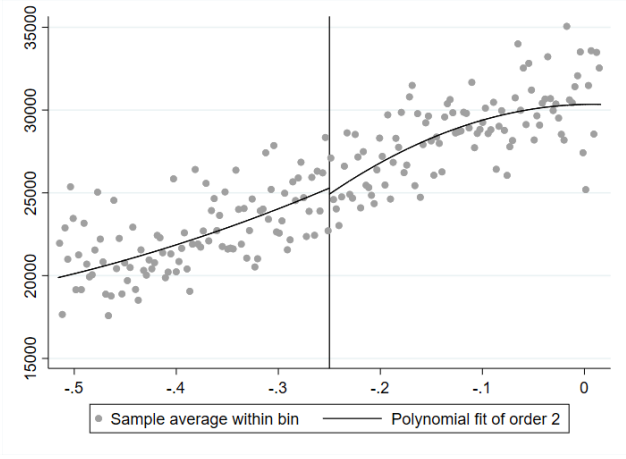
Average Wage



Total Employment



Total wage bill



Labor productivity

Notes: This figure shows fitted lines from sharp RDD plots with a local polynomial of order 2 for firm-level outcomes in 2022. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017).

Table 8: Labor market in 2021: RDD results

	Total Employment		Total Wage Bill		Average Wage		Labor Productivity	
	Sharp	**Fuzzy**	**Sharp**	**Fuzzy**	**Sharp**	**Fuzzy**	**Sharp**	**Fuzzy**
Coef.	-0.0981	-0.000	1,250.9	-0.035	121.59	0.027	1.375	0.255
Std. Er.	0.149	0.000	2,461.2	0.485	158.68	0.025	905.1	0.169
Obs.left	25,237	20,421	21,512	14,043	18,848	15,578	22,677	19,368
Obs.right	30,200	23,305	28,602	16,320	23,793	18,513	26,804	22,108
Bandwidth	0.246	0.186	0.303	0.165	0.245	0.188	0.218	0.178

Notes: This table reports the ITT and ToT RD estimates for the impact of the APOIAR program on firm-level outcomes in 2021. The treatment status variable used to implement the fuzzy RD estimation is the total amount of incentives in euros. All regressions using weighted least squares (with weights given by a triangular kernel function) include a polynomial of order 2 of the distance to threshold. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017). Significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$.

Table 9: Labor market in 2022: RDD results

	Total Employment		Total Wage Bill		Average Wage		Labor Productivity	
	Sharp	**Fuzzy**	**Sharp**	**Fuzzy**	**Sharp**	**Fuzzy**	**Sharp**	**Fuzzy**
Coef.	-0.0857	-0.000	-255.55	-0.121	176.72	0.038	520.3	0.081
Std. Er.	0.157	0.000	3,198.8	0.538	183.45	0.028	877.2	0.171
Obs.left	25,459	20,720	17,898	13,769	17,292	14,683	27,146	20,992
Obs.right	30,549	23,695	22,402	16,119	21,465	17,394	34,452	24,640
Bandwidth	0.249	0.190	0.233	0.165	0.222	0.179	0.290	0.202

Notes: This table reports the ITT and ToT RD estimates for the impact of the APOIAR program on firm-level outcomes in 2022. The treatment status variable used to implement the fuzzy RD estimation is the total amount of incentives in euros. All regressions using weighted least squares (with weights given by a triangular kernel function) include a polynomial of order 2 of the distance to threshold. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017). Significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$.

Overall, analyzing various employment-related variables in RDD regressions, shown in Table 8 for 2021 and 9 for 2022, we did not find significant effects. Our results suggest the subsidies did little to preserve job matches. This is consistent with the results of Granja et al. (2022) for the U.S. and Smart et al. (2025) for Canada. This lack of impact may be attributed to the simplified layoff program implemented during the first half of 2020, which effectively reduced layoffs for all firms.

5 Robustness

In this section, we analyze the robustness of our main estimates to variations in methodological choices, including polynomial order, bandwidth selection, and the inclusion of covariates. We present the results in Section D in the Appendix.

First, we show in Tables R2 and R3 that our results remain robust if we rely on a linear rather than a quadratic polynomial. Next, we reduce and extend the optimal bandwidth à la Calonico et al. (2017), for each outcome variable, by 10%. We highlight that all results remain consistent in Tables R4 and R5 for a reduced and in Tables R6 and R7 for an augmented sample. We also include different vectors of fixed effects to mitigate concerns about systematic differences between firms near the threshold. Specifically, we control for region- (in Tables R8 and R9), sector- (in Tables R10 and R11), and sector- and region-fixed effects (in Tables R12 and R13).[15] As can be seen, the point estimates are very similar to the baseline, lending further credibility to the internal validity of our identification strategy.

6 Concluding remarks

This paper studies the causal effects of APOIAR, a program aimed at providing liquidity to the firms in sectors most affected by the COVID-19 pandemic. Relying on sharp and fuzzy RDD and combining data from several administrative data sources, we find a rise in short-term profitability, as demonstrated by a significant increase in net income in 2021. This is coupled with modest increases in spending in categories like rents and office supplies. However, these effects were short-lived, with no persistence into 2022, highlighting the program's limited capacity to drive sustained financial resilience.

While the subsidy may have contributed to firms' operational adjustments, its impact on broader metrics such as turnover, employment, wages, and survival rates was negligible. This underscores the need for timely support to boost confidence and complementary measures to strengthen firms' long-term adaptability and competitiveness, such as fostering innovation, facilitating access to credit, and enhancing digital transformation.

Heterogeneity analyzes reveal that firms with higher sales and productivity before the pandemic did not use part of the subsidy in 2021. This suggests that targeted financial support may yield the greatest returns when directed toward firms with greater initial capacity to leverage the assistance effectively.

Our results apply to the subpopulation of firms that rank near the threshold. We acknowledge that these may not be representative of the most in need of public support if targeting was not sufficiently adequate (Bertanha and Imbens, 2020). Hence, while the RDD estimates causal effects for these firms, known as local average treatment effects (LATE), it does not allow one to draw conclusions about the ATE or the overall effectiveness induced by the policy.

[15] These vectors include the ten sectors of activity described in Table 1 and 5 regions in mainland Portugal (North, Center, Lisbon, Alentejo, and Algarve).

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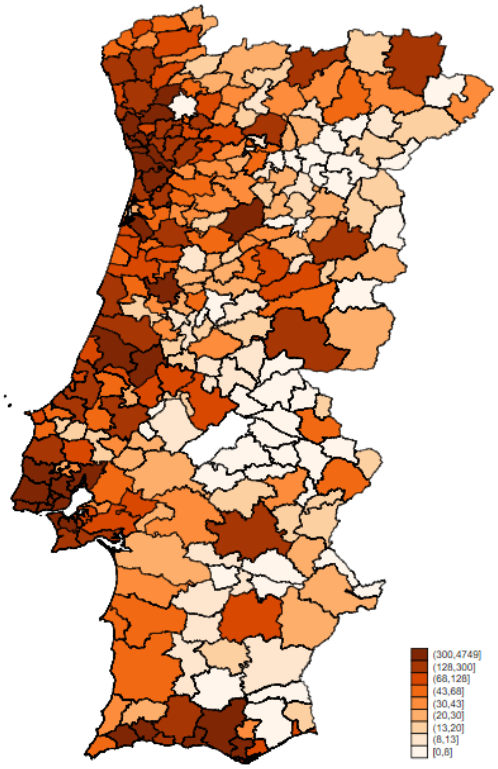
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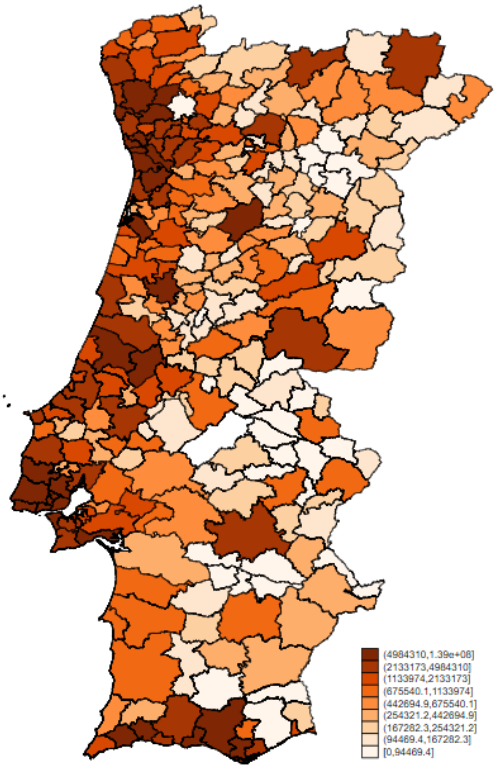
Appendix

A Figures

Figure A1: Comparison of Beneficiaries and Incentives in 2020

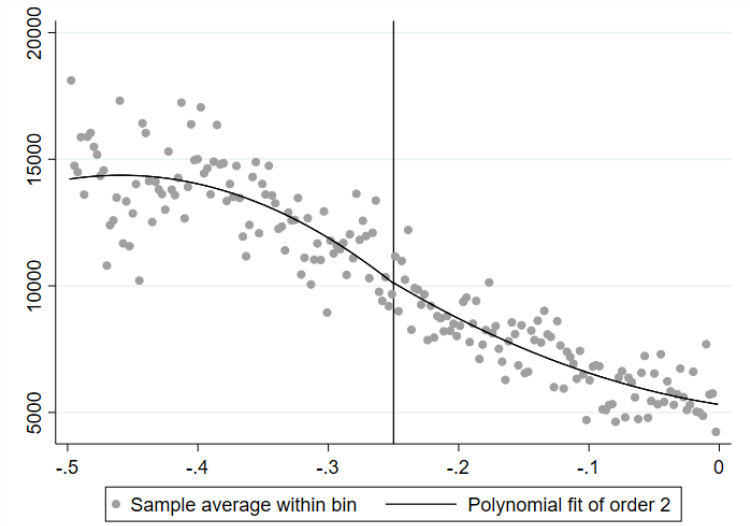


(a) Beneficiaries, nr (2020)



(b) Incentives, nr (2020)

Figure A2: Subsidies (excluding APOIAR)



Notes: This figure shows fitted lines from sharp RDD plots with a local polynomial of order 2 for the sum of operating subsidies (net of the Apoiar program) in 2020, 2021, and 2022. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017).

B Take-up

Table A1: RDD Results: Take-up

	Sharp	**Fuzzy**
Coef.	5,270.1***	15,174***
Std. Er.	361.69	801.64
Obs. (left)	17,245	20,969
Obs. (right)	19,177	24,030
Bandwidth	0.152	0.193

Notes: This table reports RD estimates for program take-up. The fuzzy specification corresponds to the treatment effect and the treatment status variable used to implement the fuzzy RD estimation is a binary indicator that turns value one if the firm received an APOIAR grant, and zero otherwise. All estimates use local polynomial regression with triangular kernel weights, second-order polynomial, and MSE-optimal bandwidths following Calonico et al. (2017). Standard errors are heteroskedasticity-robust. Significance levels: * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.

C Heterogeneity

C.1 Probability of Bankruptcy

Table H1: Survival — Heterogeneity by tercile — Sharp RDD

	Turnover			**Productivity**		
	T1	**T2**	**T3**	**T1**	**T2**	**T3**
Coef.	0.004	0.002	0.004	0.009	0.000	0.004
Std. Er.	0.010	0.007	0.006	0.011	0.007	0.006
Obs. (left)	9,346	7,874	6,854	9,096	8,225	6,587
Obs. (right)	9,277	8,967	9,615	8,569	9,759	9,210
Bandwidth	0.285	0.201	0.208	0.263	0.217	0.199
	Indebtedness			**Cash-to-assets**		
	T1	**T2**	**T3**	**T1**	**T2**	**T3**
Coef.	0.012	-0.005	0.008	-0.000	0.004	0.007
Std. Er.	0.009	0.006	0.009	0.009	0.007	0.008
Obs. (left)	7,273	8,510	7,822	7,917	7,627	7,913
Obs. (right)	8,855	10,861	8,208	8,964	9,667	8,976
Bandwidth	0.203	0.254	0.218	0.232	0.223	0.214

Notes: This table reports the ITT and ToT RD estimates for the impact of the APOIAR program on firm-level outcomes in 2021. The treatment status variable used to implement the fuzzy RD estimation is the total amount of incentives in euros. All regressions using weighted least squares (with weights given by a triangular kernel function) include a polynomial of order 2 of the distance to threshold. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017). The universe of firms is divided in terciles according to pre-pandemic characteristics (measured in 2019). Significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$.

Table H2: Survival — Heterogeneity by tercile — Fuzzy RDD

	Turnover			Productivity		
	T1	**T2**	**T3**	**T1**	**T2**	**T3**
Coef.	0.000	0.000	0.000	0.000	0.000	0.000
Std. Er.	0.000	0.000	0.000	0.000	0.000	0.000
Obs. (left)	9,706	7,382	7,778	6,240	8,257	7,873
Obs. (right)	9,614	8,329	11,749	5,777	9,798	12,210
Bandwidth	0.300	0.185	0.250	0.169	0.218	0.261

	Indebtedness			Cash-to-assets		
	T1	**T2**	**T3**	**Q1**	**Q2**	**Q3**
Coef.	0.000	-0.000	0.000	0.000	0.000	0.000
Std. Er.	0.000	0.000	0.000	0.000	0.000	0.000
Obs. (left)	9,118	8,672	6,879	9,456	5,732	10,473
Obs. (right)	12,152	11,155	7,146	11,314	6,765	12,728
Bandwidth	0.283	0.261	0.187	0.297	0.155	0.324

Notes: This table reports the ITT and ToT RD estimates for the impact of the APOIAR program on firm-level outcomes in 2021. The treatment status variable used to implement the fuzzy RD estimation is the total amount of incentives in euros. All regressions using weighted least squares (with weights given by a triangular kernel function) include a polynomial of order 2 of the distance to threshold. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017). The universe of firms is divided in terciles according to pre-pandemic characteristics (measured in 2019). Significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$.

Table H3: Firm Performance - 2021 and 2022 - Firm Size - Micro

Firm Performance - 2021										
	Net Income		Turnover		Total Assets		Equity		Total Expenses	
	Sharp	**Fuzzy**	**Sharp**	**Fuzzy**	**Sharp**	**Fuzzy**	**Sharp**	**Fuzzy**	**Sharp**	**Fuzzy**
Coef.	2,587**	0.408*	-1,348	-0.013	8,095	0.285	3,626	-0.693	-2,633	-0.036
Std. Er.	1,240	0.231	14,048	4.051	14,043	3.385	8,177	2.015	13,197	3.889
Obs.left	17,515	28,816	19,705	18,694	20,565	24,431	20,474	24,162	20,035	18,401
Obs.right	19,959	36,329	22,970	21,575	24,156	30,351	24,061	30,001	23,431	21,221
Bandwidth	0.189	0.394	0.219	0.205	0.232	0.299	0.231	0.294	0.224	0.201

Firm Performance - 2022										
	Net Income		Turnover		Total Assets		Equity		Total Expenses	
	Sharp	**Fuzzy**	**Sharp**	**Fuzzy**	**Sharp**	**Fuzzy**	**Sharp**	**Fuzzy**	**Sharp**	**Fuzzy**
Coef.	613.600	-0.122	-380.800	-0.556	2,784	-0.190	1,440	-1.385	-1,536	-1.194
Std. Er.	1,287	0.334	16,003	4.462	14,975	4.135	8,784	2.045	15,116	4.159
Obs.left	22,554	24,705	19,796	19,841	20,970	21,438	20,751	25,525	19,499	20,050
Obs.right	27,480	30,706	23,085	23,166	24,719	25,424	24,411	31,939	22,734	23,456
Bandwidth	0.265	0.304	0.221	0.221	0.238	0.246	0.235	0.320	0.217	0.224

Notes: This table reports the ITT and ToT RD estimates for the impact of the APOIAR program on firm-level outcomes in 2021. The treatment status variable used to implement the fuzzy RD estimation is the total amount of incentives in euros. All regressions using weighted least squares (with weights given by a triangular kernel function) include a polynomial of order 2 of the distance to threshold. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017). Significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$.

C.2 Firm Performance

Table H4: Firm Performance - 2021 and 2022 - Firm Size - Small

Firm Performance - 2021										
	Net Income		Turnover		Total Assets		Equity		Total Expenses	
	Sharp	**Fuzzy**	**Sharp**	**Fuzzy**	**Sharp**	**Fuzzy**	**Sharp**	**Fuzzy**	**Sharp**	**Fuzzy**
Coef.	6,543	0.367	-54,855	-0.963	-77,134	-4.382	-49,411	-2.793	-60,774	-0.231
Std. Er.	6,892	0.362	89,337	5.143	88,535	4.481	48,037	2.506	77,135	4.848
Obs.left	3,525	3,424	4,105	3,401	3,815	3,713	3,464	3,413	4,465	3,292
Obs.right	4,299	4,114	5,229	4,070	4,789	4,623	4,204	4,084	5,814	3,882
Bandwidth	0.222	0.212	0.272	0.210	0.248	0.239	0.217	0.211	0.309	0.201

Firm Performance - 2022										
	Net Income		Turnover		Total Assets		Equity		Total Expenses	
	Sharp	**Fuzzy**	**Sharp**	**Fuzzy**	**Sharp**	**Fuzzy**	**Sharp**	**Fuzzy**	**Sharp**	**Fuzzy**
Coef.	-1,901	-0.093	-102,635	0.318	-86,628	-2.499	-59,671	-2.544	-84,141	0.602
Std. Er.	8,061	0.421	94,555	6.239	93,648	5.273	51,993	2.886	88,178	5.805
Obs.left	3,616	3,452	4,535	3,184	3,918	3,382	3,639	3,279	4,434	3,118
Obs.right	4,459	4,188	5,910	3,686	4,932	4,048	4,492	3,855	5,764	3,597
Bandwidth	0.229	0.216	0.316	0.191	0.256	0.209	0.231	0.200	0.306	0.186

Notes: This table reports the ITT and ToT RD estimates for the impact of the APOIAR program on firm-level outcomes in 2021. The treatment status variable used to implement the fuzzy RD estimation is the total amount of incentives in euros. All regressions using weighted least squares (with weights given by a triangular kernel function) include a polynomial of order 2 of the distance to threshold. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017). Significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$.

D Robustness

D.1 Probability of Bankruptcy

Table R1: **RDD Robust - Survival analysis**

	Conditional to Sector				Conditional to Region			
	Survival 2021		Survival 2022		Survival 2021		Survival 2022	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	0.003	0.000	0.001	0.000	0.003	0.000	0.001	0.000
Std. Er.	0.004	0.001	0.005	0.001	0.004	0.001	0.005	0.001
Obs. (left)	26,361	21,296	30,048	22,949	26,702	24,113	30,175	23,622
Obs. (right)	32,258	24,459	37,845	26,922	32,818	28,554	38,006	27,829
Bandwidth	0.262	0.196	0.320	0.216	0.267	0.231	0.322	0.225

	Conditional to Sector and Region				Polynomial 1			
	Survival 2021		Survival 2022		Survival 2021		Survival 2022	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	0.003	0.000	0.001	0.000	0.004	0.000	0.001	0.000
Std. Er.	0.004	0.001	0.005	0.001	0.004	0.001	0.005	0.001
Obs. (left)	26,436	17,292	30,138	17,970	18,902	17,493	22,325	19,753
Obs. (right)	32,346	19,239	37,963	20,143	21,386	19,507	26,013	22,414
Bandwidth	0.263	0.152	0.321	0.160	0.170	0.154	0.209	0.179

	Firm Size - Micro				Firm Size - Small			
	Survival 2021		Survival 2022		Survival 2021		Survival 2022	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	0.006	0.002	0.003	0.000	-0.005	-0.000	-0.004	-0.000
Std. Er.	0.005	0.001	0.006	0.002	0.007	0.000	0.010	0.001
Obs. (left)	23,221	22,267	25,897	21,562	4,108	3,472	4,419	3,651
Obs. (right)	28,518	27,062	32,418	25,624	5,235	4,224	5,745	4,512
Bandwidth	0.277	0.260	0.327	0.248	0.272	0.218	0.304	0.232

Notes: This table reports the ITT and ToT RD estimates for the impact of the APOIAR program on firm-level outcomes in 2021. The treatment status variable used to implement the fuzzy RD estimation is the total amount of incentives in euros. All regressions using weighted least squares (with weights given by a triangular kernel function) include a polynomial of order 2 of the distance to threshold. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017). Significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$.

D.2 Firm Performance

Table R2: RDD Robustness in 2021: polynomial of order 1

Firm Performance - 2021										
	Net Income		Turnover		Total Expenses		Total Assets		Equity	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	2,832**	0.629***	7,344.600	2.031	7,264	1.934	10,035	1.752	-384.900	0.094
Std. Er.	1,111	0.240	19,379	3.420	18,274	3.234	16,681	2.645	8,823	1.468
Obs.left	20,178	12,124	17,696	13,076	17,412	12,898	19,986	17,385	20,180	15,902
Obs.right	23,001	12,984	19,744	14,043	19,391	13,841	22,757	19,356	23,004	17,453
Bandwidth	0.184	0.102	0.156	0.111	0.153	0.109	0.181	0.153	0.184	0.138

Firm Liabilities and Expenditure - 2021								
	Investment in Equipment		Rents		Office Supplies		Liabilities - Shareholders	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	116.240	0.025	691.200	0.153	98.080***	0.016	-4.890	-0.001
Std. Er.	420.600	0.059	397.020	0.075	32.510	0.005	8.046	0.001
Obs.left	20,096	19,198	20,289	13,790	17,215	15,375	19,990	16,661
Obs.right	22,914	21,726	23,134	14,895	19,132	16,861	22,766	18,461
Bandwidth	0.183	0.173	0.185	0.117	0.151	0.133	0.182	0.146

Employment - 2021						
	Total Employment		Salaries of Employees		Average Wage	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	-0.006	-0.000	2,026.600	0.026	176.310	0.024
Std. Er.	0.130	0.000	2,202.500	0.402	133.720	0.020
Obs.left	19,007	14,016	16,388	8,972	14,355	10,716
Obs.right	21,496	15,181	19,791	9,865	16,797	11,970
Bandwidth	0.171	0.120	0.202	0.099	0.170	0.120

Notes: This table reports the ITT and ToT RD estimates for the impact of the APOIAR program on firm-level outcomes in 2021. The treatment status variable used to implement the fuzzy RD estimation is the total amount of incentives in euros. All regressions using weighted least squares (with weights given by a triangular kernel function) include a polynomial of order 1 of the distance to threshold. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017). Significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$.

Table R3: RDD Robustness in 2022: polynomial of order 1

Firm Performance - 2022										
	Net Income		Turnover		Total Expenses		Total Assets		Equity	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	971.390	0.208	12,597	2.321	9,899.500	2.054	4,405.500	1.002	-643.400	-0.323
Std. Er.	1,687.400	0.198	23,491	3.805	21,457	3.601	17,957	2.920	9,080	1.627
Obs.left	15,069	19,467	16,123	13,581	16,547	13,213	19,979	16,892	21,188	15,823
Obs.right	16,471	22,074	17,763	14,666	18,326	14,210	22,730	18,773	24,296	17,378
Bandwidth	0.130	0.176	0.140	0.116	0.145	0.112	0.181	0.148	0.195	0.137

Firm Liabilities and Expenditure - 2022								
	Investment in Equipment		Rents		Office Supplies		Liabilities - Shareholders	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	844.960	0.135	660.740	0.137	78.250**	0.013	-11.960**	-0.002**
Std. Er.	541.800	0.086	451.470	0.085	37.070	0.005	5.410	0.001
Obs.left	16,634	15,368	19,788	13,582	17,188	18,836	17,229	17,857
Obs.right	18,434	16,841	22,461	14,669	19,107	21,290	19,160	20,001
Bandwidth	0.145	0.133	0.179	0.116	0.151	0.169	0.152	0.158

Employment - 2022						
	Total Employment		Salaries of Employees		Average Wage	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	0.006	-0.000	1,553.500	0.116	156.280	0.024
Std. Er.	0.136	0.000	2,677.700	0.428	147.870	0.017
Obs.left	19,641	13,687	15,032	9,405	14,156	13,779
Obs.right	22,282	14,780	17,907	10,430	16,697	16,145
Bandwidth	0.177	0.116	0.184	0.106	0.171	0.165

Notes: This table reports the ITT and ToT RD estimates for the impact of the APOIAR program on firm-level outcomes in 2021. The treatment status variable used to implement the fuzzy RD estimation is the total amount of incentives in euros. All regressions using weighted least squares (with weights given by a triangular kernel function) include a polynomial of order 1 of the distance to threshold. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017). Significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$.

Table R4: RDD Robustness in 2021: reducing optimal bandwidth by 10%

Firm Performance - 2021										
	Net Income		Turnover		Total Expenses		Total Assets		Equity	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	3,329*	0.598*	17,451	1.961	16,481	1.421	17,398	3.150	7,796	1.348
Std. Er.	1,930	0.359	26,182	5.148	24,235	4.831	25,866	4.914	13,436	2.532
Obs.left	19,431	17,878	23,064	18,929	23,465	18,793	22,371	19,472	21,986	19,551
Obs.right	22,023	20,031	27,070	21,411	27,617	21,244	26,072	22,079	25,509	22,173
Bandwidth	0.175	0.159	0.218	0.170	0.223	0.169	0.209	0.176	0.205	0.176

Firm Liabilities and Expenditure - 2021								
	Investment in Equipment		Rents		Office Supplies		Liabilities - Shareholders	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	56.380	0.018	335.300	0.054	112	0.024	-13.050	-0.002
Std. Er.	618	0.119	680.300	0.122	43.210	0.009	12.390	0.002
Obs.left	23,073	19,908	19,745	18,445	26,216	20,022	21,901	20,859
Obs.right	27,083	22,615	22,412	20,747	32,049	22,826	25,385	23,886
Bandwidth	0.218	0.180	0.179	0.165	0.260	0.182	0.204	0.191

Employment - 2021						
	Total Employment		Salaries of Employees		Average Wage	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	-0.154	-0.000	-793.300	-0.033	268.510	0.054
Std. Er.	0.187	0.000	3,096.800	0.604	195.490	0.032
Obs.left	23,358	18,721	20,163	12,890	17,513	14,333
Obs.right	27,453	21,153	26,206	14,785	21,558	16,777
Bandwidth	0.221	0.168	0.272	0.149	0.221	0.170

Notes: This table reports the ITT and ToT RD estimates for the impact of the APOIAR program on firm-level outcomes in 2021. The treatment status variable used to implement the fuzzy RD estimation is the total amount of incentives in euros. All regressions using weighted least squares (with weights given by a triangular kernel function) include a polynomial of order 2 of the distance to threshold. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017). Significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$.

Table R5: RDD Robustness in 2022: reducing optimal bandwidth by 10%

Firm Performance - 2022										
	Net Income		Turnover		Total Expenses		Total Assets		Equity	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	796.1	0.088	21,351	2.125	19,290	1.474	12,274	2.114	3,236	0.467
Std. Er.	2,150.2	0.409	29,476	5.936	27,215	5.472	27,361	5.123	14,623	2.724
Obs.left	22,329	19,469	23,643	18,522	23,706	18,580	22,951	20,356	22,369	20,218
Obs.right	26,020	22,075	27,869	20,869	27,974	20,963	26,925	23,244	26,067	23,040
Bandwidth	0.209	0.176	0.225	0.166	0.226	0.166	0.216	0.186	0.209	0.184

Firm Liabilities and Expenditure - 2022								
	Investment in Equipment		Rents		Office Supplies		Liabilities - Shareholders	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	1,300*	0.285**	340.600	0.037	102	0.022	-21.770***	-0.004***
Std. Er.	733.500	0.138	744.400	0.136	49.760	0.010	8.061	0.001
Obs.left	23,902	20,842	20,366	18,578	24,141	19,040	20,704	22,084
Obs.right	28,241	23,860	23,251	20,963	28,580	21,537	23,679	25,670
Bandwidth	0.228	0.191	0.186	0.166	0.231	0.171	0.189	0.206

Employment - 2022						
	Total Employment		Salaries of Employees		Average Wage	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	-0.107	-0.000	826.400	0.081	320.970	0.054
Std. Er.	0.196	0.000	3,992.200	0.669	222.770	0.035
Obs.left	23,592	19,008	30,829	12,646	16,013	13,489
Obs.right	27,782	21,497	20,260	14,604	19,364	15,727
Bandwidth	0.224	0.171	0.210	0.149	0.200	0.161

Notes: This table reports the ITT and ToT RD estimates for the impact of the APOIAR program on firm-level outcomes in 2021. The treatment status variable used to implement the fuzzy RD estimation is the total amount of incentives in euros. All regressions using weighted least squares (with weights given by a triangular kernel function) include a polynomial of order 2 of the distance to threshold. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017). Significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$.

Table R6: RDD Robustness in 2021: augmenting optimal bandwidth by 10%

Firm Performance - 2021										
	Net Income		Turnover		Total Expenses		Total Assets		Equity	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	3,719**	0.676**	7,423	3.160	6,043	2.881	11,787	3.014	3,939	1.249
Std. Er.	1,757	0.319	23,852	4.633	22,108	4.345	23,506	4.424	12,184	2.279
Obs.left	22,750	21,086	26,678	22,234	27,086	22,086	25,978	22,811	25,548	22,872
Obs.right	26,620	24,188	32,780	25,861	33,405	25,672	31,633	26,692	30,958	26,812
Bandwidth	0.214	0.194	0.266	0.208	0.272	0.206	0.256	0.215	0.250	0.216

Firm Liabilities and Expenditure - 2021								
	Investment in Equipment		Rents		Office Supplies		Liabilities - Shareholders	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	-164.200	0.009	895.600	0.128	97.290**	0.023	-13.430	-0.002
Std. Er.	561.300	0.107	616.600	0.109	39.370	0.008	11.210	0.002
Obs.left	26,690	23,288	23,090	21,688	29,930	23,448	25,440	24,346
Obs.right	32,804	27,334	27,118	25,083	37,665	27,584	30,527	28,840
Bandwidth	0.267	0.220	0.218	0.201	0.317	0.222	0.249	0.234

Employment - 2021						
	Total Employment		Salaries of Employees		Average Wage	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	-0.165	-0.000	-495.730	-0.033	201.850	0.041
Std. Er.	0.170	0.000	2,825.600	0.604	177.710	0.028
Obs.left	26,969	22,011	22,728	12,890	20,042	16,727
Obs.right	33,219	25,534	30,782	14,785	26,000	20,291
Bandwidth	0.270	0.205	0.333	0.149	0.270	0.207

Notes: This table reports the ITT and ToT RD estimates for the impact of the APOIAR program on firm-level outcomes in 2021. The treatment status variable used to implement the fuzzy RD estimation is the total amount of incentives in euros. All regressions using weighted least squares (with weights given by a triangular kernel function) include a polynomial of order 2 of the distance to threshold. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017). Significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$.

Table R7: RDD Robustness in 2022: augmenting optimal bandwidth by 10%

Firm Performance - 2022										
	Net Income		Turnover		Total Expenses		Total Assets		Equity	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	941.800	0.151	8,784	3.603	6,844	3.197	7,840	2.220	308	0.453
Std. Er.	1,953	0.368	26,957	5.334	24,909	4.925	24,877	4.641	13,260	2.464
Obs.left	25,938	22,806	27,287	21,794	27,338	21,869	26,570	23,803	25,975	23,629
Obs.right	31,574	26,690	33,664	25,242	33,750	25,353	32,562	28,110	31,625	27,839
Bandwidth	0.255	0.215	0.275	0.202	0.276	0.203	0.265	0.227	0.256	0.225

Firm Liabilities and Expenditure - 2022								
	Investment in Equipment		Rents		Office Supplies		Liabilities - Shareholders	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	1,001	0.227*	903.600	0.118	80.420*	0.018	-21.160***	-0.004***
Std. Er.	666.600	0.125	674.400	0.121	45.210	0.009	7.300	0.001
Obs.left	27,536	24,323	23,811	21,868	27,774	22,335	24,165	25,664
Obs.right	34,033	28,815	28,122	25,352	34,411	26,031	28,601	31,130
Bandwidth	0.279	0.234	0.227	0.203	0.283	0.209	0.232	0.252

Employment - 2022						
	Total Employment		Salaries of Employees		Average Wage	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	-0.144	-0.000	328.690	0.081	294.930	0.047
Std. Er.	0.179	0.000	3,642.900	0.669	201.960	0.031
Obs.left	27,223	22,290	19,048	12,646	18,483	15,820
Obs.right	33,564	25,964	24,524	14,604	23,468	19,029
Bandwidth	0.274	0.209	0.256	0.149	0.245	0.197

Notes: This table reports the ITT and ToT RD estimates for the impact of the APOIAR program on firm-level outcomes in 2021. The treatment status variable used to implement the fuzzy RD estimation is the total amount of incentives in euros. All regressions using weighted least squares (with weights given by a triangular kernel function) include a polynomial of order 2 of the distance to threshold. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017). Significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$.

Table R8: RDD Robustness in 2021: including NUTS 2 regional fixed effects

Firm Performance - 2021										
	Net Income		Turnover		Total Expenses		Total Assets		Equity	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	3.482**	0.656**	5.209	2.294	3.864	2.244	6.380	2.070	-1.476	0.371
Std. Er.	1.593	0.283	21.689	4.153	20.044	3.901	21.350	3.944	11.030	2.024
Obs.left	21,068	19,102	24,942	19,990	25,349	19,915	24,259	20,132	23,844	20,220
Obs.right	24,168	21,627	29,750	22,766	30,365	22,627	28,722	22,949	28,161	23,041
Bandwidth	0.194	0.172	0.242	0.182	0.247	0.180	0.233	0.183	0.228	0.184

Firm Liabilities and Expenditure - 2021								
	Investment in Equipment		Rents		Office Supplies		Liabilities - Shareholders	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	-93.140	-0.022	1.013*	0.180*	94.960***	0.020***	-11.440	-0.002
Std. Er.	506.200	0.096	550.200	0.097	35.830	0.007	10.020	0.002
Obs.left	24,956	21,044	21,576	19,847	27,773	20,664	23,678	22,644
Obs.right	29,791	24,121	24,871	22,534	34,402	23,610	27,933	26,457
Bandwidth	0.242	0.193	0.200	0.180	0.283	0.189	0.226	0.213

Employment - 2021						
	Total Employment		Salaries of Employees		Average Wage	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	-0.100	-0.000	-867.870	-0.098	101.160	0.024
Std. Er.	0.149	0.000	2,734.100	0.486	146.190	0.025
Obs.left	25,190	20,153	18,347	14,005	20,246	15,025
Obs.right	30,154	22,978	22,886	16,272	26,339	17,696
Bandwidth	0.245	0.183	0.236	0.165	0.274	0.180

Notes: This table reports the ITT and ToT RD estimates for the impact of the APOIAR program on firm-level outcomes in 2021. The treatment status variable used to implement the fuzzy RD estimation is the total amount of incentives in euros. All regressions using weighted least squares (with weights given by a triangular kernel function) include a polynomial of order 2 of the distance to threshold. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017). We include a vector of 5 NUTS 2 regions in mainland Portugal (North, Center, Lisbon, Alentejo, and Algarve).Significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$.

Table R9: RDD Robustness in 2022: including NUTS 2 regional fixed effects

Firm Performance - 2022										
	Net Income		Turnover		Total Expenses		Total Assets		Equity	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	735.100	0.163	4.299	2.927	2.626	2.644	3.081	1.370	-3.520	-0.230
Std. Er.	1.773	0.326	24.384	4.804	22.505	4.435	22.626	4.121	12.025	2.185
Obs.left	24,130	20,372	25,495	19,722	25,586	19,779	24,838	20,766	24,267	20,772
Obs.right	28,568	23,260	30,603	22,391	31,014	22,450	29,591	23,743	28,733	23,749
Bandwidth	0.231	0.186	0.250	0.178	0.251	0.179	0.240	0.190	0.233	0.190

Firm Liabilities and Expenditure - 2022								
	Investment in Equipment		Rents		Office Supplies		Liabilities - Shareholders	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	933.500	0.186*	862.700	0.163	76.400*	0.015*	-17.170***	-0.003***
Std. Er.	592.500	0.110	604.300	0.108	41.040	0.008	6.417	0.001
Obs.left	25,926	20,961	22,214	20,069	25,921	19,968	22,364	24,122
Obs.right	31,557	24,012	25,827	22,883	31,547	22,709	26,063	28,563
Bandwidth	0.255	0.192	0.207	0.183	0.255	0.181	0.209	0.231

Employment - 2022						
	Total Employment		Salaries of Employees		Average Wage	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	-0.088	-0.000	-596.380	0.043	133.610	0.034
Std. Er.	0.157	0.000	3,264.900	0.540	180.140	0.028
Obs.left	25,429	20,329	17,266	13,730	17,505	14,421
Obs.right	30,502	23,193	21,411	16,073	21,827	17,051
Bandwidth	0.249	0.185	0.222	0.164	0.226	0.175

Notes: This table reports the ITT and ToT RD estimates for the impact of the APOIAR program on firm-level outcomes in 2021. The treatment status variable used to implement the fuzzy RD estimation is the total amount of incentives in euros. All regressions using weighted least squares (with weights given by a triangular kernel function) include a polynomial of order 2 of the distance to threshold. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017). We include a vector of 5 NUTS 2 regions in mainland Portugal (North, Center, Lisbon, Alentejo, and Algarve). Significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$.

Table R10: RDD Robustness in 2021: including sector of activity fixed effects

Firm Performance - 2021										
	Net Income		Turnover		Total Expenses		Total Assets		Equity	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	3.369**	0.612**	-469	0.789	-1.267	0.783	2.116	0.952	-3.011	-0.064
Std. Er.	1.574	0.271	21.556	3.950	19.831	3.703	21.097	3.785	10.957	1.975
Obs.left	21,098	20,092	23,803	20,710	24,326	20,581	24,064	20,941	23,667	20,702
Obs.right	24,196	22,912	28,112	23,683	28,821	23,498	28,472	23,982	27,914	23,671
Bandwidth	0.194	0.183	0.227	0.189	0.234	0.188	0.230	0.192	0.225	0.189

Firm Liabilities and Expenditure - 2021								
	Investment in Equipment		Rents		Office Supplies		Liabilities - Shareholders	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	-103.600	-0.017	1.037*	0.182*	87.310**	0.018***	-11.960	-0.002
Std. Er.	518	0.093	549.800	0.096	34.670	0.007	10.070	0.002
Obs.left	23,543	21,410	21,554	19,809	28,319	20,719	23,364	22,593
Obs.right	27,708	24,612	24,841	22,487	35,294	23,692	27,464	26,369
Bandwidth	0.224	0.197	0.199	0.179	0.291	0.190	0.221	0.212

Employment - 2021						
	Total Employment		Salaries of Employees		Average Wage	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	-0.036	-0.000	-254.430	0.002	174.710	0.023
Std. Er.	0.143	0.000	2,658.100	0.469	136.180	0.025
Obs.left	26,104	20,140	18,994	14,203	22,199	15,098
Obs.right	31,864	22,959	24,007	16,585	29,854	17,827
Bandwidth	0.258	0.183	0.248	0.168	0.320	0.181

Notes: This table reports the ITT and ToT RD estimates for the impact of the APOIAR program on firm-level outcomes in 2021. The treatment status variable used to implement the fuzzy RD estimation is the total amount of incentives in euros. All regressions using weighted least squares (with weights given by a triangular kernel function) include a polynomial of order 2 of the distance to threshold. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017). We include a vector of ten sectors of activity described in Table 1. Significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$.

Table R11: RDD Robustness in 2022: including sector of activity fixed effects

Firm Performance - 2022										
	Net Income		Turnover		Total Expenses		Total Assets		Equity	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	792.500	0.155	840.700	1.557	-1.564	1.234	-898.800	0.263	-5.235	-0.605
Std. Er.	1.805	0.318	24.389	4.611	22.342	4.242	22.474	3.945	11.938	2.138
Obs.left	23,371	21,100	24,593	20,173	24,814	20,229	24,521	21,819	24,130	21,300
Obs.right	27,471	24,198	29,239	22,988	29,566	23,057	29,109	25,276	28,568	24,463
Bandwidth	0.222	0.194	0.237	0.184	0.240	0.184	0.236	0.203	0.231	0.196

Firm Liabilities and Expenditure - 2022								
	Investment in Equipment		Rents		Office Supplies		Liabilities - Shareholders	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	1.005*	0.202*	890.600	0.166	74.500*	0.015*	-17.160***	-0.003***
Std. Er.	563.500	0.111	602.700	0.107	40.030	0.008	6.428	0.001
Obs.left	27,709	20,278	22,267	19,914	26,535	19,956	22,313	24,090
Obs.right	34,316	23,128	25,911	22,623	32,498	22,692	25,992	28,514
Bandwidth	0.282	0.185	0.208	0.180	0.264	0.181	0.209	0.231

Employment - 2022						
	Total Employment		Salaries of Employees		Average Wage	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	-0.012	-0.000	-26.912	0.171	115.300	0.033
Std. Er.	0.151	0.000	3,153.700	0.522	174.030	0.027
Obs.left	26,302	20,289	18,095	13,830	17,959	14,545
Obs.right	32,180	23,135	22,762	16,239	22,495	17,207
Bandwidth	0.261	0.185	0.237	0.166	0.234	0.177

Notes: This table reports the ITT and ToT RD estimates for the impact of the APOIAR program on firm-level outcomes in 2021. The treatment status variable used to implement the fuzzy RD estimation is the total amount of incentives in euros. All regressions using weighted least squares (with weights given by a triangular kernel function) include a polynomial of order 2 of the distance to threshold. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017). We include a vector of ten sectors of activity described in Table 1. Significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$.

Table R12: RDD Robustness in 2021: including NUTS 2 regional and sector of activity fixed effects

Firm Performance - 2021										
	Net Income		Turnover		Total Expenses		Total Assets		Equity	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	3.322**	0.584**	-912.600	0.870	-1.668	0.797	1.167	0.979	-3.561	0.275
Std. Er.	1.576	0.265	21.591	4.154	19.861	3.874	21.084	4.141	10.953	2.143
Obs.left	21,049	21,596	23,727	18,018	24,255	18,078	24,055	17,287	23,664	17,329
Obs.right	24,125	24,910	27,999	20,188	28,717	20,258	28,462	19,234	27,907	19,294
Bandwidth	0.193	0.200	0.226	0.160	0.233	0.161	0.230	0.152	0.225	0.153

Firm Liabilities and Expenditure - 2021								
	Investment in Equipment		Rents		Office Supplies		Liabilities - Shareholders	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	-97.590	-0.002	967.600*	0.154	85.360**	0.019**	-12.600	-0.003
Std. Er.	517.900	0.102	546.100	0.098	35.020	0.008	10.090	0.002
Obs.left	23,471	17,343	21,647	18,697	27,886	17,350	23,299	17,740
Obs.right	27,627	19,302	25,007	21,119	34,585	19,310	27,353	19,816
Bandwidth	0.223	0.153	0.201	0.167	0.285	0.153	0.221	0.157

Employment - 2021						
	Total Employment		Salaries of Employees		Average Wage	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	-0.047	-0.000	-801.640	-0.077	69.450	0.023
Std. Er.	0.144	0.000	2,775.200	0.475	154.150	0.026
Obs.left	25,920	18,500	17,916	13,661	18,673	13,512
Obs.right	31,538	20,829	22,221	15,815	23,461	15,603
Bandwidth	0.255	0.165	0.228	0.160	0.242	0.157

Notes: This table reports the ITT and ToT RD estimates for the impact of the APOIAR program on firm-level outcomes in 2021. The treatment status variable used to implement the fuzzy RD estimation is the total amount of incentives in euros. All regressions using weighted least squares (with weights given by a triangular kernel function) include a polynomial of order 2 of the distance to threshold. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017). We include a vector of 5 NUTS 2 regions in mainland Portugal (North, Center, Lisbon, Alentejo, and Algarve) and ten sectors of activity described in Table 1. Significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$.

Table R13: RDD Robustness in 2022: including NUTS 2 regional and sector of activity fixed effects

Firm Performance - 2022										
	Net Income		Turnover		Total Expenses		Total Assets		Equity	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	662	0.090	61.240	1.510	-2.147	1.279	-1.880	0.156	-5.829	-0.409
Std. Er.	1.805	0.343	24.442	4.728	22.389	4.342	22.460	4.411	11.931	2.360
Obs.left	23,321	17,744	24,471	18,574	24,700	18,698	24,500	17,352	24,125	17,298
Obs.right	27,389	19,822	29,022	20,948	29,381	21,126	29,091	19,311	28,564	19,255
Bandwidth	0.221	0.157	0.235	0.166	0.238	0.168	0.236	0.153	0.231	0.152

Firm Liabilities and Expenditure - 2022								
	Investment in Equipment		Rents		Office Supplies		Liabilities - Shareholders	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	993*	0.223*	811.400	0.138	72.050*	0.015*	-17.720***	-0.004***
Std. Er.	560.100	0.120	598.500	0.109	40.150	0.008	6.434	0.001
Obs.left	27,917	17,486	22,375	18,649	26,379	17,594	22,242	17,305
Obs.right	34,648	19,494	26,075	21,043	32,270	19,620	25,874	19,268
Bandwidth	0.285	0.154	0.209	0.167	0.262	0.155	0.208	0.152

Employment - 2022						
	Total Employment		Salaries of Employees		Average Wage	
	Sharp	Fuzzy	Sharp	Fuzzy	Sharp	Fuzzy
Coef.	-0.022	-0.000	-457.660	0.083	78.286	0.029
Std. Er.	0.151	0.000	3,212.900	0.525	169.640	0.027
Obs.left	26,127	18,226	17,435	13,549	18,263	13,920
Obs.right	31,912	20,452	21,689	15,815	23,050	16,379
Bandwidth	0.258	0.162	0.225	0.162	0.240	0.168

Notes: This table reports the ITT and ToT RD estimates for the impact of the APOIAR program on firm-level outcomes in 2021. The treatment status variable used to implement the fuzzy RD estimation is the total amount of incentives in euros. All regressions using weighted least squares (with weights given by a triangular kernel function) include a polynomial of order 2 of the distance to threshold. The assignment variable is the decrease of turnover (based on *E-fatura* data) computed according to eq. (1). The cutoff value is -25%. The bandwidth is computed using Calonico et al. (2017). We include a vector of 5 NUST 2 regions in mainland Portugal (North, Center, Lisbon, Alentejo, and Algarve) and ten sectors of activity described in Table 1. Significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$.

Table V1: Variable Description

Variable	**Description**
Survival	Binary variable that identifies whether the company ceased its activity during year N. Value of 1 indicates that the company died (i.e., stopped operating), while value of 0 indicates that it remained active.
Turnover	Total net revenue generated by a company from the sale of goods and the provision of services during a specific period, excluding value-added tax (VAT) and other taxes directly related to sales.
Total Assets	Total value of company's economic resources, comprising current and non-current assets. Includes tangible and intangible fixed assets, investment properties, biological assets, inventories, receivables, cash and cash equivalents, and other assets.
Net Income	Net value after taxes generated by the company during its financial year, calculated as total revenues minus total expenses (including taxes).
Equity	Company's own funds, representing the residual value of its assets after deducting all liabilities. It includes share capital, retained earnings, reserves, and the net result for the period.
Total Expenditure	Total amount of costs incurred by the company during the financial year, including the cost of goods sold and materials consumed, external supplies and services, personnel expenses, depreciation and amortization, interest expenses and taxes.
Office Supplies	External supplies and services – Office supplies: Expenses related to the purchase of office materials and consumables used in the company's administrative and operational activities. This includes items such as paper, pens, printer cartridges, folders, and other general office supplies that are not capitalised as assets.
Rents	External supplies and services – Rents and leases: Operating expenses incurred by the company for the rental or lease of property, equipment, or other assets that are not owned by the company.
Investment in Equipment	Investment in basic, transport, administrative, and biological equipment: Capital expenditure incurred by the company for the acquisition of equipment used in production (basic), logistics and distribution (transport), office and management functions (administrative), and biological production processes (biological).

Variable	Description
Liabilities to Shareholders	Amount owed by the company to its shareholders.
Total Employment	Nr of individuals who, during the reference period, took part in the company's activity, regardless of the duration of their participation.
Wage Expenditure	Amount corresponding to fixed or periodic remuneration paid to employees (regardless of their role in the company), social security contributions, pensions and pension premiums, mandatory payroll taxes, work accident and occupational disease insurance, social welfare costs, and other personnel-related expenses such as recruitment, training, occupational health services, health insurance, severance payments, and optional retirement benefits.
Average Wage	Average amount spent by the company on each worker, calculated as the ratio between total wage expenditure and the number of employees working in the company.
Labor Productivity	Gross Value Added per employee