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DISSERTATION

ARE THE CREDIT GUARANTEE SCHEMES EFFECTIVE IN PORTUGAL? EVIDENCE FROM *PME INVESTE* PROGRAMME

PEDRO DANIEL DOS SANTOS PÓLVORA

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SUPERVISION:

MIGUEL ST. AUBYN

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GLOSSARY

CCR Central Credit Register.

CGSs Credit Guarantee Schemes.

DDM Difference-in-Difference Matching.

IAPMEI Institute to Support Small and Medium Enterprises and Innovation.

IES *Informação Empresarial Simplificada*.

JEL Journal of Economic Literature.

MGS Mutual Guarantee Society.

NPLs Non-Performing Loans.

OECD Organisation for Economic Co-operation and Development.

PEDIP *Programa Estratégico de Dinamização e Modernização da Indústria*.

ROA Return on Assets.

SMEs Small and Medium Enterprises.

SPGM Portuguese Society of Mutual Guarantees.

ABSTRACT

This dissertation examines the main effects of the credit guarantee scheme (CGS) for Portuguese micro-, small- and medium-sized enterprises (SMEs) initially adopted in 2009. The study relies on three large-scale data sources, with individual information for all Portuguese non-financial corporations and banks, to assess the impact over credit additionality and the ex-post performance of participating firms. By applying a difference-in-difference matching approach, the results have shown that the program helped participants to improve their access to the credit market, increasing the overall amount of loans granted, the proportion of long-term debt and reducing their interest expenses and the probability of default. Moreover, there is also statistical evidence of economic spillovers, such as employment growth and exports volume. The scheme also helped the Portuguese banking system to reduce their risk exposures, improving their capital ratios under the Basel Accord. Nevertheless, the results show that there is room for improvement in the scheme design and features, in particular for credit lines targeting medium-sized or exporters firms.

KEYWORDS: Credit, loan guarantees, SMEs, policy evaluation, banking, propensity score, average treatment effect, PME Investe

JEL CODES: G21, G28, H81, D82

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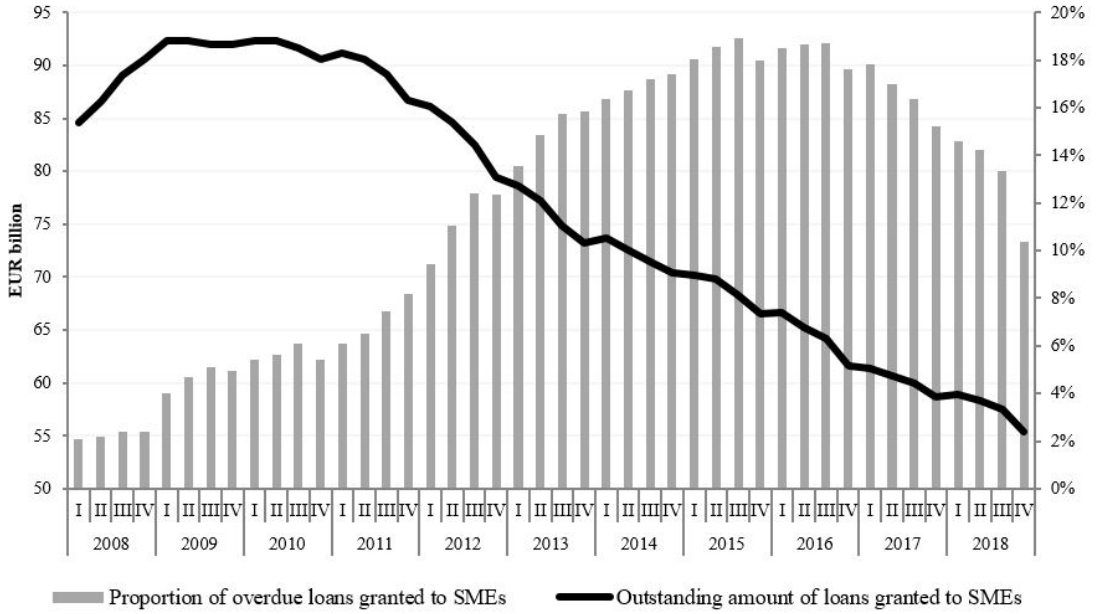
1 INTRODUCTION

Economic theory often agrees on the important role that Small and Medium Enterprises (SMEs) play in economic growth, job creation, social cohesion and regional development. However, most SMEs face several obstacles when trying to finance and develop their activities, especially due to credit market imperfections (Beck and Demirguc-Kunt, 2006; Laeven, 2003; Gelos and Werner, 2002). As Stiglitz and Weiss have shown in their seminal article (1981), the lack of individual information often leads to market failures, in particular, because banks cannot precisely assess a project's riskiness and are often forced to offer similar contracts to firms with different probabilities of success. To overcome this issue, banks commonly rely on collateral requirements as a screening device (Bester, 1985; Besanko and Thakor, 1987*a*). The literature has shown that, by committing a portion of their assets, SMEs can mitigate credit rationing (Beck et al., 2010). Pledging collateral shows the borrower's willingness to repay its loans, thereby reducing adverse selection and moral hazard problems (Deelen and Molenaar, 2004). This solution reduces the lender's risk of default (Coco, 2000), and decreases the banks' monitoring costs (Cowling and Mitchell, 2003). However, due to their size or age, most smaller firms do not have enough assets or a long enough credit history to meet the credit requirements (Columba et al., 2010), and so their access to the credit market remains restricted. As a solution, some policy makers and commerce associations have relied on Credit Guarantee Schemes (CGSs) to increase the overall amount of credit available in an economy (Llisterri, 1997; Levistky, 1997*b*; Cowling and Mitchell, 2003).

CGSs are multilateral agreements between lenders, borrowers and guarantors. By pledging a guarantee, the latter tries to offset a SME's lack of collateral and, therefore, help constrained firms access the credit market. Over the past several years, CGSs have become increasingly important, in particular after Basel II (and Basel III) Capital Accords, which, after certain conditions are met, can help a bank mitigate its credit risk and improve its capital requirements (Casasola et al., 2008). These schemes also seemed to have gained momentum, especially during economic downturns, when most firms are unable to find funding sources in the traditional credit market (Uesugi et al., 2010; Riding, 1998).

Portugal was no exception, and the financial crisis (and subsequent sovereign debt crisis) in that country led to a significant contraction in economic activity and credit supply (Farinha and Félix, 2015). This adjustment affected both the non-financial and financial sectors in Portugal. Amplified by the crowding out effect on financial markets (OECD, 2014), the crisis resulted in a significant increase in overdue loans and in stronger capital requirements for banks (Figure 1). Altogether, the aftermath of the financial crisis led to a long period of credit contraction, during which an increasing number of Portuguese SMEs were unable to meet their debt payments. During this period, Portugal had in place a set

of actions that may have prevented an even more severe contraction and bank freezes, including a CGS.



Source: *Banco de Portugal*

FIGURE 1: PERFORMING AND OVERDUE LOANS IN PORTUGAL

Although CGSs are popular, the economic literature remains inconclusive about their net effect on the funding and performance of small firms. Some authors argue that CGSs are effective instruments for promoting credit growth among participants (see Boocock and Shariff, 2005; Mankiw, 1986; Gale, 1990 and 1991; Riding et al., 2007) or that they reduce the cost of borrowing (Zecchini and Ventura, 2009; Columba et al., 2010). Meanwhile, others are more sceptical about the net effect on credit, claiming that lenders perform a loan portfolio substitution, that is, they replace non-guaranteed loans with guaranteed loans without expanding their overall loan portfolio (Vogel and Adams, 1997). Ultimately, aside from the theoretical debate, the actual impact of these programmes also remains an empirical challenge. Hancock and Wilcox (1998), Craig et al. (2004, 2007) and Hancock et al. (2007) defend the effectiveness of these schemes after analysing a set of aggregated data. However, this empirical strategy has the disadvantage of omitting the firms' responses to the programme as a factor. By contrast, Cowling (2010) relies on microdata to show that participants in the United Kingdom (UK) were less likely to experience a credit reduction, after the introduction of a CGS. Riding and Haines (2001) and Riding et al. (2007) also presented empirical evidence for a positive impact on other variables, such as job creation, for firms that joined a Canadian CGS scheme. More recently, Duarte and Gama (2018), relying on data from one participating bank, studied the credit impact of a Mutual Guarantee Society (MGS) in Portugal for a limited number of firms.

However, the applicability of the results of most of these studies remains limited by the empirical approach adopted, which has focused only on the credit impact on participating firms, without a proper comparison to non-participating firms. The identification of a policy's net effects is challenging because participating and non-participating firms may be intrinsically different, and some of these differences may be unobservable. The present article tries to overcome these limitations. First, it is based on three data sources from 2005 to 2013, consisting of individual balance sheet information, credit and guarantees granted, using data for all Portuguese non-financial corporations. Second, it measures the treatment effects of the Portuguese CGS by implementing a difference-in-difference matching algorithm, allowing a comparison between participating firms and the control group. The study of these effects is not limited to the firms' credit; it also includes a broader range of ex-post impacts, including job creation, the probability of defaulting, international trade and the firms' net value. Finally, the research design assumes that the effects of credit lines may be different across the firms' size and programmes, contributing to the debate about which scheme design is optimal. To this end, the study is structured as follows: Section 2 provides an overview of the literature and establishes the relevance of CGSs for SMEs. Section 3 describes the Portuguese CGS and establishes the hypothesis to be tested. Section 4 and Section 5 present the data sources, model and empirical strategy that were adopted for the study. Section 6 concludes the paper by assessing the overall effects of the programme and detailing its impacts for different SMEs' sizes and credit lines.

2 SME LENDING AND CREDIT GUARANTEE SCHEMES

Micro-, small- and medium-sized enterprises are frequently hailed as the backbone of the economy (Green, 2003). However, the slowdown in economic growth experienced since the beginning of the century, the challenges introduced with the globalisation, the fear of industrial setbacks and the recent financial crises contributed to the resurgence of academic and policy interest in industrial policies directed to these firms. Often, these public interventions are based on a combination of various subsidies, which may take the following form: (i) grants, defined as a monetary payment in the form of a lump sum, most frequently as a proportion of the investment; (ii) tax incentives, in the form of exemptions/reductions or as a tax credit; (iii) subsidised public loans, with lower interest rates than those charged in the credit market; and finally (iv) guarantees, in which a public entity absorbs a significant part of the risk of default, allowing constrained firms to access the credit market, and risky-but-creditworthy firms to get financing at a lower cost (D'Ignazio, A. and Menon, C., 2012). The rationale for the introduction of such policies underlines the consensus that SMEs face additional obstacles to assess banking credit

or even government funds to finance their economic activities (European Commission, 2005). In particular, the higher costs of small-scale lending, lack of collateral, reduced reliability of (often non-audited) financial statements, asymmetric information and differing liability structure obstruct these firms from meeting the contractual requirements demanded by financial institutions (Beck, T. et al., 2008). CGSs policy initiatives arise as both a reaction to this lack of collateral in smaller companies, and a means to mitigate the risks faced by lenders. Altogether, by introducing these systems, policy makers seek to diminish information problems in the credit market and, therefore, improve the overall conditions for SME financing (Green, 2003; Uesugi, I. et al., 2010).

2.1 Credit markets and asymmetric information

In light of economic theory, credit markets can be explained intuitively using a model of supply and demand. When there is an excess of credit demand – the desired amount of credit is higher than what banks are able to grant at a market price – the financial institutions will be urged to raise the price of credit (the interest rate), matching demand with supply, and leading to profit maximisation (Cowling, 2010). However, the empirical evidence shows that this equilibrium is not easily reached, raising the question of why banks refuse to grant loans to some firms, even at a higher price (Cowling, 1999; Levenson and Willard, 2000; Storey, 1997). The debate about how the asymmetric information restricts the credit granted to the real economy was launched in the literature by the seminal article of Stiglitz and Weiss (1981). In this study, the authors showed that the asymmetries between borrower and lender information lead to an equilibrium below the optimal level of lending. The authors identified two main issues – adverse selection and moral hazard – both of which affect the quality and total amount of loans granted.

2.1.1 Adverse selection

The adverse selection problem starts with the lack of information available to lenders when assessing the quality of borrowers. The expected returns for the bank depend on the probability of repayment, so banks should be able to identify borrowers who are more likely to repay their loans. However, in the absence of more information, it is difficult to distinguish 'good borrowers' and, to do so, banks must introduce a set of screening mechanisms, such as the interest rate. The problem here is that an increase in interest rates, whether due to a higher credit demand or as a screening mechanism, leads to a market equilibrium where only those firms that invest in riskier projects (higher returns, but lower probability of success) are willing to pay the higher interest expenses.

On the other hand, increased costs will also induce the remaining companies to adopt riskier investment strategies, to reach a rate of return high enough to repay their debt

service costs. Thus, the Stiglitz and Weiss (1981) model shows that, in spite of credit demand, there is an optimum interest rate in the credit market that minimises the number of risky projects and banks' potential losses. As a result, the credit supply will be negatively sloped, and the equilibrium will be reached by credit rationing.

2.1.2 Moral hazard

The second problem – moral hazard – results from borrowers' behaviour after accessing credit and incurring its monitoring costs. To minimise information asymmetry, financial institutions often rely on two mechanisms: (i) improving the economic conditions for firms that follow the objectives initially set, for example, by renewing the loan with a lower interest rate; and (ii) demanding that firms pledge part of their assets as collateral, which could be exercised in case of default. These information problems, and higher monitoring costs, lead to a scenario where the credit granting process is driven not only by the banks' profitability, but also by a more careful and prudent assessment of the quality of borrowers, relying on such metrics as firm size and collateral pledged. This naturally results in a market equilibrium where smaller companies may be deprived of funds for new investment projects.

These information asymmetries encouraged the economic literature to study the collateral pledged by firms when contracting loans, particularly as an indicator of borrower quality and as a method applied by banks to mitigate these information problems (Besanko and Thakor, 1987*b*; Bester, 1994; Cowling, 2010). In fact, Bester has argued that the introduction of collateral eliminates any credit rationing. According to this author, the firms with prudent investment projects signal their willingness to repay their loans by pledging part of their assets. On the other hand, riskier borrowers with a higher probability of default will be more reluctant to pledge any collateral, thereby being subject to higher interest rates or even rejection of their funding requests. However, this argument is not universally accepted in the literature, with Besanko and Thakor (1987*a*) arguing that collateral is not an accurate indicator of the quality of borrowers. For these authors, the amount of collateral required may exceed the value of assets available, leading to an equilibrium where credit is rationed even among firms less likely to default, as shown in the aforementioned theoretical model developed by Stiglitz and Weiss (1987). These information asymmetries in the credit market became one of the main arguments for the policy makers to promote CGSs, especially programmes targeting smaller firms that have a limited amount of assets to pledge as collateral.

2.2 Credit guarantee schemes - Overview

According to the European Commission, the CGSs are 'collective initiatives of a number of independent companies or their organisational representatives. Its main objective is to collect a set of guarantees for loans granted to its members, who directly or indirectly participate in the formation and asset management of the system' (2005, p. 10). These systems have their origin in the late 20th century, but have recently become increasingly important in the funding of small and medium-sized firms (Beck et al., 2010).

Guarantee schemes have subsequently become widespread in both developed and developing economies[1], and are often listed by international organisations as a policy recommendation (OECD, 2013). For policy makers, the attractiveness of these schemes derives from their multiplier effects (Table I) and from their ability to move private capital (Cowling and Mitchell, 2003), but also due to the possibility of recovering a large share of the public funds by the end of the programme (D'Ignazio and Menon, 2012). For participants, CGSs are a mechanism to increase the overall volume of credit available, especially to small firms lacking sufficient collateral. This feature is commonly known as 'additionality' (Riding et al., 2007).[2] By reducing the risk taken by lenders, this policy also has the potential to reduce the cost of small-scale loans, while improving both access and banks' knowledge of small borrowers. More recently, with the adoption of Basel II (and III), these societies have become particularly important for financial systems, given that when certain criteria are met, they allow banks to mitigate the credit risk for loans granted to SMEs and consequently to ensure the required capital and liquidity ratios (Casasola, M. et al., 2008).

TABLE I: CGSS POTENTIAL EFFECTS

Author	Benefits
Cowling and Mitchell (2003)	Overall increase of credit granted to SMEs.
Riding and Haines (2001)	Employment and tax revenue growth.
Bradshaw (2002)	Potential increase in international trade of goods and services.
Riding et al. (2007)	Potential spillovers resulting from the development of a new commercial relationship between financial institutions and SMEs by reducing the adverse selection and monitoring costs for subsequent loans.

[1] At the beginning of the 21st century, there were more than 2250 distinct systems, spread across 100 countries (Green, 2003).

[2] In North America, literature refers to this property as 'incrementality'.

In general, these systems rely on three economic agents – the borrower, the lender and a guarantor. Obviously, each of the parties has different incentives to join these schemes. The borrower is typically a SME seeking funds to run its business. The lender is a private financial institution that pursues profit maximisation by using a screening device to identify credible signals from the borrowers. However, this sorting process carries high fixed costs and is considered to be one of the main obstacles to credit granting (Riding et al., 2007). To overcome this, the two agents may rely on a third party – the guarantor. Normally, this is a government agency or a trade association that issues a guarantee to the creditors, as a predetermined percentage of the loan.

Beyond the relationship between borrower and lender, these schemes also create a link between guarantor and lender. The policy maker must therefore define a set of system parameters and incentives, considering not only borrowers' but also lenders' motivations. In general, the guarantor has the power to establish four types of criteria: (i) eligibility; (ii) the guarantee level granted; (iii) the fees charged;[3] and (iv) the scope of discretion left to lenders.[4] These parameters obviously differ according to the purposes of and participants in the scheme in question. For some countries, its primary objective is to increase the amount of credit available for SMEs[5] (e.g., Canada, France and the UK). Meanwhile, in other cases (e.g., some programmes in the USA), these schemes are only applicable as a last resort, acting when firms cannot find the necessary funds in the capital markets.[6] Finally, other systems grant these guarantees to companies that otherwise would have to shut down their activity (e.g., Japan; see Nitani and Riding, 2005).

Besides having different purposes and motivations, the organisational structure of these programmes also changes from country to country, depending on the operating model chosen. The literature identifies five broad models, namely mutual guarantee societies, purely public systems, enterprise systems, bi-lateral or multi-lateral systems and schemes managed by non-governmental organisations (Green, 2003). The mutual guarantee societies have become the most widely adopted structure and can also be classified into two types, according to the source of its funding. First, mutual guarantee associations (for example, Confidi in Italy) are purely private organisations formed by borrowers to share their debt risk. This type of scheme tends to be more permissive to adverse selection problems, because higher-risk firms with limited access to credit have move incentives to

[3]Generally, the guarantor establishes the fees to cover the costs associated with failure or to preserve the integrity of capital associated with the programme.

[4]In some systems, the entity offering the guarantees specifically decides which applications receive the requested loans, such as in Canada, while in other legal frameworks, as in the UK, the guarantor can only review the applications.

[5]Please see Llorens (1997).

[6]In some programmes in the United States of America, only companies whose loans applications have previously been refused by financial institutions are eligible for funding.

join this organisational model. Second, publicly backed mutual societies, which are created on a regional or national basis, and are often managed by government agencies or a specific legal entity created for this purpose. In this case, the organisation's resources are often public and available for a limited period. This structure is particularly relevant in lower-income economies, and is the most popular scheme in developed countries (Beck et al., 2010); this model was adopted for the Portuguese credit guarantee scheme.

3 THE POLICY

The current design of the Portuguese's credit guarantee scheme started to be implemented in 2002 by the Institute to Support Small and Medium Enterprises and Innovation (IAPMEI)[7]. The scheme followed a structure similar to others adopted across many countries in Europe (Columba et al., 2010), and its main aim was to increase the supply of credit to SMEs. Within this overall structure, three mutual guarantee societies were created[8] – Norgarante, Lisgarante and Garval – being responsible for monitoring and providing resources for all Portuguese Society of Mutual Guarantees (SPGM) operations.[9] The first credit line was formally introduced in July 2008, under the name *Programa PME Investe*, the main goal of which was to improve SMEs' access to the credit market, through interest rates subsidies and by pledging a pre-determine amount of collateral (guarantee) for bank loans.

The process to join the programme also follows a similar approach to the model adopted in several southern European countries (Zecchini and Ventura, 2009). Each credit-guaranteed transaction requires the agreement of three parties: a small business borrower, a financial institution, and a mutual guarantee society representing the national 'reinsurance' fund (i.e., Mutual Counter Guarantee Fund). In Portugal, this fund is mainly backed by public funds and covers part of the risk incurred by MGSs and, thereby, leveraging their ability to support SMEs (Duarte et al., 2018). Initially, the firms' applications are filed by the banks on behalf of the borrowers. The MGS then conducts a credit assessment of these applications, based on such key metrics as the firms' financial statements, their industry sectors and growth prospects. Once the application is approved and the guarantee credit is granted, the SMEs must buy a share in the SPGM. This share corresponds to 2% of the issued guarantee, acquired from the promoter or another mutualist (i.e., another shareholder), which can be back-sold at its nominal value to SPGM or another participant firm after leaving the programme. The borrower is also obliged to pay a

[7]The Portuguese CGS was formally created in 1994, as part of the broader programme *Programa Estratégico de Dinamização e Modernização da Indústria* (PEDIP)

[8]*Decreto-Lei No. 211/98 published in Diário da República Portuguesa.*

[9]The SPGM's activity is guided by the legal norm *Decreto-Lei* No. 309-A/07 published in *Diário da República Portuguesa.*

commission annually, usually ranging from 0.5% to a maximum of 4.5% of the guarantee granted. Although the scheme is supported by public funds, these two features provide a mutualist character to all transactions. Finally, the SPGM, or one of the banks, is responsible for collecting the loan re-payments.

Between 2008 and 2010, and as part of the policy response to the tightening conditions to access the credit market created by the financial crisis, the scheme established six credit lines, amounting to EUR 9.092 million. Altogether, these lines covered around 10.1% of the total credit granted to SMEs by the financial sector in Portugal during this period. Most of these loans had an initial amortisation period of 3 to 5 years, with the guarantees covering from 50% to 75% of the total amount. Initially, only six banks decided to join this system.[10] Unlike major programmes adopted in other countries (see Levistky, J., 1997*a*) the access to these credit lines was not very restrictive (Table II), allowing many firms to join the scheme.

TABLE II: ELIGIBILITY REQUIREMENTS

	Requirement	**Programme line**
I	Do not have any unjustified incidents or defaults in banking sector	All
II	Do not have tax arrears	All
III	Be a micro-, small- or medium-sized enterprise as defined in Commission Recommendation C(2003)1422.[1]	All
IV	Had a positive net profit in the last year and at least two positive results in the last four years, or two positive net profits if the firm has been in operating for less than four years	All
V	Required to keep the same number of employees, at the date of signing the contract, until the loan is fully repaid	All

[1] Note: Commission Recommendation of 6 May 2003 concerning the definition of micro-, small- and medium-sized enterprises (C(2003)1422) (OJ L 124, 20.5.2003, p. 36).

Despite these general criteria, the scheme also introduced some specific credit lines focussed on particular economic sectors and specific purposes. For instance, *PME Investe II* and *III* allocated part of their funds to tourism, catering, automobile or retail sector; while, on the other hand, *PME Investe III* and *VI* endowed a specific amount to exporting firms. Nevertheless, these five criteria (Table II) were universally adopted across all programmes.

[10]Namely Banco BPI, Banco Espírito Santo, Millennium BCP, Caixa Geral de Depósitos, Santander Totta and Montepio.

3.1 Programa PME Investe III and IV

This study focuses on two credit lines launched in 2009 (*PME Investe III* and *IV*). These two programmes can be considered the first nationwide CGS in Portugal, with a total budget of EUR 3.850 million.[11] Together, these two credit lines targeted a broad category of firms – the export sector and small and micro-enterprises – and covered most SMEs in Portugal, offering them a first opportunity to participate in a credit guarantee scheme.

TABLE III: *PME INVESTE III* AND *IV* MAIN FEATURES

Credit line	**Export Sector** *(PME EXP)*	**Small- and Micro-Enterprises** *(PME SME)*
Year	2009	2009
Total amount	EUR 1 831 million	EUR 1 429 million
Month	January and June	January and June
Targeted firms	· Firms headquartered in mainland Portugal · International transactions must be 10% or higher of firm's annual turnover	· PME firms in Portugal, with a yearly turnover below 10 million euros
Eligible investments	· Investment in tangible or intangible fixed assets · Improve operating or working capital	· Improve working capital
Credit maximum value	EUR 1 000 000	· EUR 25 000 (Micro-Enterprises) · EUR 50 000 (Small Enterprises)
Credit minimum value	EUR 100 000	*NA*
Maximum credit length	3 years	3 years
Type of credit	Long- and medium-term bank loans	Long- and medium-term banking loans
Collateral value	50% of the loan	75% of the loan
Other benefits	Subsidised interest rate of 1%	Subsidised interest rate of 0.25%
Charges supported by the participating firms	Euribor interest rate (3 months) minus 1%, until a lower bound of 1.5%	Euribor interest rate (3 months) minus 0.25%, to a lower bound of 1.5%

[11] By contrast, the past two programmes (*PME Investe I* and *II*) launched in 2008 summed less than EUR 1.000 million.

The programme provided different conditions to each group (Table III). Although the range of investments covered by these programmes was wide, the benefits granted differed significantly between exporting firms and small or micro-firms. For instance, while one line focused on reducing the interest rate (PME EXP), the other focused on pledging a larger amount of collateral (PME SME). As mentioned before, the latter feature is particularly important for firms that try to access the credit market for the first time and do not have enough assets to pledge as a guarantee.

Also important, apart from being the first nationwide programmes, the two credit lines incorporated special conditions to identify and measure the programme impact. Initially, the amount and maturity of the loan differed depending on the credit line for which the firm was eligible. Also, three additional criteria are implicitly defined for the group of PME SMEs. The firms should have fewer than 50 employees, its annual turnover should not exceed EUR 10 million and the combined proportion of imports and exports should be less than 10% of its annual turnover.

3.2 Programme aims and expected outcomes

The main purpose of the programme was the same regardless of the size of firms targeted. According to policy makers, its primary objective was to help SMEs access the credit market. Therefore, one expected outcome was to increase the overall amount of credit granted, especially to smaller firms that enter this market for the first time. This suggests implicitly that the program was able to reduce the information asymmetry in the Portuguese credit market, specifically the role of adverse selection (Stiglitz and Weiss, 1981). Moreover, by developing new commercial relationships between SMEs and financial institutions, the scheme also helped to reduce their monitoring costs (as suggest by Riding et al., 2007).

Hypothesis 1 (Credit additionality). The overall amount of loans should increase for the firms participating in the *PME Investe III* and *IV*.[12]

Hypothesis 1a (Credit additionality – Moral hazard). The scheme is expected to contribute to reducing the banks' monitoring costs. In particular, it should help firms to establish borrower-lender relationships that continued after the end of the programme.

Hypothesis 1b (Credit additionality – Adverse selection). The programme should be especially efficient at increasing the amount of credit granted to smaller firms that had limited capital to pledge as a guarantee or that accessed the credit market for the first time.

The scheme also offered special conditions to improve its participants' debt structure.

[12]This overrules the substitution effect (Hypothesis 3) that the increase of guaranteed loans is offset by a decrease of non-guaranteed loans, which would result in an insignificant increase in the credit market.

One of its primary features was the introduction of subsidised interest rates to reduce firms' costs of borrowing. Moreover, the loans were granted with an average maturity of three years, helping the participants to restructure their credit debt and reducing the need for short-term funding. It is, therefore, expected that the scheme would help companies to reduce their financing costs and increase the proportion of long-term loans on their balance sheets.

Hypothesis 2 (Debt structure and funding costs). The scheme should help treated firms to decrease their short-term funding needs and, consequently, to reduce their interest expenses.

Another important feature of this programme is that the credit risks are shared between the guarantee scheme and the bank. By insuring only a proportion of the loan, the scheme implicitly encourages the bank to assess and monitor closely the loans granted. This is especially important to ensure that lenders mitigate the likelihood of default. After the 2008 financial crisis, banks were forced to raise capital or decrease their risk-weighted exposures. Under the Basel Accord, non-guaranteed loans have a risk weight of 100%, while guaranteed loans are weighted at 10%. This may have encouraged banks to replace non-guaranteed with guaranteed loans and, due to the increasing provision costs and internal synergies to oversee these loans, banks were exhorted to carefully monitor their exposures in order to reduce Non-Performing Loans (NPLs) on their balance sheets.

Hypothesis 3 (Substitution effect). The increase in guaranteed loans is expected to be offset by a decrease in non-guaranteed loans, resulting in a limited growth in overall credit (as Vogel and Adams, 1997).

Hypothesis 4 (Monitoring effect). The scheme created internal synergies, allowing banks to monitor closely the loans granted under this programme. This should effectively reduce the likelihood of firms' defaulting and the amount of overdue credit on their balance sheets.

As stressed by Bradshaw (2002), some CGSs also focused on promoting employment and firms' exports. The programme *PME Investe* is no exception, and was also designed to guarantee that participants experienced a wider range of effects. For instance, enrolled firms were not allowed to reduce their number of employees, implying a direct impact on the job market. Likewise, a distinct line was created for exporting firms, aiming to promote their competitive advantage in international markets.

Hypothesis 5 (Economic spillovers). Although the scheme focused on increasing the credit granted to SMEs, it should also have additional effects on a set of economic variables.

Hypothesis 5a (Employment). Participant firms should, at least, maintain their workforce numbers during the length of the programme.

Hypothesis 5b (Exports). The participant firms in PME EXP are expected to increase their volume of exports.

Last, but not least, the Portuguese scheme also states that these loans should be used to invest in fixed assets (PME EXP) or to enhance operating capital (PME EXP and SME). Although profitability was not a main feature targeted by the programme, the scheme design may implicitly improve the overall profitability of participating firms. In fact, Diamond (1989) argues that, in a situation of asymmetric information, many profitable investment opportunities are left unfunded in the unfettered equilibrium.[13] Uesugi et al. (2010) add that the introduction of CGSs alleviates this pressure, creating room to finance riskier, but also profitable projects. This implies that participants will increase their investment rate during the programme and, therefore, achieve higher earnings in the medium-term. The effect should be stronger for those firms obliged to increase their investment in fixed assets (PME EXP).

Hypothesis 6 (Investment effect). The ex-post performance of participant firms, in particular for PME EXP, should show that they can implement profitable projects with positive net present value.

4 DATA

4.1 Data sources

This study relies on information from three data sources. The first set of variables was derived from the Portuguese data set 'Simplified Corporate Information',[14] which comprises detailed balance sheet information on the universe of Portuguese non-financial corporations. This database has a longitudinal dimension, given that each company is identified using a unique code. This strategy allowed firms' economic activity to be tracked for the period from 2005 to 2013.

The second set of variables was calculated using the Central Credit Register (CCR). This is a database collected by *Banco de Portugal* from all financial intermediaries legally authorised to operate in Portugal (Antunes et al., 2010). This data set has a significant level of granularity and provides information, at the year-end, for the credit balance granted by all banks, distinguished according to financial product, credit maturity and loan status. Furthermore, a complementary CCR database was used, containing infor-

[13] Please note that this assertion is dependent on the risk-return relationship of investment projects. While Mankiw (1986) and Gale (1990, 1991) consider second-order stochastic dominance, in which projects with higher expected returns are not implemented in an unfettered pooling equilibrium, DeMeza and Webb (1987) assume first-order stochastic dominance, and conclude that any unfunded project has a negative net present value and, therefore, that government intervention is not needed.

[14] The *Informação Empresarial Simplificada* (IES) is a joint project of the Ministry of Finance and Public Administration, Ministry of Justice, National Institute of Statistics and National Central Bank of Portugal.

mation on the collateral pledged. This additional database includes information for each borrower, guarantor, guarantee value and amount of each loan. Cross-referencing this information with the credit database allowed the firms that enrolled in the PME programme to be identified, along with the value of the collateral pledged.

Given the high number of observations obtained by combining the information available in these three databases,[15] it was necessary to pre-process the final data set. The first criterion was to select only the entities that remained active for at least four consecutive years. This condition is based on the programme's minimum loan duration of three years, and due to the fact that this study aims to observe the company´s financial behaviour before and after joining the scheme. Moreover, given that the relevant period starts in 2008, this requirement allows us to estimate the initial impact of the loan, as well as measuring its subsequent effect over three additional years.

On the other hand, the observations lacking some of the information needed to estimate the variables of interest were excluded. Companies without data regarding their assets, net income, turnover, liabilities and interest payments were removed from the study. Also, only the sectors targeted by the programme were considered, and firms classified as Holding Companies were also excluded. Finally, observations above the 99th percentile or below the 1st percentile were treated as outliers.[16] The final sample includes data for 86 089 firms for up to nine years.

This data set has two primary advantages over those employed in other studies. First, it is focused on the PME programme, allowing us to precisely establish the beginning of the treatment for each participant. Most empirical studies only have information on whether a company is participating or not, without specifying when they joined the programme. Second, given that the panel covers nine years, it allows both short- and medium-term effects of the programme to be studied. Although cross-sectional data may be used to identify whether the introduction of a credit guarantee programme produces an immediate increase in loan availability, there are also additional longer-term effects that can only be assessed using panel data, such as the profitability and default probability of firms.

4.2 Variables and summary statistics

Four groups of variables were chosen to characterise the firms' features, namely their ability to access the program, their general characteristics, their degree of engagement with the financial sector and their performance before and after joining the programme.[17]

[15] The initial database comprised 2,008,343 observations.

[16] Most of these criteria are defined following recent studies that use the same databases. See, for example, Farinha and Félix (2015).

[17] A detailed list of the variables used in this study, and their respective definitions, is presented in Appendix A.1

The first set of variables focused on the ability of individual firms to access the programme. This includes variables distinguishing whether a firm is eligible for the programme (*ELIGIBLE*) or credit line (e.g., *EXT. TRANS. >= 10%*), and whether mutual guarantee societies (*MGS*) have any influence on the firms' probability of joining the scheme. Although the other three groups also include variables that affect firms´ decisions about participating in the programme, such as the ability to pay their debt (*DCOVER*) and interest expenses (*ICOVER*), most of those variables address the impact of the programme on the subsequent performance of firms. This includes such financial indicators as the share of bank loans among total liabilities (*LOAN RATIO*), the return on assets (*ROA*) and firms' total number of employees (*EMP*).

Table IV presents a set of summary statistics for sample firms for the year before the introduction of the *PME Investe* programme, dividing the sample into companies that enrolled in the scheme and those that did not access it.

TABLE IV: SUMMARY STATISTICS
BEFORE ACCESSING THE PROGRAM

	All firms	**Participating**	**Non-participating**
	Mean	**Mean**	**Mean**
	Std. dev.	*Std. dev.*	*Std. dev.*
Programme accessibility			
ELIGIBLE t	**77.6%**	**97.1%**	**72.9%**
	(0.417)	*(0.166)*	*(0.444)*
EMP <= 50	**98.6%**	**97.7%**	**99.8%**
	(0.119)	*(0.151)*	*(0.048)*
EXT. TRANS. >= 10%	**18.3%**	**25.5%**	**16.5%**
	(0.386)	*(0.436)*	*(0.371)*
TURNOVER <= EUR 10 million	**99.8%**	**99.7%**	**99.8%**
	(0.043)	*(0.052)*	*(0.040)*
MGS A	**42.5%**	**44.0%**	**42.1%**
	(0.494)	*(0.496)*	*(0.494)*
MGS B	**19.3%**	**25.4%**	**17.8%**
	(0.395)	*(0.435)*	*(0.383)*
MGS C	**38.2%**	**30.6%**	**40.1%**
	(0.486)	*(0.461)*	*(0.490)*
Bank's relation			
CREDIT (EUR)	**195 838**	**329 430**	**163 934**
	(451 277)	*(568 971)*	*(411 946)*
LOAN RATIO	**38.1%**	**45.1%**	**36.4%**
	(0.285)	*(0.279)*	*(0.284)*
LONG RATIO	**65.9%**	**61.6%**	**67.0%**
	(0.383)	*(0.348)*	*(0.390)*
SHORT RATIO	**33.5%**	**38.4%**	**32.3%**
	(0.379)	*(0.348)*	*(0.386)*
INTEREST RATE	**10.0%**	**8.9%**	**10.3%**
	(0.110)	*(0.085)*	*(0.116)*
BANKS	**1**	**2**	**1**
	(0.744)	*(0.486)*	*(0.777)*
p(DEFAULT=1)	**5.2%**	**1.7%**	**6.0%**
	(0.222)	*(0.129)*	*(0.238)*
PROGRAMME VALUE[18]	**10 122**	**52 508**	**0**
	(43 451)	*(86 996)*	*(0)*
GUARANTEE RATIO[19]	**4.9%**	**25.6%**	**0.0%**
	(0.142)	*(0.228)*	*(0.0)*

[18] Value in EUR, measured in the first year of the programme.
[19] Measured in the first year of the programme.

	All firms	**Participating**	**Non-participating**
	Mean	**Mean**	**Mean**
	Std. dev.	*Std. dev.*	*Std. dev.*
Performance			
ROA	**-2.0%**	**2.1%**	**-2.9%**
	(0.244)	*(0.079)*	*(0.268)*
ICOVER Dummy[20]	**56.5%**	**55.2%**	**56.8%**
	(0.496)	*(0.497)*	*(0.495)*
DCOVER Dummy[21]	**61.0%**	**62.1%**	**60.8%**
	(0.488)	*(0.485)*	*(0.488)*
NEGATIVE CAP. Dummy[22]	**13.8%**	**1.1%**	**16.8%**
	(0.345)	*(-0.106)*	*(0.374)*
NET PROFIT (EUR)	**7 336**	**18 541**	**4 661**
	(56 556)	*(57 163)*	*(56 081)*
TURNOVER (EUR)	**687 992**	**1 082 754**	**593 717**
	(1 226 009)	*(1 494 851)*	*(1 132 401)*
EXPORTS (EUR)	**61 247**	**113 402**	**48 792**
	(387 062)	*(548 078)*	*(336 239)*
General characteristics			
EMP	**9**	**12**	**8**
	(11)	*(13)*	*(10)*
ASSETS (EUR)	**627 187**	**928 023**	**555 342**
	(1 027 683)	*(1 189 046)*	*(971 572)*
NET VALUE (EUR)	**183 136**	**287 919**	**158 113**
	(423 194)	*(469 682)*	*(407 351)*
EXTERNAL WEIGHT	**9.2%**	**12.3%**	**8.5%**
	(0.221)	*(0.241)*	*(0.216)*
MICRO	**73.2%**	**57.2%**	**77.0%**
	(0.443)	*(0.495)*	*(0.421)*
SMALL	**25.3%**	**40.2%**	**21.8%**
	(0.435)	*(0.490)*	*(0.413)*
MEDIUM	**1.5%**	**2.7%**	**1.2%**
	(0.121)	*(0.161)*	*(0.109)*
N	**86 089**	**16 596**	**69 493**
Frequency		**19.3%**	**80.7%**

The descriptive statistics show a significant difference between participating and non-

[20]Ratio of profits to interest payments (*Interest coverage ratio*). 1 if the ICOVER is less than one, 0 otherwise.

[21]Ratio of profits to total credit (*Debt coverage ratio*). 1 if the DCOVER is less than 10%, 0 otherwise.

[22]Ratio of firm's net worth to total assets (*Capital Ratio*). 1 if the Capital Ratio is negative, 0 otherwise.

participating firms. The proxy variable identifying the firms' eligibility for the programme has a significant discriminant power, covering almost the full sub-sample that accessed the scheme. Moreover, the companies that joined the programme showed a stronger and closer relationship with the banking sector in Portugal, even before accessing the programme. On average, these firms had twice the value of loans compared to the remainder of the sample. Also, on average, these companies relied on more than one bank when seeking credit while showing significantly lower interest expenses.

The firms that enrolled in the programme seem to be more profitable and in less financial distress than others. Participating companies showed a positive *ROA*, while only a small proportion (1.1%) recorded negative capital (*NEGATIVE CAP.*) in the year before joining the scheme. These are two key indicators used to assess a firm's cash-flow and its ability to repay debt, which apparently excluded a significant number of participants from the programme. The differences between participating and non-participating firms are therefore significant, and a simple empirical strategy of comparing the average results between these two groups is not suitable.

5 METHODOLOGY

The data shows that a simple comparison between the ex-post performance of participating and non-participating firms is not appropriate. In general, the firms participating in the programme do not represent a random sample of the population. This means that the same company characteristics that influence its participation in the programme, may also influence the firm's performance in the future. For instance, a riskier firm without sufficient collateral will have a greater propensity to access the scheme and use its credit guarantee. Simultaneously, a less risky firm that already relies on banking credit as its main source of funding, would also have a financial record that allows the bank to run a more precise assessment and, therefore, would face a lesser risk of adverse selection by the bank. Moreover, as argued by Stiglitz and Weiss (1987), high-risk firms are likely to have fewer profitable investment opportunities compared to 'safer' firms, which may affect their financial performance and future ability to repay their loans. Altogether, a simple comparison between treated and non-treated firms may therefore lead to an underestimation of the programme's impact.

This is a common problem when evaluating policy interventions, and has been studied extensively in the literature (Heckman et al., 1999). To overcome this obstacle, the literature suggests a set of methods, drawing on the use of natural experiments, to evaluate treatment effects in the absence of true experimental data. These methods propose several solutions to the problem of generating the comparison group needed to perform a valid evaluation of these programmes (Centeno et al., 2008).

The typical methodologies proposed to address these issues are difference-in-difference approaches (Meyer and Nagarajan, 1996; Abadie, 2005) and matching methods (Rubin, 1977; Rosenbaum and Rubin, 1983; Rubin, 2006). The difference-in-difference matching method has been proposed by Heckman et al. (1997) and Heckman et al. (1998) as a combination of the two former methods. It was recently reviewed and compared with the other methods by Smith and Todd (2005) and has the potential benefit of eliminating some sources of bias present in quasi-experimental settings, improving the quality of the results significantly. Moreover, this is a well-grounded and tested approach, commonly applied in the literature to assess the efficiency of CGSs in countries such as Canada (Clark et al., 1998) and Japan (Uesugi et al., 2010).

The characteristics of the dataset and programme implementation in Portugal provide a special opportunity to construct treatment and control groups. In particular, they allow an exploration of (i) the existence of data for the pre- and post-programme periods, and (ii) the variation resulting from the participation in the programme (which generates spatial and temporal differences). The sample includes pre-treatment and post-treatment observations, which can be used to implement estimators from the difference-in-difference class.

5.1 The model

Let Y_{it}^{D} be the outcome of interest for firm i at time t given its state D, where $D = 1$ if exposed to the programme, and 0 otherwise. Let treatment take place at time t. The identification problem lies in the fact that one cannot observe, at time t, firm i in both states and, therefore, measure the simple individual treatment effect,$Y_{it}^{1} - Y_{it}^{0}$. However, if provided with an adequate control group, it is possible to estimate the average effect of the treatment on the treated. The method applied is often known as difference-in-difference (D-in-D) and compares the average behaviour before and after the programme for the treatment group with the before and after measures for the comparison group (Blundell and Costa Dias, 2000).

The underlying idea of a D-in-D estimator is that it can be used with an untreated comparison group (counterfactual) to identify variation in the outcome that is not due to the treatment. However, to achieve an identification of the general D-in-D estimator it must be assumed that the average outcomes for treated and control cases would have followed parallel paths over time. This is known as the common trend assumption:

$$E\left[Y_{it}^{0} - Y_{it'}^{0} \mid D = 1\right] = E\left[Y_{it}^{0} - Y_{it'}^{0} \mid D = 0\right] \tag{1}$$

where t' is an observation before programme implementation. The assumption states that the temporal evolution of the outcome variable of treated individuals $(D = 1)$, if

they had not been exposed to the treatment, would have been the same as the observed evolution for individuals not exposed to the treatment $(D = 0)$.

If the assumption expressed in (1) holds, the D-in-D estimate of the average treatment effect on the treated can be obtained by the sample analogues of

$$\alpha_{D-in-D} = \{E[Y_{it} \mid D = 1] - E[Y_{it} \mid D = 0]\} - \{E[Y_{it'} \mid D = 1] - E[Y_{it'} \mid D = 0]\} \tag{2}$$

where Y_{it} is the observed outcome for individual i at time t. As showed before, this approach measures the impact of the programme by the difference between participants and non-participants in the before-after difference in outcomes.

The common trend assumption can be too severe if the treated and control groups are not balanced in covariates that are believed to be associated with the outcome variables (a common problem referred to as the Ashenfelter's dip, after Ashenfelter (1978)). The D-in-D setup can be extended to accommodate a set of covariates, which is usually done in a linear fashion. The formulation below considers eligibility-specific and time/aggregate effects. In the following model, $\hat{\alpha_D}$ corresponds to this estimate and is obtained for a sample of treatment and control observations:

$$Y_{it} = \lambda D + \eta\tau_t + \theta' Z_{it} + \alpha_D D_{\tau_t} + \varepsilon_{it} \tag{3}$$

Where D is as before and represents the eligibility specific intercept, in this case defined as the variables listed in Table II along with a set of variables defined according to the rules of the scheme, τ_t captures time/aggregate effects and equals 0 for the pre-programme period and 1 for the post-programme period. Z is a vector of covariates (pre-determined with respect to the introduction of the programme) included to correct for differences in observed characteristics between firms in treatment and control groups.

This estimator allows the analysis to control for differences in Z and for time-specific effects, but it does not allow α_D to depend on Z nor does it impose a common support on the distribution of the Z's across the four cells defined by the D-in-D approach (the before and after observations, and the treatment and control groups). Additionally, as pointed out by Meyer and Nagarajan (1996), this process might be inappropriate if the treatment has different effects for different groups in the population.[23]

These pitfalls can be mitigated by supplementing the D-in-D estimates with propensity score matching. The Difference-in-Difference Matching (DDM) estimator implemented follows Heckman et al. (1997, 1998) and Smith and Todd (2005). Intuitively,

[23] Although this heterogeneity in the treatment effect can be accommodated in (3) by interacting D with the Zs.

benefits may arise, compared to the simple D-in-D estimator, because the matching version ensures comparability of the observable covariates that characterise the propensity score matching estimator. The feasibility of this matching strategy relies on a rich set of observable individual characteristics, those included in Z, and is used to guarantee that the distribution of the meaningful individual characteristics for the definition of the outcome is the same in the difference-in-difference cells. The matching process models the probability of participation and matches individuals with similar propensity scores. The common trend assumption behind the DDM estimator (Smith and Todd, 2005) is

$$E\left[Y_{it}^{0} - Y_{it'}^{0} \mid P\left(Z\right), D = 1\right] = E\left[Y_{it}^{0} - Y_{it'}^{0} \mid P\left(Z\right), D = 0\right] \tag{4}$$

where $P\left(Z\right) = Pr\left(D = 1 \mid Z\right)$ is the propensity score. The set of variables in Z typically includes information on the firms´ characteristics and possible relationship with the banking sector. Thus, the key identifying conditions affecting the growth are conditional on Z, and this implies (4) via properties of the propensity score (Rosenbaum and Rubin, 1983). The DDM estimator also requires the support condition of a nonparticipant analogue for each firm, formally that $Pr\left(D = 1 \mid Z\right) < 1$. As pointed out in Heckman et al. (1997, 1998), it is important to guarantee that we can find a match for programme participants, to guarantee that the condition $Pr\left(D = 1 \mid Z\right) < 1$ is satisfied. Indeed, if there are regions where the support of Z does not overlap for the treatment and control groups, one should restrict the matching to the common support region to avoid a major source of bias in quasi-experimental programme evaluations (Heckman et al., 1998).

Using the repeated cross-sectional dimension of the data, it can be implemented the DDM estimator following Smith and Todd (2005):

$$\hat{\alpha}_{DDM} = E\left[Y_{t}^{1} - \hat{E}\left(Y_{t}^{0} \mid P\right)\right] - E\left[Y_{t'}^{1} - \hat{E}\left(Y_{t'}^{0} \mid P\right)\right] \tag{5}$$

where $\hat{E}\left(Y_{t'}^{0} \mid P\right)$ and $\hat{E}\left(Y_{t}^{0} \mid P\right)$ represent the expected outcome for individuals in the control group and for those matched with those in the treatment group, respectively, in the after and before periods. To guarantee that, in each period, the distribution of the relevant characteristics is the same for treatment and control groups, observations in the four cells (Before/After; Treatment/Control) are required to have propensity scores within the same range. In practical terms, this approach restricts the computation of the average treatment effect on the selected units so that, after being successfully matched in each period, they have propensity scores within a common range among the four cells, ensuring common support as required in Smith and Todd (2005).

5.2 Implementing the matching process

When implementing a propensity score matching (PSM) process, there are three fundamental stages to consider (Caliendo and Kopeinig, 2008). As a first step, one must decide how to estimate the propensity score. Then the matching algorithm must be chosen, and the region of common support needs to be determined. To conclude, the matching quality must be assessed, which also means testing the sensitivity of the estimated treatment effects or the failure of the common support condition.

The quality of the estimated propensity scores is one of the cornerstones of a successful matching procedure (Centeno et al., 2008). At this initial stage, the estimation of the propensity scores entails two decisions: (i) the model to be used for the estimation and (ii) the variables to include in the model specification. While the selection of the model type is rather straightforward, revolving around the ubiquitous choice between probit and logit models, the second decision, concerning the set of variables to be included, is less consensual and more crucial towards the successful use of propensity score matching models. While some studies, such as Augursky and Schmidt (2001) and Bryson et al. (2002), suggest the use of parsimony models, Rubin and Thomas (1996) recommend an over-parameterised specification.

In this way, although there is no generally-accepted method to specify a propensity score model, the literature provides advice regarding the inclusion (or exclusion) of covariates. First, the variables included should influence the treatment status and outcome variables simultaneously (Sianesi, 2004; Smith and Todd, 2005). Extensive literature has demonstrated that such factors such as firm size, financial performance and the previous credit level are important determinants of credit market access. Therefore, the inclusion of these variables in the model is justified not only due to its effect on the outcome variable, but also because it is rather likely that selection on observables (by banks and MGS entities), if it takes place, is based on such characteristics. Moreover, the model also includes variables such as programme eligibility that rely on the firm's financial indicators, which affect both likelihood of access to the programme and the potential outcome variables. Finally, the model controls for business activity and for regional differences, which may be less important in determining the treatment status, but are clearly important to control for differences in firms' performance.

The matching estimation approach itself follows the one suggested in Caliendo and Kopeining (2008). The procedure starts by applying a logit model to estimate the probability of firms' joining the PME in year t, conditional on covariates observed in the previous year (Z). The firms (borrowers) participating in the programme ($PME_t = 1$) provide the treatment observations. A propensity score is then obtained to each observation and is defined as

$$P\left(Z_{t-1}\right) \equiv Pr\left(PME_t = 1 \mid Z_{t-1}\right) \tag{6}$$

where Z_{t-1} is a vector of firm characteristics in year $t-1$. The variables are measured in the year before the participation, ensuring that they are unaffected by the programme, as mentioned in Heckman et al (1999).

The second step is to apply the matching algorithm, guaranteeing that all our observations are inside the support area (common support). The treated observations are selected from the participant pool and matched with the control group, using a kernel matching algorithm. This is a non-parametric matching estimator that uses weighted averages of all individuals in the control group to construct the counterfactual outcome (Caliendo and Kopeining, 2008). As Smith and Todd (2005) noted, kernel matching can be seen as a weighted regression of the counterfactual outcome on an intercept with bulks given by the kernel weights. These weights depend on the distance between each individual and the control group and the participant observation for which the counterfactual is estimated.

One main benefit of this set of approaches is the lower variance, which is achieved because more information is used. A shortcoming, though, is that possible observations used might be bad matches. A proper imposition of the common support criterion is therefore of paramount importance (Heckman et al., 1998).

Implementing the common support condition ensures that any combination of characteristics observed in the treatment group can also be found among the control group (Bryson et al., 2002). A simple criterion for common support is to delete all observations whose propensity score is smaller than the minimum or larger than the maximum in the opposite group. However, this paper has adopted a more robust and conservative approach suggested by Smith and Todd (2005), applying a trimming procedure to determine common support. According to this method, the region of common support is defined as those values of P that have a positive density within both the $D = 1$ and $D = 0$ distributions, that is:

$$\hat{S}_{Pq} = \left\{ Pq : \hat{f}\left(P \mid D = 1\right) > q \; and \; Pq : \hat{f}\left(P \mid D = 0\right) > q \right\} \tag{7}$$

where $\hat{f}\left(P \mid D = 1\right) > q$ and $\hat{f}\left(P \mid D = 0\right) > q$ are non-parametric density estimators and q is a percentage of the remaining P points exceeding zero. So, by following this approach, not only are the P points for which the estimated density is exactly zero excluded, but also an additional density of P that exceeds zero by a threshold amount of q is also left aside. In this study, the common support exercise benefits from a large pool of firms from which to draw units with 'common' characteristics. Allowing the algorithm to assure common support across all four groups and that only a few observations are

dropped from the full sample.[24]

In the third and last stage, the annual performance of a set of variables is compared to the treatment and control group for years $t-1$ to $t+i$, where $i = 0, 1, 2, 3$. The main advantage of adopting this matching estimation approach is that it allows the treatment and control observations to be matched according to their scalar propensity score. The propensity score is the conditional probability of being treated given the observed characteristics, and is a useful variable when dealing with a high-dimension vector of covariates. In their seminal article, Rosenbaum and Rubin (1983) showed that treatment observations (in this case, those who accessed the PME programme) and control observations (those who did not) with the same propensity score value have the same distribution over the full vector of covariates. In this study, to achieve the same probability distribution of the covariates for the treatment and control observations, it is sufficient to match in terms of propensity scores – balancing score $P(Z)$ – and firm size (Rosenbaum and Rubin, 1983).

However, as a final step, one must ensure that the treatment effect estimator is unbiased, by satisfying the balancing hypothesis:

$$PME_t \perp Z_{t-1} \mid P\left(Z_{t-1}\right) \tag{8}$$

In other words, for a given propensity score, a pool of treatment and control observations should exist, which are, on average, identical. Therefore, after implementing the matching estimation, condition (8) should hold. The testing procedure adopted follows Sianesi (2004) and compares the logit model estimation of (6) and the equivalent estimation using the data set containing only the treatment and control samples. If the balancing hypothesis is satisfied, the treatment and control firms should be identical and $Z-1$ does not distinguish PME users from the matched non-users. This is tested by calculating the pseudo *R*-squared and the likelihood ratio statistic, which tests the null of all the parameters being jointly zero after the sample matching. A detailed assessment of the matching quality is shown in Appendix A.2 Assessing the quality of matches.

6 ASSESSING THE EFFECT OF THE PME PROGRAMME

The empirical analysis therefore starts with a logit model to estimate the firms' propensity to join the programme. In the second phase, the overall treatment effects of the PME programme are estimated. Finally, the sample is split according to the targeted firms of the programme and a set of heterogeneous effects and spillovers are measured.

[24]The number of removed observations is shown in Appendix A.2 Assessing the quality of matches.

6.1 Probit and propensity score estimation

The procedure starts by estimating the propensity score for each firm (Eq. 6). As previously discussed, the propensity score is the conditional probability of participating in the PME programme in year t, given the values observed in the previous year. The dependent variable is a binary variable indicating the firm's participation in year t (PME_t) and Z_{t-1} is a vector of explanatory variables, divided into four groups. The first set (*Programme accessibility*) includes the variables related to eligibility requirements, the second (*Bank relationship*) describes the degree of firms' financial involvement with the banking sector. The third (*Performance*) groups some key indicators on firm performance, while the last set (*General characteristics*) includes information on the industry sector, size, value and external transactions. The following model was estimated:

$$\begin{aligned} Pr\left(PME = 1 \mid Z_{t-1}\right) = \Phi\left(\beta_0 + \beta_1 Programme\ accessibility_{t-1}\right. \\ + \beta_2 Bank\ relationship_{t-1} + \beta_3 Performance_{t-1} \\ \left. + \beta_4 General\ characteristics\right) \end{aligned} \quad (9)$$

Table V shows the estimation results and the conditional probability (dy/dx) of participating in the scheme. All the variables included in the first set (*Programme accessibility*) are positive and significant. As expected, this implies that the selection criteria have a positive influence on the conditional probability of enrolment in the scheme. In fact, the dummy variable that identifies the firm's eligibility for the programme is the most relevant for the model (with an increase in the overall probability of 32.7%). Furthermore, there are statistically significant differences across the mutual guarantee societies that assessed the firms' applications, showing that companies who had their credit reviewed by MGS A had a higher probability of accessing the scheme.

TABLE V: LOGIT MODEL

Dependent variable: Treatment[1]	**Coefficient**	**Std. Errors**	**Delta-method** *(dy/dx)*	**Std. Errors**
CONSTANT	-21.123	(1.010)		
Programme accessibility				
ELIGIBLE	2.525	(0.051)***	0.327	(0.006)
EMP <= 50	0.445	(0.121)***	0.058	(0.016)
EXT. TRANS. > 10%	0.124	(0.024)***	0.016	(0.003)
TURNOVER <= 10 million	0.573	(0.168)***	0.074	(0.022)
MGS A	0.318	(0.029)***	0.041	(0.004)
MGS B	0.256	(0.066)***	0.033	(0.009)
Bank's relation				
LOAN RATIO	0.795	(0.038)***	0.103	(0.005)
SHORT RATIO	0.399	(0.027)***	0.052	(0.004)
BANKS	0.756	(0.018)***	0.098	(0.002)
Performance				
ICOVER Dummy	-0.106	(0.032)***	-0.014	(0.004)
DCOVER Dummy	0.114	(0.034)***	0.015	(0.004)
NEGATIVE CAP Dummy	-1.754	(0.077)***	-0.227	(0.010)
General characteristics				
SMALL	0.458	(0.024)***	0.059	(0.003)
MEDIUM	0.925	(0.119)***	0.120	(0.015)
lnASSETS	2.079	(0.156)***	0.269	(0.020)
$lnASSETS^2$	-0.075	(0.006)***	-0.010	(0.001)
REGIONAL Dummies	Yes			
SECTORAL Dummies	Yes			
N	86 089			
Pseudo *R*-square	0.19			

[1] Note: The dependent variable is measured in year 2009, while the explanatory variables are measured in 2008.
* Significance level of 10%.
** Significance level of 5%.
*** Significance level of 1%.

The results related to firms' connections to the financial system, although interesting, are also not surprising. The companies that already rely on banking credit as a primary source of funding (*LOAN RATIO*) and have a stable relationship with the banking sector (*BANKS*) show a greater propensity to join the programme. Interestingly, the entities that have a higher short-term credit volume (*SHORT RATIO*) are also more likely to apply for

the programme. This implies that loan-dependent firms, especially those reliant on short-term loans, are more prone to use the programme. Moreover, both results suggest that the scheme may have been used to increase firms' credit maturity, allowing companies to restructure their debts.

The same applies to firms that are 'distressed' to the point of insolvency (a *NEGATIVE CAPITAL* ratio), which are less likely to join the programme successfully. This outcome is not unexpected, as this is a key criterion used by banks for credit assessment and reflects a legal requirement to join the scheme. Note that the above results do not contradict the prediction of adverse selection, in that low-quality firms tend to use the CGS while high-quality firms avoid using it. In fact, one may see that although the companies with negative business profits (*ICOVER*) are unlikely to see their credit requests approved, the firms with a greater ability to repay their debts (*DCOVER*) are also less likely to apply for the programme. Taken together, this implies that financially distressed firms show a higher propensity to use the guarantee, as long as they are solvent.

Last, but not least, the firm size variables (*EMP* and *ASSETS*) are significantly positive. This suggests that firm size also plays a significant role in the conditional probability of accessing the scheme; this is one of the reasons to include a quadratic term for total assets to control for the largest firms in the sample. By contrast, companies that are already depended on exports to increase their turnover are less likely to use the programme. The literature also shows that these companies, due to their sound financial structure, have access to other types of loans to fund their economic activities.

6.2 Treatment effect

Following the empirical approach described above, the treatment effect of the PME programme is estimated by matching each treated observation in year t (16 596 observations) with the closest bucket of non-user observations in the same year, using a kernel algorithm. After implementing the matching process, the balancing condition is tested. While the pseudo R-squared in the full sample estimation is 0.189, once it is limited to only include treatment and control observations, the equivalent R-squared drops to 0.001. Thus, the null hypothesis that all parameters are jointly zero, with the p-value of 0.955, cannot be rejected[25].

The impact of the programme is measured on borrowers' credit availability (Total amount of credit, proportion of long-term credit, interest rate and probability of default), financial (*ROA*, net profits and default ratio) and economic performance (Number of employees, firms' net value, exports and turnover). For each group of treatment and control, the difference is estimated for each variable between periods $t + i$ and t, where

[25] A detailed sensitivity analysis is shown in Appendix A.2.

$i = 0, 1, 2, 3$. For example, the first difference for the total credit amount is estimated as $\Delta CREDIT^{j}_{t+i} = \Delta CREDIT^{j}_{t+i} - \Delta CREDIT^{j}_{t}$, where $j = \{Treatment, Control\}$. Then the treatment effect is estimated as a second difference between the treatment and control groups. For this specific case, the difference in the credit amount will be given by $\Delta^2 CREDIT^{j}_{t+i} = \Delta CREDIT^{Treatment}_{t+i} - \Delta CREDIT^{Control}_{t+i}$.

The results are presented in Table VI. The treatment effect estimated for the entire sample is considered the base case. For each variable, there are four estimates of the treatment effect corresponding to each of the four different time horizons. The first two columns respectively show the average of each variable for the treatment and control groups. The last column presents the treatment effect (or the difference-in-differences result) for each of the variables.

TABLE VI: AVERAGE TREATMENT EFFECT

Variable	Period	Group		Treatment Effect[1]	Variable	Period	Group		Treatment Effect[1]
		Treatment	Control				Treatment	Control	
Δ *CREDIT*	t	0.565	0.175	0.391***	Δ *EMP*	t	0.010	-0.005	0.015***
	$t+1$	0.585	0.201	0.385***		$t+1$	0.036	-0.006	0.042***
	$t+2$	0.450	0.086	0.364***		$t+2$	0.031	-0.014	0.045***
	$t+3$	0.260	-0.078	0.338***		$t+3$	-0.005	-0.064	0.059***
Δ *LONG RATIO*	t	0.156	0.027	0.130***	Δ *NET VALUE*	t	0.022	0.021	0.001
	$t+1$	0.162	0.062	0.101***		$t+1$	-0.113	-0.114	0.001
	$t+2$	0.119	0.051	0.069***		$t+2$	-0.095	-0.097	0.002*
	$t+3$	0.119	0.072	0.047***		$t+3$	-0.079	-0.081	0.002**
Δ *INTEREST RATE*	t	-0.049	-0.029	-0.020***	Δ *TURNOVER*	t	-0.074	-0.085	0.011*
	$t+1$	-0.054	-0.038	-0.015***		$t+1$	-0.025	-0.046	0.022**
	$t+2$	-0.041	-0.026	-0.015***		$t+2$	-0.043	-0.081	0.037***
	$t+3$	-0.028	-0.018	-0.010***		$t+3$	-0.116	-0.162	0.047***
Δ *p(DEFAULT=1)*	t	0.013	0.023	-0.010***	Δ *EXPORTS*	t	-0.010	-0.007	-0.003*
	$t+1$	0.021	0.029	-0.009**		$t+1$	0.096	0.091	0.004
	$t+2$	0.042	0.051	-0.010*		$t+2$	0.244	0.180	0.064*
	$t+3$	0.074	0.080	-0.006		$t+3$	0.325	0.227	0.098**
Δ *DEFAULT RATIO*	t	0.000	0.001	-0.001**	Δ *ROA*	t	-0.006	-0.006	-0.000
	$t+1$	0.001	0.002	-0.001*		$t+1$	-0.007	-0.007	0.000
	$t+2$	0.002	0.005	-0.003***		$t+2$	-0.016	-0.020	0.004*
	$t+3$	0.007	0.009	-0.002*		$t+3$	-0.024	-0.027	0.003
Δ *NET PROFITS*	t	-0.005	-0.007	0.002					
	$t+1$	-0.004	0.000	-0.005					
	$t+2$	-0.038	-0.043	0.006					
	$t+3$	-0.059	-0.057	-0.003					

[1] Note: For each group of treatment and control, the difference is estimated for each variable between periods $t+i$ and t, where $i = 0, 1, 2, 3$. The treatment effect is estimated as a second difference between the treatment and control groups.
* Significance level of 10%.
** Significance level of 5%.
*** Significance level of 1%.

There is a strong and overall evidence of positive treatment effect for loan additionality. That is, compared to non-participants, participants showed a significant increase in loan volume, particularly in the first year of the programme (Hypothesis 1). More importantly, this effect lasted for four consecutive periods, and remains even when there is a decreasing trend in the credit market (Hypothesis 1b). The first differences show that, while untreated firms experienced a significant decrease in a longer horizon, the treated companies were still able to keep a credit level 26.0% higher when compared to the baseline level. Both results confirmed that the scheme's effects remained after the programme ended (33.8%), corroborating the first two assumptions of credit additionality.

Furthermore, the treated firms also experienced a meaningful change in their credit structure (Hypothesis 2). Between $t-1$ and t, the proportion of long-term loans (Δ*LONG RATIO*) increased by 13.0% for participants and remained higher over a longer period (4.7% higher after four years). The treatment effect for the interest payments (Δ*INTEREST RATE*) also confirms this change, with participants showing a reduction of its average interest rate of 2.0 p.p. and 1.0 p.p. in the first and last periods, respectively. The effect over the proportion of defaulted loans also shows that the borrowers' quality of treated firms slightly improved, with a *DEFAULT RATIO* 0.2 p.p. lower than among the control group (Hypothesis 4). Taken together, both results confirm that the programme granted more liquidity to treated firms, helping to alleviate their refinancing needs and decrease their interest expenses.

There is also substantial evidence that economic performance improved for the scheme's participants (Hypothesis 5). Table VI shows that participants increased their workforce (Δ*EMP*) in the first three years, while non-participants recorded a modest decrease. More importantly, while in the last period there was reduction across the full sample, the impact for treated firms was to a lesser degree, with this group showing a significant and positive treatment effect of 5.9% (Hypothesis 5a). This outcome corroborates the impact on employment and reveals that the consequences of the programme were not limited to the availability and type of funding.

In fact, as suggested in the literature, the scheme has positive spillovers for the economic performance of participating firms (Hypothesis 5). Even though turnover (Δ *TURNOVER*) decreased across the sample, the programme participants experienced a smaller reduction compared to non-participants. This difference is particularly significant after the end of the programme, when the treatment effect was 4.7%. These results also suggest a positive impact on treated firms' exports (Δ*EXPORTS*), showing a positive treatment effect of 9.8% in the last period (Hypothesis 5b). The participant firms' value (Δ*NET VALUE*) was also affected, albeit not immediately, with a positive average treatment effect of 0.2 p.p. Altogether, there is statistical evidence that the scheme

showed positive spillovers, contributing to improvement in the participants' economic performance.

Nevertheless, the financial performance of treated firms shows mixed effects. Although the likelihood of participants defaulting ($\Delta p(DEFAULT=1)$) is lower during the programme, there is no statistical evidence that this difference remains after the credit line ends (Hypothesis 4). This shows that banks' credit supervision may have been an important feature in the scheme, playing a key role in monitoring the borrowers' performance.

This resulted in a double and positive effect for the Portuguese financial system. First, as the enrolled firms experienced a lower probability of default, the banks were able to reduce their provisions, and consequently their capital requirements, for these loans. Second, under the Basel Accords, it is significant that the guaranteed loans have a risk weight only of 10% (instead of 100% for nonguaranteed loans), enabling the banks to reduce their overall risk exposure. Taken together, and aside from the direct impact on treated firms, the results also suggest that the scheme helped the participant banks to improve their capital levels.

Moreover, even though the firms increased their investment, there is no statistical evidence that they could find more profitable projects (Δ*NET PROFITS* and Δ*ROA*) when compared to the control group (Hypothesis 6).[26] In fact, profitability was not one of the main features targeted by the programme. However, so as to improve the overall performance of participating firms, this outcome suggests that further mechanisms could be introduced to control firms' investment plans.

6.3 Treatment effects across programmes and subsamples

The previous section (6.2) shows that the base case estimation provides evidence to support credit additionality (Hypothesis 1), decreased funding costs (Hypothesis 2) and economic spillovers (Hypothesis 5), including job creation (Hypothesis 5). Nevertheless, several issues remain unaddressed, such as whether the scheme was able to increase the amount of credit granted to smaller firms (Hypothesis 1b); and whether it promoted export growth for those participants targeted by the EXP credit line (Hypothesis 5b). Moreover, by measuring various effects across firm sizes and credit lines, it may also help shed some light on how to improve the design of the scheme and make it more efficient.

This section studies the main effects across different subsamples and the two credit lines. The results are shown, respectively, according to the targeted outcome: credit additionality (Section 6.3.1), economic spillovers (Section 6.3.2) and participants' profitability (Section 6.3.3).

[26] A caveat has to be made, since the four periods may not be enough to measure this effect.

6.3.1 Impact on credit

The previous estimation shows that the *PME Investe* programme increased the overall amount of credit available for participating firms. However, as discussed in Section 3, this scheme targeted different firms and incorporated distinct features in its credit lines. For instance, while the SME line tried to overcome the lack of capital so that smaller companies could access the credit market, by covering 75% of the loans granted, the EXP programme granted larger loan amounts and, simultaneously, focused on reducing financing costs for participants. Following the theoretical literature, one might say that these two lines were purposely designed with different objectives. Nevertheless, it is important to measure whether these goals were accomplished and, more importantly, the differences between the participants in these two lines.

The results are shown in Table VII. The first three columns show the estimated treatment effect for each size of firm. Columns 4 and 8 show the estimated individual effect of the two credit lines, while columns 5 to 7 and 9 to 10 distinguished the individual effects of these lines over firms' different sizes.

TABLE VII: AVERAGE TREATMENT EFFECT ON TREATED
CREDIT

		Programme									
					EXP Programme				**SME Programme**		
Variables		Micro [1]	Small [2]	Medium [3]	Total [4]	Micro [5]	Small [6]	Medium [7]	Total [8]	Micro [9]	Small [10]
CREDIT	t	0.452***	0.376***	0.282***	0.402***	0.872***	0.399***	0.200**	0.356***	0.414***	0.308***
	$t+1$	0.457***	0.374***	0.296***	0.398***	0.784***	0.418***	0.152*	0.328***	0.422***	0.262***
	$t+2$	0.401***	0.366***	0.231**	0.414***	0.834***	0.440***	0.074	0.288***	0.361***	0.242***
	$t+3$	0.360***	0.347***	0.214**	0.424***	0.855***	0.451***	0.040	0.235***	0.323***	0.195***
LONG RATIO	t	0.127***	0.127***	0.124***	0.144***	0.145***	0.144***	0.135***	0.111***	0.128***	0.101***
	$t+1$	0.084***	0.101***	0.100***	0.113***	0.104**	0.112***	0.110***	0.084***	0.085***	0.087***
	$t+2$	0.044***	0.077***	0.057*	0.081***	0.041	0.085***	0.073**	0.054***	0.046***	0.070***
	$t+3$	0.024*	0.057***	0.027	0.057***	0.049	0.062***	0.034	0.038***	0.026*	0.062***
INTEREST RATE	t	-0.024***	-0.018***	-0.022**	-0.015***	-0.030***	-0.015***	-0.010	-0.022***	-0.024***	-0.020***
	$t+1$	-0.023***	-0.014***	-0.011	-0.011***	-0.024***	-0.012***	-0.001	-0.018***	-0.023***	-0.015***
	$t+2$	-0.019***	-0.014***	-0.013*	-0.013***	-0.027***	-0.014***	-0.002	-0.017***	-0.019***	-0.014***
	$t+3$	-0.013***	-0.009**	-0.014*	-0.008**	-0.020*	-0.009*	0.000	-0.011***	-0.014***	-0.008**
p(DEFAULT=1)	t	-0.024***	0.007	-0.010	-0.010*	-0.033***	-0.009	-0.013	-0.011***	-0.025***	-0.001
	$t+1$	-0.007***	-0.013**	-0.011	0.017***	0.013	-0.018**	-0.020	-0.007	-0.012*	-0.003
	$t+2$	-0.005***	-0.006	-0.027	-0.023***	0.020	-0.024**	-0.037	-0.001	-0.009	0.008
	$t+3$	-0.001***	0.002	-0.020	-0.011	-0.010	-0.011	-0.012	0.006	0.000	0.014
DEFAULT RATIO	t	-0.003	0.000	0.000	-0.001*	-0.008*	0.000	0.000	-0.001***	-0.002***	0.000
	$t+1$	-0.003	0.000	0.000	-0.001	-0.009*	-0.001	0.000	-0.001**	-0.002**	0.000
	$t+2$	-0.004	-0.002	-0.002	-0.003**	-0.005	-0.003**	-0.001	-0.003***	-0.005***	-0.001
	$t+3$	0.000	-0.002	-0.003	-0.003	-0.001	-0.003**	0.000	-0.001	0.000	-0.002

* Significance level of 10%.
** Significance level of 5%.
*** Significance level of 1%.

Table VII confirms that the credit guarantee scheme increased the overall amount of credit across all participating firms (Hypothesis 1). The treatment effect was stronger, however, for micro- and small-sized companies (columns [1] and [2]). In fact, after the third year, there were no statistical differences for the medium-sized firms that accessed the EXP Programme ([7]). By contrast, the EXP line showed a higher impact for small- and micro-sized firms ([5] and [6]) in comparison to the SME line ([9] and [10]). This result is obviously related with different amounts granted by these two programmes. Nevertheless, both results corroborate a credit increase for participants, notably for- micro- and small-sized firms (Hypothesis 1b), refuting the substitution hypothesis (Hypothesis 3).

Similarly to the base case, both lines proved to reduce participants' short-term credit needs and interest expenses efficiently (Hypothesis 2). However, for micro-sized firms that accessed EXP line, the increase in long-term loans only held for two periods. Bearing in mind that the volume of credit increased and interest rates remained lower for the participants, this suggests that credit lines were renewed for these firms but with a shorter maturity.

The comparison across sizes of firms also shows that the EXP Programme had limited effects for medium-sized firms. This set of participants experienced a decrease in their short-term funding needs, but the price of loans remained broadly the same when compared to non-participants. These differences also suggest that the EXP credit line was more efficient for small- and micro-, rather than medium-sized firms.

Finally, the credit guarantee scheme also seemed to reduce the probability of default for micro- and small-sized firms efficiently. This effect is particularly strong in the EXP line, with small-sized participants showing a likelihood of defaulting, after two years, 2.4% lower than non-participants. Table VII also shows that micro-sized firms that joined the SME credit line recorded a smaller proportion of defaulted loans compared to the control group. However, both effects only lasted for the duration of the programme, reinforcing the observation that the banks were able to create monitoring synergies by closely following these loans (Hypothesis 4), but only for the micro-sized firms.

6.3.2 Economic spillovers

The baseline scenario showed that the Portuguese credit scheme contributes efficiently to increasing employment, exports and turnover volume across the sample of enrolled firms. However, and as shown in the previous section, this effect was not homogeneous for all of the firms' size classes and programmes.

TABLE VIII: AVERAGE TREATMENT EFFECT ON TREATED
EMPLOYMENT, TURNOVER AND EXPORTS

		Programme									
					EXP Programme				**SME Programme**		
Variables		Micro [1]	Small [2]	Medium [3]	Total [4]	Micro [5]	Small [6]	Medium [7]	Total [8]	Micro [9]	Small [10]
EMP	t	0.033***	0.006	0.018*	0.014 *	0.029	0.011	0.009	0.016**	0.034***	0.003
	$t+1$	0.052***	0.036***	0.029*	0.047***	0.080**	0.044***	0.019	0.032***	0.042***	0.019*
	$t+2$	0.041**	0.049***	0.021	0.069***	0.101**	0.070***	0.015	0.028***	0.033*	0.027**
	$t+3$	0.044**	0.066***	0.024	0.091***	0.140***	0.091***	0.012	0.030**	0.028	0.031**
TURNOVER	t	0.016	0.010	0.005	0.026**	0.024	0.033***	-0.018	0.001	0.010	-0.005
	$t+1$	0.027*	0.020	0.009	0.044***	0.097 **	0.042***	-0.025	0.000	0.009	-0.010
	$t+2$	0.021	0.041**	0.014	0.071***	0.102*	0.069***	-0.016	0.005	0.003	0.006
	$t+3$	0.010	0.058***	0.004	0.102***	0.140**	0.104***	-0.015	-0.008	-0.024	-0.001
EXPORTS	t	-0.113**	0.034	0.114	0.140***	0.187	0.127**	0.092	-0.089**	-0.133**	0.000
	$t+1$	-0.083	0.026	0.016	0.131***	-0.080	0.115**	0.028	-0.045	- 0.088	0.025
	$t+2$	-0.099*	0.0108*	-0.054	0.151***	-0.043	0.143**	0.066	-0.018	-0.124*	0.074
	$t+3$	-0.081	0.170***	-0.146	0.225***	0.050	0.229***	-0.005	-0.025	-0.114*	0.046
EXTERNAL WEIGHT	t	-0.021***	-0.002	-0.015	0.009*	-0.006	0.007	-0.012	-0.017***	-0.027***	-0.007
	$t+1$	-0.019**	-0.007	-0.013	0.000	-0.029	-0.005	-0.005	-0.012**	-0.022***	-0.004
	$t+2$	-0.029***	0.007	-0.010	0.016**	-0.032	0.012	-0.004	-0.011**	-0.030***	0.004
	$t+3$	-0.026***	0.012	-0.017	0.022***	-0.033	0.021**	0.006	-0.013**	-0.031***	-0.001

* Significance level of 10%.
** Significance level of 5%.
*** Significance level of 1%.

The detailed results (Table VIII) suggest that the programme was particularly efficient in increasing the labour force in micro- and small-sized firms (Hypothesis 5a). This effect was mainly stronger for the firms that accessed the EXP Programme, with a difference of 14.0% and 9.1% respectively for micro- and small-sized companies, when compared to the control group. To a lesser extent, the SME-participants also recorded an overall increase (3.0%) of their number of employees, although for micro-firms there is no statistical evidence that this effect held after the programme's end. As in the previous section, the results also pointed out a limited effect on medium-sized firms, with the treated and untreated firms experiencing a minor, but positive, statistical difference[27] in employment (*EMP*) only in the first two years (more 1.8% and 2.9%, respectively).

The EXP credit line was also particularly effective in promoting the increase of turnover among micro- and small-sized firms. This trend, however, was driven by different factors. The results of the study suggest that participant firms became more competitive in international markets, increasing their *EXPORTS* by 22.9% compared to non-participants. The turnover growth experienced by micro-sized firms is mainly explained by an increase in the domestic market, as there is no statistical evidence to support a difference between treated and untreated firms in their overall amount of exports. On the other hand, similarly to the effects on the job market, this credit line also seemed to be unsuccessful in promoting turnover and export growth for medium-sized firms. Together with the results shown in the previous section, this last effect indicates that the EXP Programme should be redesigned to achieve higher efficiency among medium-sized firms.

Table VIII also shows that there is no statistical evidence supporting the assumption that the SME Programme promoted an increase of turnover and exports for its participants. In fact, one may see that micro-firms that accessed this line preferred to focus their economic activity on the domestic market, showing a significant decrease of exports (-11.4%) and, consequently, a reduction of the proportion of international transactions (*EXTERNAL WEIGHT*) on their balance sheets (-3.1%). Taken together, these results confirm that the EXP Programme was particularly efficient at promoting export growth for small- and micro-sized firms (Hypothesis 5b). On the other hand, there is no statistical evidence supporting a similar effect over micro- and small-sized firms for the SME Programme.

6.3.3 Profitability

The Portuguese CGS also established that the credit granted could only be used to invest in fixed assets or to reinforce firms' operating capital. Both objectives focused on improving participants' ex-post performance, in particular by allowing them to implement

[27] At a significant level of 10%.

profitable projects producing net positive present value (Hypothesis 6). Economic literature, however, also recognises that by easing requirements on collateral and third-party guarantees, the CGS might exacerbate information problems. For example, managers may take riskier investments (Stulz and Johnson, 1985) or be less likely to exert managerial effort (Boot et al., 1991) when their assets are not pledged as collateral. Also, as this objective may only be accomplished at the end of the programme and there is a high volatility associated with the situation, it is less likely that banks and national competent authorities would be able to follow and measure its effects.

Even though the participant firms experienced an increase in the overall amount of funds available (Hypothesis 1), there is no statistical evidence that this credit has been correctly directed to more profitable projects (Hypothesis 6). As in the base case, Table IX shows that both credit lines seemed unsuccessful in promoting an overall increase in treated firms' profits (Δ*NET PROFITS* and Δ*ROA*)[28]. However, there is also no evidence that these firms underperformed in comparison to non-participants. This shows that, although treated observations were not able to find and adopt higher-earning projects, the absence of statistical differences for the control group rules out the option of guarantee users succumb to moral hazard and, therefore, decrease their profitability and/or have a higher probability of falling into financial distress (as in). This is a very interesting result in comparison to similar schemes implemented in Italy (D'Ignazio and Menon, 2012) and Japan (Uesugi et al., 2010), where most of the participants underperformed after accessing the scheme.

Indeed, there are positive and statistical differences for the net value of micro- and medium-sized firms that accessed the EXP Programme. Although both sets of treated firms were unable to adopt profitable projects with a positive net present value, its managers were capable of raising these companies' value.

[28] With one exception: the small firms that accessed the SME Programme showed a marginal increase of 0.8% in the third year.

TABLE IX: AVERAGE TREATMENT EFFECT ON TREATED PROFITABILITY

		Programme									
					EXP Programme				**SME Programme**		
Variables		Micro [1]	Small [2]	Medium [3]	Total [4]	Micro [5]	Small [6]	Medium [7]	Total [8]	Micro [9]	Small [10]
NET PROFITS	t	0.000	0.001	0.040	0.003	0.003	-0.002	0.034	-0.001	0.000	0.000
	$t+1$	0.005	-0.008	-0.020	0.009	0.013	-0.016	-0.015	0.000	0.003	-0.006
	$t+2$	0.001	0.005	-0.002	0.002	0.007	-0.006	-0.013	-0.002	-0.001	-0.004
	$t+3$	0.000	-0.006	0.015	-0.008	-0.011	-0.018	0.031	-0.005	0.000	-0.011
ROA	t	-0.005*	0.002	0.004	-0.001	0.005	-0.002	0.004	-0.001	-0.007*	0.004
	$t+1$	0.001	0.001	-0.004	-0.002	0.004	-0.003	-0.005	0.003	0.000	0.004
	$t+2$	0.001	0.005	0.000	0.002	0.007	0.001	0.001	0.006*	0.002	0.008**
	$t+3$	0.004	0.002	0.003	0.000	0.012	-0.002	0.005	0.002	0.003	0.003
NET VALUE	t	0.000	0.000	0.003*	0.000	0.001	0.001	0.005 **	0.000	0.000	0.000
	$t+1$	0.001	0.000	0.005	0.001	0.010***	0.000	0.010*	0.000	0.000	0.000
	$t+2$	0.001	0.001	0.005	0.001	0.011***	0.001	0.014**	0.000	0.001	0.000
	$t+3$	0.001	0.002	0.006	0.002	0.011***	0.002	0.014**	0.000	0.000	0.000

* Significance level of 10%.
** Significance level of 5%.
*** Significance level of 1%.

7 CONCLUSION

Guarantee schemes are widespread in both developed and developing countries, where they are currently seen as effective instrument for improving the firms' access to credit markets, especially for SMEs. Most of these schemes are publicly funded, and this policy approach is often recommended by international organisations (D'Ignazio and Menon, 2012). Although these initiatives are popular, economic theory has not yet determined their net effect on participating firms.

This paper has examined empirically the effects of a broad government credit guarantee scheme on loan availability and the ex-post performance of firms. The programmes *PME Investe III* and *IV* are an excellent test case, because both were implemented on a large scale, for a limited period, and were uniformly available to almost all Portuguese SMEs. To measure their impact, this study relied on a unique set of panel data covering small firms and their liabilities to the financial sector. Using a difference-in-difference matching method, the paper has evaluated the treatment effect of the policy on a number of potential outcome variables – such as the bank debt of each firm, its debt structure, its interest expenses, its profitability and the probability of default – for four years after joining the scheme.

The results have shown that this Portuguese CGS successfully mitigated the information asymmetries in the credit market, with programme participants experiencing an overall increase of credit in comparison to nonparticipants. More importantly, this growth continued after the programme ended, even during the severe contraction of credit lending to SMEs experienced in Portugal after 2011. The programme also helped participants to reduce their short-term debt needs and their interest expenses. The results showed that the policy led to a statistically significant increase in the proportion of long term debt, and that treated firms were able to renegotiate their debt structure even after the guarantees ceased. The introduction of this scheme also led to lower interest rates for the beneficiary firms, achieving one of the main aims of the policy.

The design of the scheme also contributed to reducing the moral hazard among borrowers. All loans granted were partially guaranteed by a public institution, splitting the risk between the bank and the state. This design seemed to encourage careful assessment and monitoring of the participants' performance, reducing the overall probability of default. This was particularly important for the Portuguese financial system, helping the banks to reduce their risk-weighted exposures, and therefore to improve their capital ratios under the Basel Accord.

Moreover, there is also statistical evidence of economic spillover effects. The treated firms experienced a positive and significant difference regarding employment growth, turnover, exports and net value in comparison to the control group. However, there is

no evidence that the programme helped the participants to find and invest in more profitable projects. This suggests that further mechanisms should be implemented, such as controlling the type of investments that these loans can be used for, to improve the overall performance of these firms.

In a similar vein, these effects were not homogenous across firms differing in size and credit. The design and features of the scheme were slightly different between programmes; these differences allowed the magnitude of the effects to be distinguished among different kinds of firms programmes. The credit line directed to exporters (EXP Programme) had limited effects among medium-sized firms, suggesting that the programme design should be reshaped for these entities. Moreover, although the programme directed to smaller firms (SME Programme) increased the overall level of credit, there is also statistical evidence that the participant firms reduced their international transactions, such as their volume of exports.

This study, however, opens some space for further developments. The results covered four years after the participants accessed the scheme. This obviously poses limitations, and a longer term could be used in the future to assess the effect of loan guarantees on the profitability of participants. More importantly, this study did not examine the operating costs of the scheme. As this is a key feature of this kind of economic policy, a cost-benefit analysis should be conducted to determine whether or not these programmes should be expanded. Last but not least, Portugal experienced a period of credit constraint, with most of the banks reducing their volume of retail lending and facing additional regulatory capital requirements. Determining how this scenario affected the borrower-guarantee-lender relationship between firms, the credit guarantee scheme and undercapitalised banks would also be of interest to further understand the effectiveness of this scheme.

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APPENDIX

A.1 Variables

TABLE A1: VARIABLES DEFINITION

Variable name	Definition
Programme accessibility	
PME_t	1 if the firm enrols in PME programme in t, 0 otherwise
$ELIGIBLE_t$	1 if the firm meets all the criteria to enrol in the programme in t, 0 otherwise
EMP <= 50	1 if the firm has 50 or less employees in $t-1$, 0 otherwise
EXT. TRANS. >= 10%	1 if the proportion of firm's exports and imports is equal or greater than 10% of their turnover in $t-1$, 0 otherwise
TURNOVER <= 10 million	1 if the firm has a turnover of less than EUR 10 million in $t-1$, 0 otherwise
GUARANTEE VALUE	Total amount of guarantees granted
GUARANTEE RATIO	Ratio of programme value over total bank credit
MGS A	1 if the firm is geographically located in the MGS A jurisdiction, 0 otherwise
MGS B	1 if the firm is geographically located in the MGS B jurisdiction, 0 otherwise
MGS C	1 if the firm is geographically located in the MGS C jurisdiction, 0 otherwise
Bank relationships	
CREDIT	Total amount of the firm's banking credit
LOAN RATIO	Ratio of total loans to total liabilities
LONG RATIO	Ratio of medium- and long-term loans (loans with more than 1 year of maturity) to total liabilities
SHORT RATIO	Ratio of short-term loans to total liabilities
INTEREST RATE	Ratio of interest payments to total amount of loans
DEFAULT	1 if the borrower has at least one defaulted loan, 0 otherwise
DEFAULT RATIO	Ratio of amount of loans past due to total amount of loans
BANKS	Number of banks per firm

Variable name	Definition
Performance	
ROA	Ratio of business profits to total assets
ICOVER	Ratio of business profits to interest payments (Interest coverage ratio)
ICOVER Dummy	1 if the ICOVER is less than one, 0 otherwise
DCOVER	Ratio of business profits to total credit (Debt coverage ratio)
DCOVER Dummy	1 if the DCOVER is less than 10%, 0 otherwise
NEGATIVE CAP. Dummy	1 if the Capital Ratio (firm's net worth/total assets) is negative, 0 otherwise
NET PROFIT	Total amount of the firm's end-of-year profits
TURNOVER	Total amount of the firm's turnover
EXPORTS	Total amount of the firm's exports
General characteristics	
EMP	Number of employees
ASSETS	Total value of the firm's assets
NET VALUE	Total amount of firm's net worth (Total assets less total liabilities)
EXTERNAL WEIGHT	Ratio of external transactions (Imports + Exports) to total turnover
MICRO, SMALL and MEDIUM	Dummy variable, identifying firms' size as defined in the Commission Recommendation of 6 May 2003 (C(2003)1422) (OJ L 124, 20.5.2003, p. 36).
CAE	Dummy variables identifying firms' activity sector.
REGIONAL	Dummy variables identifying firms' district.

A.2 Assessing the quality of matches

The quality of matches is assessed by examining the distribution of covariates used in the propensity scores estimation within each matching exercise. Table A.2 shows the p-value of the standard t-test for the equality of mean sample values, the standardised bias (Rosenbaum and Rubin, 1985) and the joint significance tests and pseudo-R^2 (Sianesi, 2004). This table details only the assessment of the sample of placed individuals in the PME Programme in the post-programme period.

TABLE A2: MATCH QUALITY

Variables	**Sample**	**Mean**		***t*-test**	**% bias**[2]	**Reduction**
		Treated	Control	***p*-value**[1]		**in | bias |**
ELIGIBLE 2009[3]	Unmatched	0.98	0.84	0.000		
	Matched	0.98	0.98	0.827	-0.3	99.3
EMPLOYEES 50[3]	Unmatched	0.92	0.94	0.000		
	Matched	0.92	0.92	0.872	-0.5	94.5
EXTERNAL TRA.[3]	Unmatched	0.78	0.76	0.182		
	Matched	0.78	0.77	0.772	0.8	76.1
TURNOVER[3]	Unmatched	0.99	0.99	0.573		
	Matched	0.99	0.99	0.911	-0.3	79.0
MGS A[3]	Unmatched	0.21	0.14	0.000		
	Matched	0.21	0.22	0.318	-3.0	85.3
MGS B[3]	Unmatched	0.59	0.60	0.318		
	Matched	0.59	0.57	0.330	2.7	-9.1
LOAN RATIO	Unmatched	0.46	0.38	0.000		
	Matched	0.46	0.46	0.873	0.4	98.5
SHORT RATIO	Unmatched	0.39	0.36	0.011		
	Matched	0.39	0.39	0.931	-0.2	96.4
BANKS	Unmatched	1.87	1.77	0.000		
	Matched	1.87	1.86	0.635	1.1	94.6
ICOVER SM[3]	Unmatched	0.57	0.54	0.053		
	Matched	0.57	0.58	0.591	-1.5	69.2
ICOVER BANK[3]	Unmatched	0.64	0.59	0.000		
	Matched	0.64	0.64	0.965	-0.1	98.9
NEG. CAPITAL[3]	Unmatched	0.00	0.05	0.000		
	Matched	0.00	0.00	0.874	0.2	99.5
SMALL FIRM[3]	Unmatched	0.63	0.49	0.000		

Variables	**Sample**	**Mean**		***t*-test**	**% bias**[2]	**Reduction**
		Treated	Control	***p*-value**[1]		**in | bias |**
	Matched	0.63	0.63	0.750	0.9	96.9
MEDIUM FIRM[3]	Unmatched	0.09	0.06	0.000		
	Matched	0.09	0.09	0.927	0.3	97.3
lnASSETS	Unmatched	14.02	13.62	0.000		
	Matched	14.02	14.01	0.670	1.1	97.2
lnASSETS[2]	Unmatched	197.58	186.76	0.000		
	Matched	197.58	197.28	0.684	1.1	97.2
CAST. BRANCO[3]	Unmatched	0.02	0.01	0.000		
	Matched	0.02	0.01	0.589	1.6	81.3
COIMBRA[3]	Unmatched	0.03	0.02	0.003		
	Matched	0.03	0.04	0.634	-1.5	79.7
EVORA[3]	Unmatched	0.01	0.01	0.328		
	Matched	0.01	0.01	0.807	-0.7	69.5
FARO[3]	Unmatched	0.02	0.01	0.135		
	Matched	0.02	0.02	0.799	0.7	79.6
LEIRIA[3]	Unmatched	0.12	0.07	0.000		
	Matched	0.12	0.13	0.339	-3.0	82.3
PORTO[3]	Unmatched	0.23	0.25	0.066		
	Matched	0.23	0.22	0.732	0.9	79.7
SANTAREM[3]	Unmatched	0.04	0.03	0.033		
	Matched	0.04	0.04	0.808	-0.7	86.1
SETUBAL[3]	Unmatched	0.02	0.03	0.003		
	Matched	0.02	0.02	0.829	-0.5	93.1
VISEU[3]	Unmatched	0.03	0.03	0.432		
	Matched	0.03	0.03	0.877	0.4	78.9
CAE C[3]	Unmatched	0.44	0.39	0.000		
	Matched	0.44	0.44	0.816	0.6	94.3
CAE G[3]	Unmatched	0.38	0.36	0.185		
	Matched	0.38	0.38	0.865	-0.5	85.6
CAE H[1]	Unmatched	0.07	0.10	0.000		
	Matched	0.07	0.07	0.900	0.3	97.2
CAE J[3]	Unmatched	0.02	0.02	0.042		
	Matched	0.02	0.02	0.952	0.1	97.1
CAE M[3]	Unmatched	0.04	0.05	0.016		
	Matched	0.04	0.04	0.895	-0.3	94.4
CAE P[3]	Unmatched	0.00	0.00	0.033		

Variables	Sample	Mean		*t*-test *p*-value[1]	% bias[2]	Reduction in | bias |
		Treated	Control			
	Matched	0.00	0.00	0.829	-0.3	94.3
Observations						
On common support		2637	4031			
Off support		4	241			
		Unmatched	**Matched**			
| Bias | summary statistics:						
Mean		13	0.9			
Med. Bias		7.7	0.6			
Maximum		78.2	5.3			
Minimum		0.36	1			
% Var		73	18			
Pseudo *R*-square[4]		0.189	0.001			
LR test *p*-value		999.19	3.7			

[1] The p-value for the t-test measures the equality of means in the treated and control groups, both before and after matching.

[2] % Bias is the standardised bias as suggested by Rosenbaum and Rubin (1985), shown together with the achieved percentage reduction in | bias |.

[3] Dummy variables.

[4] Pseudo R-square from the logit model estimation of the propensity scores, including all variables shown in Table IV before and after the matching process (Sianesi, 2004).

Starting with the standard *t*-tests for the equality of means for the treatment and control groups for each of the variables included in the specification of the propensity score model, there are two noteworthy results. First, as already pointed out in Table IV – Summary statistics, there is a remarkable similarity between the treatment and control group's mean values before matching. Nonetheless, from a purely statistical point of view, the mean values are different from each other for most variables. This leads to the second point. After matching, the null hypothesis (of mean equality between the treatment and control groups for all variables) cannot be rejected.

In the following columns, the table reports the standardised bias as suggested by Rosenbaum and Rubin (1985), and the reduction in the absolute bias obtained after matching control and treatment units. One oft-noted pitfall of this indicator is the fact that it has no formal (statistical) threshold for assessing of the reduction in mean bias (Caliendo and Kopeining, 2008). Nevertheless, the values obtained seem to grant some success in the matching procedure, with reductions as large as 99.5 percent, and are in line with previous empirical studies (Uesugi et al., 2010; Sianesi, 2004). At the bottom of the table, the

overall summary statistics for the absolute bias are also shown. The mean absolute bias in the matched sample is 0.9, while in the unmatched sample is 13.

Finally, and as proposed by Sianesi (2004), the joint statistical significance of the covariates and the pseudo-*R* of the propensity score in the unmatched and matched samples were studied. As can be seen in the last two rows of Table A2, the pseudo-*R* in the propensity score estimation that used only the treated units and the matched control units falls to values close to zero. The F-test complements this information, corroborating the view that matching has successfully eliminated any systematic observable differences between the treated and control groups.