

**Governmental Mezzanine financing in France*

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Abstract

This paper explores the support provided by a publicly funded participative loan on 921 young and innovative small firms from 2006 to 2014. Based upon matching approach and double-difference estimator, certification, resource-based effects, and performance-enhancing effects are analysed. Findings point out the importance of public support design for innovation through a positive impact on intangible assets. However, similarly to the performance-enhancing effect, a non-significant impact is found for certification. Results are robust to the program and econometric settings.

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1. Introduction

Widely acknowledged by business operators and academic research, Innovative Young and Small enterprises (YICs²) face numerous difficulties regarding their development (Berger and Udell, 1998, 2006). Among the constraints met, financing appears to be the primary factor limiting innovative growth prospects, notably in the early-stage (OECD, 2012). Financing issues lead to an under-investment situation limiting growth prospects (Carpenter and Petersen, 2002). Highlighted as- at least partially- responsible for the issue (Mazzucato et Penna 2016), market imperfections include information asymmetry, agency costs, and knowledge spillovers (Hall and Lerner, 2010). Besides market failures, internal characteristics could exacerbate adverse situations such as youth or the lack of tangibles assets to pledge as collateral (Biancalani et al., 2020; OECD, 2020). While the former raises information asymmetry issues resurfacing the opaque organizational structure feature, the latter reduces the firm's capability to ensure quality. Therefore, it can lower external financing availability reminding high agency and transaction costs issues faced by YICs in funding processes (Marti and Quas, 2018). Above mentioned caveats compete in increasing the bankruptcy rate of YICs compared to any other firm class that further fuels the financial gap (Revest and Sapio, 2012, Coad, 2018). In this context, YICs should face cumulated external financing constraints (Czarnistki and Delanote, 2015 Schneider and Veugelers, 2010), especially during the crisis period (Lee et al., 2015) in bank-based economies (Hernández-Cánovas and Martínez-Solano, 2010, Colombo and Grilli, 2007) which can weight on developments prospects. Despite acknowledged as an efficient answer to early-stage financial gap³, the impact of formal and informal venture capital investors (such as business angels or venture capitalists) is constrained by structural factors that competent institutions try to reduce⁴ at national and international levels. Yet, the inability of European market players to alleviate YICs' financial constraints (Giraud et al., 2019a) forced governments and competent authorities to implement structural innovation policies tailored, from architecture to application, to have an impact on the local ecosystems on which the development of YICs strongly depends (Kerr et al., 2014). Besides the SME population under scrutiny was revealed to be important from political, social, and societal viewpoints (OECD, 2020). SMEs and particularly young and innovative ones, are responsible for an essential share of employment and productivity (Grimsby, 2018, Hölzl 2016). However, whether public authorities efficiently reduces market imperfections remains unsolved by empirical and theoretical literature. This paper aims at reducing this gap by exploring the impact of governmental support on YICs developments.

For decades, worldwide authorities have constructed and conducted various programs to directly allocate public funds to innovation financing, producing extended but heterogeneous

² We refer to the definition stated by Pellegrino et al., (2009) for which YICs are firms engaged in product innovation and with less than 8 years of activity.

³ The main advantage of business angels and other venture capitalists over banks lies in their capacity to lower information asymmetry (Sahlman, 1990). Another aspect is in the human capital value added provided by informal investors Politis (2008) for the case of Business Angel and Cumming et al. (2017) for venture capitalists value added)

⁴ The bank-based structure of the European Union is pointed out to be responsible of the low recovery from the crisis compared to market-based system Allard and Blavy, 2011. Grjebine et al., 2019) and of the overall low growth level in Europe these later years. (Bhatia et al., 2019). Supra-national and regional measures have been undertaken to reinforce equity market and ultimately growth prospects of financed firms. Recently, in September 2020, the European Commission release an action plan to strengthen capital market in the EU relayed by the French financial market authority (AMF).

empirical literature on direct governmental instruments for YICs financing⁵. On the supply side, government financing support to YICs mainly takes the form of fiscal and tax incentives to R&D, grants, loans and credit guarantee schemes (respectively LSs and CGs), equity financing, and mezzanine finance. While univocal findings are hardly findable for budgetary and tax incentives to R&D (Czarnitzky and Delanote, 2015) the positive impact of LSs and CGs widely finds support in the literature (Grimsby, 2018; Lelarge et al., 2010). In contrast, the influence of government equity-based support (Governmental venture capital funds) reveals to have either a negligible or negative impact on backed firms' performance (Cumming et al., 2017). Although increasing these latter years, the literature about governmental mezzanine instruments is much less developed than other financing instruments (Bertoni et al., 2019). The Recent investigations point out that, to date and despite widely used since the 2010s across OECD countries, only a few and sparse evaluation has been performed (Cusmano and Thompson, 2019). We contribute to fill the gap on investigating a still underexplored early-stage financing instrument⁶; governmental mezzanine support granted by French national authorities. Called Junior Loans (JLs), this mezzanine instrument is like a traditional debt contract in terms of defined maturity and interest payment⁷. However, on the opposite of conventional debt, the repayment is delayed and is subordinated to senior debt contracts, making JLs a mezzanine financing instrument (Cusmano and Thompson, 2018).

The paper explores a JL. program granted by the French Public Investment Bank (Bpifrance) for early-stage financing called starting loans (SLs) (*Prêt d'amorçage*). Created to overcome treasury tensions and to go along with fundraising, JLs are suited for less than five years old innovative companies.⁸ With amounts between 30 000 and 500 000 €, the program includes a three-year investment deferral for a total of eight loan years. Rigorous screening process firm selection and data cleaning lead us to consider 921 firms receiving an SL from 2006 and 2014. Using matched sample based on Mahalanobis distance (King et al., 2011) augmented by a double difference estimator to control time invariant characteristics, we investigate the development of backed companies compared to their non-funded counterparts. We test the sensitivity of results to loan design and the investment's timing (in years) between the innovative award and the program participation. Being able to link financial and employment data⁹, we notably analyse the effects of program assignment on both input and output outcomes. Inputs effects are investigated through resource accumulation hypothesis in terms of tangibles and intangibles assets and certification hypotheses regarding human capital growth (Employees)¹⁰. Output outcomes consider sales and labour productivity as production indicators. Findings point out the importance of government support design in financing innovation through a positive impact on intangible assets. However, similarly to the performance-enhancing effect, a non-significant impact is found for certification.

The paper contributes to innovation and entrepreneurship literature. Firstly we investigate a mezzanine instrument, a relatively new financing tool evaluated in an innovative financing

⁵ Table A.I in appendix A summarizes the main financing instruments available for SME (i.e demand side).

⁶ Firsts initiatives back to mid 2000s in Europe (Cusmano and Thompson 2018) In 2017 mezzanine finance represented 396 million € and 811 million € in 2018 which is the fastest growth of private debt financing instrument according to France invest and Deloitte (2018)

⁷ See appendix A table A.II for detailed information on mezzanine finance landscape

⁸ The innovative aspect is ensured since recipient firms already have innovation subsidies prior to the PL.

⁹ Data comes from the National Institute of statistics and economic studies and cover financial statement as well as data on employment.

¹⁰ We do not have access to R&D data and thus use intangible asset as a proxy of innovative aspect of firms.

landscape. Concomitantly, we enrich the scope of innovation financing studies using a unique French dataset to explore early-stage financing different from the mainstream U.S and Canada and the U.K datasets (Granz et al., 2020). Lastly, through the study of government support, in line with the rigorous public finance context, we enrich the literature devoted to impact evaluation of public spending and the one on innovation and early-stage financing.

The rest of the paper is organized as follows: While a second section is dedicated to the academic literature around entrepreneurship support from governments, a third section develops research design, data, and methodology. A fourth and a fifth section are respectively devoted to baseline results and associated robustness. The last section concludes with policy recommendations.

2. Theoretical background: entrepreneurship's contribution to growth and its public support

Based on the foundation of entrepreneurship and innovation literature laid by Schumpeter (1934), numerous scientific fields tried to explain entrepreneurship and innovation processes¹¹. While bringing precious insights, the multidisciplinary approach of entrepreneurship rises numerous, still unclear, debates. Among them, a prominent one is (i) the comparative advantage for small organizations to innovate that would (ii) drive their contribution to growth (Hölzl 2016). Since innovation and growth contribution are part of the rationale behind public support for YICs, debates on the role and importance of entrepreneurship and innovative new ventures public management in knowledge economics theory are important for policy considerations. New insights are needed continuously to take account of the heterogeneous and disruptive nature of entrepreneurship.

2.1 Does size matters: from firm size to growth.

In the Schumpeterian tradition, entrepreneurs are the channel through which knowledge, and thus innovation, is linked to economic activity. Yet, the Schumpeterian's concept of innovation is not burdened to entrepreneurial firms; larger firms are even seen as essential innovation contributors.

Innovation literature widely debates the (dis)advantages of size on innovation (Knott and Viegerr 2020).¹² Theoretically, larger firms benefit from economies of scale that allows better diversification of stochastic R&D project. They have more financial resources to allocate to innovative activities and benefit from a cost-spreading in terms of output (Galbraith, 1952).¹³ On the other hand, small firms have lower organizational costs that facilitate flexible decision-making (Knott and Vieregger, 2020). Besides, small firms are closer to customers from a market positioning viewpoint and can better adjust production capabilities to market needs. Finally, larger enterprises can dilute the perception of individual contribution in innovative efforts, leading to a loss of creativity and motivation. The innovation literature leads to a puzzling

¹¹ See Landström et al., (2012) and Landström (2020) for a comprehensive and exhaustive review on development around entrepreneurship policies. Developments include notably history (Carlen 2016), sociology (Weber 1930) and psychology (Baum and Lock, 2004).

¹² Even if it has improved since then (Nelson, 1959 and Scherer, 1991) theoretical developments mainly rest upon Schumpeter insights and is heavily driven by empirical considerations (Knott and Vieregger, 2020).

¹³ Cost-spreading argument can have deleterious implications for social welfare. In Scherer's (1991, 1992) framework the cost driven consideration incentives to undertake project with relative low risk (i.e. incremental instead of radical innovation projects) could negatively weight on social welfare on the long run.

statement where R&D productivity decreases with size while R&D investment depicts the opposite pattern. Recently, Knott and Vieregger (2020) bring new insight to the size innovation relationship. They state that the apparent contradiction is either driven by the "contingent tack"¹⁴ or by measurement issues (the indicator traditionally used fails to account for innovation theory). While they find that size is correlated with innovation forms, they do not exhibit different productivity patterns invalidating the "contingent tack" hypothesis. Instead, results confirm the productivity measurement issue hypothesis since their indicator (R&D elasticity to investment measure) is positively correlated to size. Although, as stated by the authors, their data's cross-sectional nature could drive the depicted relationship. Furthermore, results obtained from the U.S data can be widely different of those from continental European data.

As above-stated, besides the innovation-size relationship, a critical rationale of public support for YICs lies in their contribution to growth. From the US Lucas (1978), and following endogenous growth models developments, links firm size and per capita income of economies with a Solow-type growth model (Solow, 1960). In Europe, Bentolila and Bertola (1990) link employment dynamics and labour policies. Their contribution provides essential implications on the impact of market barriers that structurally influence firms' productivity and thus entry/exit. They conclude that barriers distort the re-allocation process leading to higher entrants' productivity than incumbents and exit firms¹⁵. Endogenous growth models (Arrow, 1971; Romer 1990) in mind, entrepreneurship literature (Acs et al., 2012; Audretsch et al., 2014) developed the mechanisms of the link between knowledge, innovation, and growth. At a micro level, innovative activities induce Research & Development spending (in terms of researchers' wage) that constitute the first link between knowledge and economic activity. At a macro level, the mechanism through which knowledge is converted to growth is through knowledge spillovers that state that innovative activities will benefit to others than the innovative companies (Acs and Audretsch, 2010)¹⁶.

Recent developments suggest that the research question regarding YICs' contribution to growth is mainly an empirical one. European investigations on the contribution of YICs' to growth widely confirm the disproportionally high contribution to both and employment and productivity growth. However, these effects are heterogeneous across time and countries (Hölzl 2016).¹⁷

2.2 The role of governmental intervention in financing innovation: YICs policies

The primary rationale behind the public intervention in the entrepreneurial market takes its roots in market imperfections (Stiglitz and Weiss, 1981, Gompers and Lerner, 2000, Lerner, 1999). Market frictions exacerbate transaction costs and information asymmetry issues (Myers and Majluf, 1984) and limits growth opportunities of entrepreneurial firms (Carpenter and Petersen, 2002), especially in crisis periods (Lee et al., 2015)) in bank-based economies (Hernández-Cánovas and Martínez-Solano,2010). It also creates distortions and misalignment between agents' expectations and reduces market internalization of innovative outcomes.

¹⁴ This explanation of the puzzle start with the assumption firm's size is correlated with the type of innovation forms.

¹⁵ See Bartelsman et al., (2005) and Criscuolo et al., (2014) for a review.

¹⁶ However, the knowledge spillover is recognised not to be automatic (Acs et al., 2013a, b).

¹⁷ With U.S. data, Haltiwanger et al., (2013) find no monotonic relationship between firm size and growth, once controlling for age.

In this context, governments' intervention is legitimized¹⁸ (Mazzucato 2016), and national authorities have developed various entrepreneurial financing instruments through decades and countries (Giraud et al., 2019). The range goes from government venture capital funds (GVCs), and related limited partnerships (GLPs) (Section 2.1) to R&D subsidies through (section 2.2) loans guarantee scheme (also called credit guarantee scheme) (section 2.3) and loans schemes (section 2.4) among many other instruments (OCDE, 2020). Regardless of the public instrument, the research question mainly focuses the additionality (crowding-in or -out of public spending) or the certification effect of public expenditure (Leleux and Surlemont, 2003), but given heterogeneity, results hardly converge (Zúñiga-Vicente, et al., 2014, Srhoj et al., 2019).

2.2.1 Intervention on capital market

Public equity intervention is divided between direct (Leleux and Surlemont, 2003; Botazzi and Da Rin, 2002), indirect (Alperovych et al., 2018; Standaert and Manignart, 2018) and syndicated interventions (Bertoni and Tykova, 2015; Brander et al., 2015; Cumming et al., 2017 and Grilli and Murtinu 2014) and produced highly heterogeneous literature. Public intervention in the capital market has been driven by the importance of entrepreneurship and innovation for inclusive growth (Kortum and Lerner, 2000, Da Rin et al., 2006, OECD, 2020) in a context of high information asymmetry limiting bank financing. In France, like any other bank-based economy, private venture capital funds (PVCs) and governmental venture capital funds (GVCs) have increased since the 2009 crisis.¹⁹ Because of banks' reluctance to lend to more opaque firms (Lee et al., 2015) and regulatory pressures to clean balance sheet from previous bad loans (Wehinger, 2014). Recent methodologic developments in evaluation literature reduce the variability of results and globally show a positive impact of public equity intervention.

Besides the two main research questions depicted, specific ones to GVCs are linked to the economic (Grilli and Murtinu, 2014) and exit performances (Cumming et al., 2017) and the probability of getting public (Gompers and Lerner, 2000). Empirical investigations on the impact of GVCs highlight a positive effect of mixed syndicates (Grilli and Murtinu, 2014; Brander et al., 2015) that allow the rejection of the full crowding-out hypothesis.²⁰ On the opposite, GVC support is found either non-significant (Grilli and Murtinu, 2014) or negative compared to independent VC support (Alperovitch et al., 2015).²¹ Yet, enhancing effect of GVC is asserted in Bertoni and Tykova (2015), while a positive certification effect of governmental support is found in Guerini and Quas (2016) for entrepreneurial high-tech firms.

2.2.2 R&D subsidies

Like previously and despite a broad literature (Czarnitzki and Delanote (2015) for a recent review) the crowding-in effect hardly finds univocal support. Recent studies globally reject the crowding-out without accepting the crowding-in hypothesis of public intervention in terms of

¹⁸, see Schmidt (2018) or Mazzucato et al., (2016) for recent developments around the theoretical background of public intervention.

¹⁹ See (Harrison and Mason, 2019). Developments are still in late compared to the market-based economies (Botazzi and Da Rin, 2002).

²⁰ Mixed syndicates involve both private and public venture capital funds. The rationale of partnership between public and private sector is rooted in the government failure theory (Legrand, 1991). This theory reconsiders the ability of government authorities to efficiently screen the market (Lerner 2012) as well as the political orientation of public funds (Lerner 2002) as source of inefficiency.

²¹ See Bertoni et al., 2019a for a review.

R&D subsidy for innovative SMEs (Dimos and Pugh, 2016). Vanino et al., (2019) for the U.K use propensity score matching in a double difference research design (PSM-DiD) to explore the additionality of public R&D subsidies. Even if the additionality hypothesis is not rejected, its magnitude varies according to the project and firm characteristics. Belluci et al. (2019) use the same methodology to investigate the R&D policies in Italy. Two programs²² were studied, producing mixed results, favoring crowding-in effects, yet with heterogeneous magnitudes, for both Italians' R&D programs.²³ Besides crowd-in or out hypothesis, some studies investigate the 3B hypothesis of public spending.²⁴ Using a PSM-DiD research design, Autio and Ranniko (2016) study the impact of a Finnish program on young high growth firms on sale growth.²⁵ They highlight the program's positive effect by boosting organizational capacities, leading to increased sales by 120 percentage points compared to counterfactuals.

Studies of public R&D subsidies also explore the legitimacy argument. Meuleman and Maeseneire (2012) explore government certification effect on external finance attractivity using Belgium data from 1995 to 2004. A positive impact of subsidies on long term debt formation (a smaller result is found on short term debt) and a positive impact on equity only for startups is seen.²⁶ Colombo et al., (2013) also consider the certification effect of selective versus automatic Italian schemes. Their result validates the certification hypothesis for the selective program. In the same vein, Söderblom et al., (2015) explore the certifying aspect of public spending using Swedish data for firms financed from 2002 to 2008 by a selective program. In line with Colombo et al., (2013), they conclude to a conditional certification effect, reinforced for early stages firms. Lastly, the certification effect is also investigated by Howell (2017) using a regression discontinuity design (RDD) from Small Business Innovation Research (SBIR) data. The conclusions highlight a reduced-uncertainty mechanism through the prototyping channel, rather than a certification effect.²⁷

2.2.3 Credit guarantee schemes (CGSs)

Besides R&D policies, public authorities have at their disposal credit guarantee schemes (CGSs) that knew and extensive scrutiny for authorities these previous years. The primary rationale of public intervention through CGSs lies in that these schemes allow, at relatively low costs, to improve external finance availability for guaranteed firms. CGSs studies are numerous (Cowling et al., 2018, Boschi et al., 2014). In France, Lelarge et al., (2010) study the SOFARIS program and exploit an exogenous change in the program's scope to perform the program's evaluation impact. Their results converge toward CGS's positive effects on financial

²² One program focuses on individual firm's research project and the other one on collaborative projects between universities and firms.

²³ Several studies also confirm previous inconclusive results including Michalek et al. (2015) in Germany.

²⁴ The 3B hypothesis refers to buffering, bridging and boosting. The buffering argument point out a passive role of public spending that is to isolate firms from adverse market situations leading to higher survival. On the opposite, the bridging argument refers to the certification effect, the needed legitimacy granted by the program to obtain external finance; finally, the boosting argument refers to the capacity of public spending to enhance growth by bringing hands-on support for example.

²⁵ Eligible firms are less than six years old with at least 15% of R&D expenditure during the last three years.

²⁶ The heterogenous nature of the results is confirmed by the higher certification effect granted to more opaque firms;

²⁷ In France, R&D subsidies often take the form of tax credit which is not an injection a cash flow but a tax shield. In this regards we will not explore this aspect since this paper focus on direct cash injection from public authorities. Relevant studies include Duguet, (2004), Mulkai and Mairesse, (2013) Bozio et al., (2014) and Bedu and Vanderstoken (2019)

constraints, employment, and cost of debt. However, they cannot disentangle if the program's signal effect drives the result by a better screening and monitoring process following the reform.

Interestingly, their outcomes find support with de Blasio et al., (2018)²⁸ that also notice an increase of backed firms' default risk²⁹. However, results can hardly be extrapolated to other frameworks given different policy scope and motivation around CGSs (Riding et al., 2007)³⁰. Indeed, in the U.S CGSs are limited to a market imperfection reduction mechanism. On the opposite, in Europe or Canada, CGSs is also a way to improve social welfare, finance projects with high social value or high spillover effects, and finance new trends (green finance, transports and infrastructures, renewable energies (Mazzucato, 2016)).

2.2.4 Loans

A last widely spread public instrument favouring innovation financing is LSs used to reduce market imperfections and boost financed firms' capacities. Conversely to CGSs, LSs do not involve a third party in the transaction. Competent authorities directly intermediate on entrepreneurial markets. In this regard, L.S.s are beneficial for lending institutions since it improves know-how, expertise and relationship lending (Grimsby, 2018) reducing the government failure issue (Grand, 1991). It frequently involves either participative (subsidized, subordinated) loans or mezzanine instrument. Despite this instrument's relevance for national authorities, its evaluation impact is rarer than previous instruments due to data available on the pre-treatment period (Hottenrott and Richstein., 2020). Norrman and Bager-Sjögren (2010) investigate Swedish Innovation Center (SICs) programs between 1994 and 2003. Despite an in-depth screening process, the authors hardly find evidence of the positive impact of SICs participative loans on employment, sales, and total assets, reflecting government failure in screening and monitoring firms. Still, in northern Europe, Grimsby (2018) investigate, using Norwegian panel data, innovative loan programs from 2004 to 2009. Being aware of the importance of the control group in evaluation impact (Rosenbaum and Rubin, 1985), he builds several control groups³¹ to account for unobserved heterogeneity biasing matching. Compared to rejected applicants, accepted firms record either higher performances or, in worst cases, no differences (for survival deficit and profitability). However, when controlling for credit demand, results are less univocal. Compared to privately financed firms, treated companies record lower survival and deficit; no difference is found in sales and employees' growth. Ultimately, treated firms have higher value-added formation, assets growth, and profitability. Results are even more equivocal when the author uses VC-backed firms as control groups, highlighting the importance of the counterfactual related issues to estimate the treatment effect.

Taking previous caveats into consideration, Marti and Quas (2018) study 488 Spanish firms receiving participative loans between 2005 and 2010. Investigating on the program's certification effect, they look at debt accumulation and postulate that investors will rely on public support to access a project's quality in a context of high information asymmetry.

²⁸ Using a regression discontinuity design, de Blasio et al., (2018) investigate on the impact of Italian CGSs. Findings support the positive impact on external finance availability but are more nuanced on the costs of debt that seems unchanged. Yet, the insignificant impact on investment and sales could be due, according to the authors, to the crisis.

²⁹ First, the adverse selection arises because bank are incentives to guarantee risky investments to improve expected incomes. Second, moral hazard issues increase, the guarantee institution is less incentives to perform deep screening and monitoring processes which can result in an increase in exit probability.

³⁰ In addition to conceptual features, methodologies employed hardly satisfy external validity requirements.

³¹ A first one is build using firms that applied for the program.

Consequently, public financing acts as a certification, improving external financing availability for backed firms. They conclude that the ENSIA loan program's positive effect with an increase of 31.5% of debt compared to firms not financed, this effect being more substantial for more opaque firms (smaller, young and innovative firms). Based on Marti and Quas (2018), Bertoni et al. (2019b), with a larger dataset (512 firms between 2005-2011), investigate no longer on certification effect but instead study employment and sales growth. Their findings support and confirm previous ones for more opaque and high-tech firms³², reflecting their increased capacity to attract resources, which can be interpreted as a project high-value indicator (Grimsby 2018).

The insights of previous studies around public support for YICs developments lead us to consider the impact on both input and output outcomes. While the program could positively impact resource accumulation (i.e input effect), this resource accumulation may not be used efficiently, which can have no impact on output outcomes or even adverse effects.

2.3 Hypothesis Development

The present paper mixes insights from innovation and financing literature to develop a framework where program participation value added is expressed in both inputs and output outcomes. However, since we do not focus on R&D subsidy, our definition moves away from Czarnitski and Delanote (2015). Instead, we follow Söderblom et al., (2015) and define input outcomes as any outcomes used in the firms' production process to produce economic or financial payoff, considered the output outcomes. While input outcomes give information firms the capability to expand and develop to reach higher growth paths, output outcomes provide information about the firm's current achievement.

2.3.1 Input effects: resource accumulation

To explore how program participation affects the production process, we focus our attention on the resource accumulation process. To do so in a reproducible way, we include in our analysis an Employment indicator (*Empl*) computed as the logarithm of the number of employees at the end of the fiscal year. Frequently used in evaluation policy literature, employment is considered a proxy for firms' resource attractiveness, ultimately reflecting project quality (Grimsby, 2018; Söderblom et al., 2015). However, due to newness liability, workforce hiring can be challenging (Stinchombe 1965). In this context, increased workforce following program participation can be considered a certification effect (Söderblom et al., 2015, Marti and Quas, 2018). Moreover, IYCs are acknowledged to be high job creation contributors (Huber et al., 2017 Biancalani et al., 2020) that should be reflected in their employment growth. However, using Austrian data, Huber et al., (2017) show that while young firms contribute more to net job creation, the small one contributes less than the large one, casting doubt according to young and small companies' net contribution. Therefore, bearing in mind previous caveats, we expect to observe higher and employee's growth for recipient companies compared to their matched pairs, which is reflected by the following hypothesis:

H1: P.L.s backed companies record higher resource attractiveness in terms of employees reflecting certification effect on the labour market of program participation.

³² The larger growth for high tech firm's hypothesis is only verified for employee growth.

Besides employment consideration in early stage developments of YICs, another important feature of a firm's expansion is innovative capacities and efforts. Since the P.L.s program under study targets innovative firms we can expect to record higher innovation efforts in intangibles asset formation from recipient firms than from their matched counterparts.³³ On the one hand, intangibles assets' uncollateralized nature makes them more dependent on internal funds, of which YICs are sorely lacking (Jarboe and Ellis, 2010). On the other hand, intangibles assets can generate economies of scale and scope that could enhance market power and productivity, which can incentivize YICs to invest in intangibles assets.

H2: Firms benefitting from the program record higher intangibles growth than their matched pairs.

In addition to firms attractiveness in terms of workforce, another aspect of policies certification effect lies in the program's capacity to reduce financial constraint of selected firms, which is captured stock of tangibles assets. By depicting collateral capacity (Meuleman and De Maeseniere, 2012, and Hottenrott and Richstein, 2020), we expect that treated firms, benefiting from a capital buffer from the program, could use it to reinforce its external financial potential leverage through the accumulation of tangible assets to pledge as collateral.

H3: Firms benefitting from the program record higher tangibles growth than their matched pairs.

Resource accumulation prospects focus on input value-added of public intervention. Another component lies in the output additionality of public support (Czarnitski and Delanote, 2015).

2.3.2 Hypothesis development: output effect

To investigate the output effect, we rely on Sales that is a proxy of customer satisfaction and a manager's ability to commercialize a product (Norrman and Bager-Sjögren, 2010). This indicator is widely used in impact evaluation literature. Therefore, it is used to ensure, as far as possible, comparability between studies (Autio and Ranniko, 2016, Bertoni et al., 2019b Söderblom et al., 2015 Biancalini et al., 2020).

H4: Firms benefitting from the program record higher Sales than their matched pairs.

Finally, as stated above and yet criticized (Shane, 2009 and Mazzucato, 2016) from a government failure viewpoint, YICs policies rest upon a "pick-out winner" design where selected firms have passed out a rigorous selection process. This design is based on the idea that only a small fraction of firms (even within innovative ones) have disproportionately high contributions to job creation (Haltiwanger et al., 2013 for the U.S and Hölzl 2016 for Europe) and productivity (Crisuolo et al., 2014 Hölzl 2016). Thus, given their commitment to innovative activities and their will to grow, they should record higher productivity per employee for selected firms.

H5: Firms benefitting from the program record higher productivity gains than their matched pairs.

³³ Intangibles asset encompass assets related to software and database purchase, copyrights and trademark, patents. The reporting of intangibles suffers from a downward bias due to the tax-deductible feature of expenses which incentive firms to register intangibles as expenses (to be deductible from earning) instead of as intangibles assets. In this regards the conclusion must be taken carefully.

However, European empirical evidence of government support for productivity gains are mixed, calling for more investigations in the field (Dvoulety et al., 2020). Some papers acknowledge job creation productivity contribution by YICs (see Hölzl 2016), but while recognizing the net job creation contribution of YICs, Heyman et al. (2018), using Swedish data observe that productivity gains come from large firms.

3. Data and Methodology

Mezzanine finance is an umbrella term that encompasses an endless number of financing instruments mixing senior debt and pure equity financing. Traditionally used as a short-term financing tool, it is increasingly used to reinforce the capital structure and therefore is built in-hands with venture capitalists or business angels.

3.1. Program design

In France, the public support for innovation mainly originated from the Public Investment Bank Bpifrance launched in 2005 a financial instrument for innovative startups aiming to provide support for creative activities. The loan is designed for firms wishing to reinforce treasury pressures and to help firms to prepare fundraising while pursuing business cycle. Called "Prêt d'Amorçage" (PA. hereafter), the loan is designed for innovative SMEs incorporated as companies created less than five years ago, in the seed stage. Covering eight years including three years of delayed repayments, the program is composed of two distinct parts. The instrument covers amounts between 30k and 150k € for firms preparing a significant first round of financing and covers amounts between 100k and 500k € for firms in a fundraising support phase.³⁴ Priority is given to companies deemed promising in terms of value creation and future growth. A participative loan constitutes a real incentive for investors to take an equity stake. No guarantee or personal deposit is required, but regional subsidiaries can guarantee the loan, allowing to increase the amount that is limited to the equity amount at the time of the deposit. The instrument is designed to reinforce the capital structure of firms for subsequent financing round(s) and complement the innovative aid already received to fund R&D projects. The program is composed of 1607 financed firms from 2005 to 2015, geographically polarised around the Paris and Lyon areas, and mainly operating in computing (27%), R&D and scientific services (25%) and edition (11%). The program is mostly used by firms to expand new business opportunities from both national and international markets

3.2. Data

To be a candidate, companies must justify research and development projects for which they have previously received innovative grants or aid. The framework depicted allows using innovative firms without PA. as counterfactual. This natural control group will enable us to investigate investment timing and control for dimensions on both observable (innovative aspect) and unobservable (wish to growth and team's motivation), thus ensuring confident quasi-experimental framework causal estimates, discussed below. The dataset is composed of 921 treated firms financed between 2006 and 2014. While summary statistics are displayed in table 1 below, further information about correlation matrix and loan amount distribution is available in Tables A.III and A.IV in appendix A.

³⁴ The amount of the loan is capped to the amount of equity or quasi-equity of the applicant firm.

Table 1 Summary statistics

	Obs	Mean	Std.	Min	Max
Panel A : Control Firms					
Age	648	0,8	0,5	0,0	1,8
Autonomy	648	0,3	0,4	-2,2	1,4
Leverage	648	-0,1	1,2	-4,0	4,1
Employees	648	1,6	0,8	0,0	4,9
Intangibles	648	3,0	2,3	0,0	8,5
Tangibles	648	3,0	1,7	0,0	7,4
Sales	648	0,9	1,8	0,0	8,8
Labour Productivity	648	2,0	3,4	-5,2	6,3
Panel B : Treated Firms					
Age	921	0,7	0,5	0,0	2,1
Autonomy	921	0,4	0,3	-1,4	1,4
Leverage	921	0,0	1,0	-3,8	4,1
Employees	921	1,5	0,8	0,0	4,9
Intangibles	921	3,5	2,3	0,0	8,5
Tangibles	921	3,0	1,6	0,0	7,9
Sales	921	0,7	1,6	0,0	10,1
Labour Productivity	921	1,3	3,3	-5,1	6,3

Notes: This table records summary statistics for the year before the loan obtention expressed in natural logarithms.

3.3 Empirical settings

The methodology used in the paper follows the research design depicted in Figure 1 below. In the first step, we run a logistic regression on the probability, given observables, to participate in the program (treatment assignment modelling - Step (1)). To provide comparable results to previous impact evaluation, we start from the model developed in Bertoni et al. (2019b). Similarly, we include our model pre-treatment variables related to sales, the number of employees, and age. In addition to sectorial and location dummies already present in Bertoni et al. (2019b), we provide the matching process additional information related to the ownership and the type of innovation award obtained before program assignment. Therefore, we also include the award obtention year, controlling for the link between ownership and innovative activities and the link innovation and external credit demand bias (respectively Cucculelli and Peruzzi, 2020 and Grimsby, 2018).³⁵ The matching process is performed yearly using Mahalanobis distance (King et al., 2010).³⁶ Once matched samples are obtained, one needs to access the matching adjustment quality (Step (2)). We rest upon the standardized mean differences and t-statistics of equal mean test between matched samples to ensure efficient adjustment. Table 5 present the results of the adjustment quality of the matching algorithms. Another component to be checked to ensure confident estimates of the treatment effect is the

³⁵ The caveat comparing innovative to non-innovative firms is to have different growth profile and behaviours between treated and control group leading to biased estimates. In addition, by comparing innovative firms to another innovative firm one can expect that external financing needs are similar between both groups limiting these both bias sources. On the other hand, the closer the firms are the lower the treatment effect is due to spill overs effect in the long run. Here stands a trade-off between accuracy of the counterfactual used and the magnitude of treatment effect under investigation.

³⁶ (See Baltar et al., (2014) for Mahalanobis matching and Stuart (2010) for details about various matching approaches)

common trend (C.T.) or parallel trend assumption (PTA) (Step (3)). The assumption state that before treatment both treated and control group record similar outcomes dynamics. Formally we use an equality test of the coefficient from interacted terms of treatment dummy ($D_{i,t}$) variable with temporal pre-treatment dummies (δ_t):

$$\log(Y_{i,t}) = \alpha + \sum_{t=2006}^{2014} \beta_t ([D_{i,t} * Year_t]) + \delta_t + \varepsilon_{i,t} \quad (1)$$

Combining matching and regression-based approaches are popular in impact evaluation literature, given bias correction it allows (Lechner, 2011). Consequently, we use conditional double-difference research design on matched samples from matching (MCDiD) to explore the treatment effect of program participation on firm input and output outcomes (Step (4)). The estimation rests upon the following equation:

$$\log(Y_{i,t}) = \alpha + \beta_1 X_{i,t-1} + \beta_2 * treated + \beta_3 * post + \beta_4 * Treated * Post + IE_{i,t-1} + \varepsilon \quad (2)$$

Following Bertoni et al. (2019), and Dvoulety et al. (2020), we express the dependent variable $Y_{i,t}$ as the logarithm of either: employees, sales, labour productivity, tangible or intangibles. X represents lagged control variables and includes the set of dependent variables, except the one of interest plus debt ratio (equity on total debt) and autonomy ratio that controls for financial structure changes. IE encompasses individual effects related to location, industry, and ownership, as well as time trends.

Figure 1. Research Design

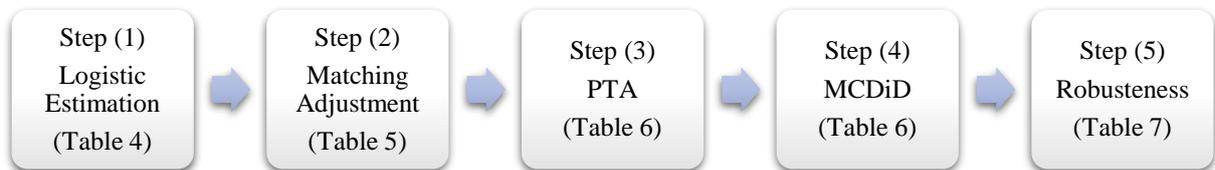


Table 2: Step (1) Logistic regression on a year by year basis

	2006	2007	2008	2009	2010	2011	2012	2013	2014
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
RA	0,30	0,20	0,99	1,35	-0,002	0,70	0,78	0,64	0,75
Obtention Year	0,56	0,45	1,73	2,3	-0,01	1,56	1,86	1,55	1,81
SUB	-0,11	-0,21	-0,28	-0,15	-0,24	-0,27	0,001	0,04	0,38
IFL	-1,78	-3,73	-4,14	-1,88	-3,26	-3,51	0,03	0,46	4,44
Age (i, t-1)	-0,30	-0,62	0,18	-0,57	-1,03	-0,20	-0,67	-0,22	-0,27
Employees (i,t-1)	-0,55	-1,34	0,31	-0,94	-2,25	-0,46	-1,59	-0,56	-0,65
Sales (i,t-1)						-0,39	-1,32	-0,11	-0,23
Constant						-0,44	-1,57	-0,19	-0,4
	-0,91	-1,53	-1,13	-1,29	-0,99	-0,92	-2,18	-0,53	-0,36
	-2,25	-5,87	-3,97	-2,27	-3,83	-4,15	-11,15	-2,69	-1,95
	0,08	0,33	0,32	0,13	0,24	0,27	0,44	0,26	0,28
	0,5	2,8	2,75	0,94	2,1	2,42	3,99	2,32	2,81
	-0,06	-0,05	-0,08	-0,12	-0,16	-0,03	-0,24	-0,04	-0,09
	-0,74	-0,8	-1,34	-1,6	-1,89	-0,47	-2,97	-0,71	-1,43
	224,19	423,36	555,01	293,19	487,78	544,13	-5,77	-72,98	-775,66
	1,75	3,74	4,11	1,89	3,24	3,51	-0,05	-0,47	-4,45

Individual Effects									
Awards	Yes								
Industry	Yes								
Localisation	Yes								
Ownership	Yes								
Legal Status	Yes								
N	1819	2,336	1,976	1,019	1,787	1,687	1,241	1,736	1,817
Log likelihood	-191,72	-306,85	-319,50	-196,18	-303,86	-365,90	-386,79	-431,81	-485,69

R.A. refers to refundable advances, SUB to subventions and IFL for interest free loans.

Table 3MCDiD Results

Dependent	Employment		Intangibles		Tangibles		Sales		Productivity	
	FE	OLS	FE	OLS	FE	OLS	FE	OLS	FE	OLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Treatment*Post-Grant	-0,11*** (-2,71)	-0,11*** (-2,50)	0,15+ (1,71)	0,15 (1,58)	-0,03 (-0,58)	-0,03 (-0,53)	0,01 (0,1)	0,01 (0,09)	-0,08 (-0,58)	-0,08 (-0,54)
Age (i,t-1)	-0,05 (-1,54)	-0,05 (-1,42)	0,16*** (2,63)	0,16 *** (2,42)	-0,01 (-0,12)	-0,01 (-0,11)	0,05 (0,72)	0,05 (0,72)	0,08 (0,69)	0,08 (0,64)
Leverage (i,t-1)	-0,01 (-0,93)	-0,01 (0,85)	0,05*** (3,12)	0,05 *** (2,88)	0,01 (1,24)	0,01 (1,15)	0,01 (0,08)	0,01 (0,07)	0,01 (0,14)	0,01 (0,12)
Autonomy (i,t-1)	0,25*** (9,39)	0,25 *** (8,65)	0,28*** (4,53)	0,28 *** (4,17)	0,12*** (3,24)	0,12*** (2,98)	0,03 (0,77)	0,03 (0,71)	-0,61*** (-5,81)	0,61 *** (5,35)
Employees (i,t-1)			0,43*** (10,61)	0,43 (9,77)	0,46*** (16,44)	0,46*** (15,14)	0,10*** (2,84)	0,10 *** (2,61)	0,42*** (6,7)	0,42 *** (6,17)
Intangibles (i,t-1)	0,04*** (5,13)	0,04 *** (4,72)			0,06*** (4,89)	0,06*** (4,51)	0,03+ (1,89)	0,03 + (1,74)	0,02 (0,77)	0,02 (0,71)
tangibles (i,t-1)	0,13*** (11,09)	0,13 *** (10,21)	0,13*** (5,15)	0,13 *** (4,74)			0,04+ (1,74)	0,04 (1,60)	0,02 (0,36)	0,01 (0,34)
Sales (i,t-1)	0,01 (1,06)	0,01 (0,98)	-0,01 (-0,90)	-0,01 (-0,83)	0,01 (0,2)	0,01 (0,18)			0,01 (0,37)	0,01 (0,34)
Labour Productivity (i,t-1)	0,03*** (7,1)	0,03 *** (6,54)	0,03*** (3,53)	0,03*** (3,25)	0,01 (1,25)	0,01 (1,15)	0,01 (0,29)	0,01 (0,27)		
Constant	2,12*** (3,16)	2,74 *** (3,84)	7,69*** (6,3)	6,54 *** (4,56)	5,40*** (4,1)	6,98*** (4,35)	1,62 (1,59)	5,27 (4,36)	3,14 (1,3)	4,24 + (1,68)
Fixed Effects										
Firm	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Financial historic	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Localisation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ownership	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	10387	10387	10387	10387	10387	10387	10387	10387	10387	10387
adj. R-sq	0,13	0,644	0,351	0,810	0,324	0,826	0,023	0,686	0,049	0,581
Pre-Trend F Test	0,44		0,06		0,66		0,49		0,43	

Estimation of the treatment effect following equation (1). Regressions have been performed on Mahalanobis matched samples using fixed-effect panel and OLS estimators. Dependent and independent variables are expressed in logarithm ($\log(1+)$)(asinh transformation when necessary) and are winzorized at 5% to avoid outliers' dependent results. Standard errors are clustered at the firm level. +, ** and *** respectively denotes 10% 5% and 1% significance.

4. Results

This section presents the outcome of the empirical procedure from steps (1) to (4), results will be interpreted according to the step they belong to in the research design.

Concerning step (1), even if the logistic regression's main purpose is mainly a statistical goal, economical insights can be drawn to estimate treatment assignment on year by year basis. First, given the stable estimates overs years presented in table 2 from models (1) to (9), one can argue that the selection process did not change much during the covered period, even during the crisis (defined as the years 2008 and 2009 in our framework).

Second, the nature of the innovation grants previously received appears to be insignificant to explain the funding process. Despite that being awarded is one of the criteria to be funded, the awards' nature seems less important than being awarded, suggesting that public business operators are not very concerned about the type of aid received. Another feature of innovation aid received is the obtention timing that appears to be significantly linked to treatment assignment. More precisely, we can see that firms awarded in 2012 and 2013 have lower chances of being funded with respective coefficients of 0,001 and 0,04 (with although an exception for the last year, 2014). This could either suggest a "wait and see" approach from public business operators or reflect public funding restrictions following the sovereign crisis period and tightening the public budget since then. The high significance of *Age* is associated with the prism for a maximum five years old companies. The size of the firm appears to be

positively linked to treatment assignment. In line with innovation literature, this result shows the positive correlation between the accumulation of human capital and innovative dynamics (Söderblom et al., 2015). *Sales* appear to be negatively associated with treatment assignment highlighting prism for young firms in early-stage developments in which they may not yet have marketed products. This variable seems to be particularly significant for years following the global financial crisis. Respectively, for 2009 and 2010, results show significant coefficients of -0,12, and -0,16. During the sovereign crisis (2012) we notice that the coefficient nearly doubled to reach -0,24, highlighting the cumulative tightening of credit conditions, which seems to be driven by more financial and tangibles and contemporary financial aspects.

Regarding step (2), the adjustment quality of matching using Mahalanobis distance is presented in Table A.V. We show that bias reduction is substantial for all dimensions included in the matching process. We successfully matched treated firms with innovative counterparts funded with the same innovative aid around the same year. Regardless of the criteria under consideration to analyze the matching quality (standardized mean difference or t-statistics), the results uniformly confirm the equality for covariates distribution across groups. We cannot reject the null hypothesis of the equal mean for all variables and state that the bias is substantially reduced between groups following the matching procedure. Step (2) validates the use of that control group as a confident counterfactual, thus ensuring a confident quasi-experimental research design. Besides, the bottom of table 5 displays the associated joint F-statistics whose null hypothesis leads to the validity of PTA (step (3)). We notice that all outcomes record similar dynamics between the treated and control group in the pre-treatment period.

The PTA validation allows us to interpret causally, with lower doubt on the estimates' validity, the effect of program participation on the firm's development. Turning to Table 3, In the first step, we focus on the program's capacity to boost the funded firms' attractiveness. Results presented in table 6 show a negative treatment effect on employment growth. The results show (model (1) table 3) that treated firms record a 10,4% $((\exp(-0,11)-1)*100)$ decrease of employment compared to the level that would have been theirs without funding. Based on this finding, H1 does not find strong support, the certification effect on resource attractiveness is not highlighted. We conclude that the program participation does not allow firms to access enough visibility to acquire the workforce for the covered period. The negative effect on employment finds support from Coad et al. (2017) that shows that staff member growth is not the primary growth concern for YICs. Instead, firms with high growth prospects would favour profit or asset over employment growth. They might wish to create a productive framework within which subsequent employees could be fully productive and not limited by technological or capital stock.

Besides the resource accumulation in terms of human capital, another essential component of YICs' development is their innovative activities captured in an output way through the stock of intangibles assets. From the model in Table 4, we observe a positive and significant impact of program participation on innovative output formation. Quantitatively, program participation enhances the average creative output by 17,4%. Consequently, H2 finds support from our data and we conclude that program participation help funded firms to improve their innovative character through intangibles assets.

Lastly, from our resource accumulation framework, we investigate the program's capacity to enhance financed firms' creditworthiness. Results for tangibles assets as a proxy of firms' collateral capacity are recorded in Table 4 model (3). We do not notice any significant effect of program assignment. As tangible asset captures firms' ability to provide collateral, we interpret that result as the lack of program's capacity to create a collateral-generator mechanism for funded firms. In this regard, H3 does not find any support, and the program does not significantly help firms acquire assets to pledge as collateral. We conclude that the program hardly involves information asymmetry reduction mechanisms.

On the "performance enhancing" side, we do not highlight a significant impact on sales treatment. Coad et al. (2017) explore the growth process for both high growth and non-high growth firms and finds that, in contrast to the latter, the former followed the subsequent growth process: Profit growth enhances asset

growth in turn positively influences the growth of sales. The last link in the growing chain is that of employment. Insofar we do not find any differences in net tangible assets dynamics we can argue that the growth chain is stopped. This mechanism also supports the negative influence found on employment growth.

Consequently, and based on the above mechanism, we do not find support for H4. Program participation does not significantly help the commercialization process of the innovative project. No different conclusion can be drawn from the impact on labour productivity, and we find no significant differences compared to non-treated firms.

This paper seeks to study the impact of direct public funding on treated firms' developments *vis a vis* firms that record similar innovation patterns to avoid unobservable-driven biased estimations. To depict the multidimensionality of firm development, we encompassed in our framework both input and output outcomes. While the former is disclosing a capability-enhancing picture, the latter leads us to consider the performance-enhancing side. The results point out a positive impact on innovative assets formation (through intangibles asset formation) while pointing no influence of program assignment on commercialization (in terms of sales), collateral availability (in terms of tangibles assets), and productivity (measured as labour productivity). A slight negative effect is found on attractiveness in terms of workforce accumulation.

5. Robustness

Each step of the research design could be the subject of sensitivity analysis.³⁷ From the first step (1), one can argue that the logistic regression may suffer from omitted variable bias since we only include three pre-treatment variables and dummies related to industries, location, innovative status, and ownership (i). From the second step, t-statistics for non-normally distributed variables is controversial, and standardized mean differences can be preferred (ii). Related to the regression framework, to test our results' sensitivity to research and program design, we split the sample into different sub-populations. First, we separate firms for which the innovation aid received comes contemporaneously to program participation from those financed with a lag between the innovative grant and the participative loan (iii). Then, we separate firms according to whether the financing started during a crisis or not (iv). Finally, we explore the loan design by splitting firms financed under the original framework and those funded under the revised framework (v). These sensitivity tests are in addition to specification validity (vi) discussed below.

For (i) insofar we successfully adjust observables covariates distribution across groups, we argue that the matching process is confidently specified. Linked, to the matching process, for (ii) we rely on both t-statistics and standardized mean difference reduction to interpret matching adjustment quality. Regardless of the criteria used and the matching algorithms under consideration, adjustments appear to be efficient. Robustness checks from (iii) to (v) presented in table 4 are also used to prolong the main specification. We can see that despite few patterns, which highlight heterogeneous effects, the results from table 4 mainly converge toward those presented in the main specification from table 3. The negative influence of program participation on workforce accumulation is comforted as the non-significant impact on tangibles, sales, and labour productivity. More precisely, results from table 4 model (1) show that firms financed contemporaneously to the innovation aid exhibit a negative average causal effect of program participation on the employment of around 23% compared to counterparts' firms.

In contrast, the favorable treatment effect on intangibles is no more significant in the main specification. On the opposite, firms financed with a lag do not show different employment dynamics compared to counterparts. Firms invested during the GFC exhibit different (model (3)) dynamics compared to firms invested outside the crisis (model (4)). Respectively, we observe a negative average causal impact of

³⁷ Matching design itself can be the place for many sensitivity tests, see Stuart and Rubin (2008).

20% (coefficient of -0,26) compared to 8,6% (insignificant coefficient of -0,07) on workforce accumulation. Insofar the adverse effect is reinforced during economic declines and is attenuated during economic; the governmental financing instrument appears to have pro-cyclical nature. Finally, models (5) and (6) respectively depict the average causal treatment effect for firms financed with relatively low tickets and those invested with high tickets. The results show a decrease of 15,6% (coefficient of -0,14) of employment for firms funded under the original framework. In contrast, firms financed with the revised one do not record different employment dynamics than counterparts (coefficient of 0,03). The loss of significant negative results when focusing on high amounts could (i) suggests an increase of the know-how from public business operators³⁸ and an (ii) possible threshold effect of the instrument.

Table 5. Alternative specifications of the treatment effect

	Employment		Intangibles		Tangibles		Sales		Productivity	
	FE	OLS	FE	OLS	FE	OLS	FE	OLS	FE	OLS
(1)	-0,21*** (-2,83)	-0,21*** (-2,62)	0,01 (0,05)	0,01 (0,05)	-0,08 (-0,80)	-0,08 (-0,74)	0,01 (0,08)	0,01 (0,07)	0,03 (0,14)	0,03 (0,13)
N	3994	3994	3994	3994	3994	3994	3994	3994	3994	3994
adj. R-sq	0,152	0,647	0,41	0,817	0,347	0,822	0,048	0,699	0,058	0,571
(2)	-0,02 (-0,48)	-0,02 (-0,44)	0,32*** (2,97)	0,32*** (2,72)	-0,01 (-0,21)	-0,01 (-0,19)	0,01 (0,14)	0,01 (0,13)	-0,13 (-0,76)	-0,13 (-0,70)
N	6393	6393	6393	6393	6393	6393	6393	6393	6393	6393
adj. R-sq	0,127	0,646	0,327	0,808	0,333	0,833	0,02	0,680	0,051	0,588
(3)	-0,26*** (-3,23)	-0,26*** (-3,04)	0,04 (0,16)	0,04 (0,15)	0,06 (0,45)	0,06 (0,42)	-0,03 (-0,15)	-0,03 (-0,1)	-0,1 (-0,35)	-0,1 (-0,33)
N	2297	2297	2297	2297	2297	2297	2297	2297	2297	2297
adj. R-sq	0,161	0,679	0,393	0,7933	0,332	0,815	0,028	0,7488	0,048	0,594
(4)	-0,07 (-1,49)	-0,07 (-1,36)	0,18** (2,05)	0,17+ (1,79)	-0,05 (-0,76)	-0,05 (-0,69)	0,02 (0,2)	0,02 (0,19)	-0,06 (-0,36)	-0,06 (-0,33)
N	8090	8090	8090	8090	8090	8090	8090	8090	8090	8090
adj. R-sq	0,129	0,636	0,342	0,818	0,329	0,829	0,024	0,665	0,053	0,0578
(5)	-0,14*** (-3,04)	-0,14*** (-2,80)	0,33*** (3,57)	0,33*** (3,29)	-0,07 (-1,03)	-0,07 (-0,94)	-0,07 (-0,81)	-0,07 (-0,75)	-0,05 (-0,33)	-0,05 (-0,30)
N	8419	8419	8419	8419	8419	8419	8419	8419	8419	8419
adj. R-sq	0,123	0,645	0,366	0,818	0,325	0,836	0,021	0,689	0,043	0,0560
(6)	0,03 (0,34)	0,03 (0,24)	-0,66*** (-2,88)	-0,66*** (-2,64)	0,11 (0,8)	0,11 (0,73)	0,35** (2,23)	0,35** (2,05)	-0,06 (-0,21)	-0,06 (-0,19)
N	1968	1968	1968	1968	1968	1968	1968	1968	1968	1968
adj. R-sq	0,174	0,642	0,348	0,789	0,348	0,788	0,059	0,674	0,086	0,637

Notes. This table presents the value of the coefficient of the interaction between treatment assignment and time post-treatment dummies. The Models (1) to (6) have been performed on equation (1) from sub-population where firms are financed: contemporaneously to the innovation grants received (1) with a certain lag between both (2) during the crisis period (i.e. financing started during 2008 or 2009) (3) outside the crisis (4) with relative low tickets (5) with relative high tickets (6). T-statistics in brackets, Dependent and independent variable are expressed in logarithm (log1+) (asinh transformation when necessary) and are winzorized at 5% to avoid outlier's dependent results. Standard errors are clustered at the firm level. +, ** and *** respectively denotes 10% 5% and 1% significance.

Different patterns also arise when considering the intangible assets. Indeed, results exhibit positive causal impact on intangibles of program participation for firms financed with a lag between innovation aid and loan (+ 23,6% of intangible assets). In contrast, no significant average causal impact is found for firms financed contemporaneously (models (7) and (8)). We exhibit that firms invested during economic collapse record no difference compared to their counterparts. Instead, firms financed outside

³⁸ the increase of the average loan size through studied years can be interpreted, *ceteris paribus*, as an increase of the governmental expertise of financing innovation.

record a positive and significant increase of around 16% of innovative assets. Finally, we show that firms invested under the initial framework record a positive and significant impact of 30%, whereas firms financed with the revised framework record a negative causal average effect of 34%.

Lastly, to control for specification used (vi), OLS regressions are estimated to handle all the credit history at our disposal for both control and treated groups and presented in table 5. The results confirm the one obtained in table 4.

6. Discussion

The results mentioned above highlight different patterns regarding program participation's impact on a firm's resource accumulation and performance.

First, the negative average causal effect of program participation on employment raises the concern of this financial instrument's objectives for YICs. From the firms' perspective, we could have expected higher outcomes than counterfactuals, meaning that the program design properly targets and selects promising firms with high growth potential and, ultimately, reveals it. From a local ecosystem perspective, we could have expected that knowledge spillovers would help the entire ecosystem within which the invested firm is, meaning that counterfactuals could also indirectly benefit from a given firm's program participation. These two opposite perspectives lead to puzzling and opposite statements based on the same results. From the firms' perspective, it would be adventurous, at this stage, to conclude that the program produces a negative effect despite a reduced workforce accumulation financed firms record higher innovative asset accumulation than the counterfactual sample. This re-allocation of production factors is not favoring short-term workforce increase but lays the foundation of innovative ecosystems from which subsequent positive effect on employment can emerge.³⁹ However, our analysis level is based less on a local than on firm's level perspective, which leads to a lack of certification mechanisms in terms of workforce attractivity. This mechanism is also found in Coad et al. (2017) that depict, thanks to an SVAR framework growth process of firms. They notice that employment growth is not the top ranked growth consideration for a sub-sample of potential high-growth firms.

Second, the high heterogeneity in results, robust across sensitivity tests, shows that program design has important implications regarding the magnitude of firms' workforce accumulation. In addition to the previous discussion, the negative influence of the program on employment raises concerns about program moral hazards. Financed firms do not use the amount to increase the workforce, which is one crucial rationale of YICs financing but instead seems to increase their asset stock in terms of intangibles. Indeed, although innovative activities are not exhaustively represented in our framework⁴⁰, a positive effect of program participation is found for the firms financed with little amounts. Insofar, contrary to high amounts, below 150k the funding event has not occurred already, we argue that the quasi-equity buffer is used to reinforce the capital structure. Indeed, it would highlight the firms' innovative aspect and ultimately improve the probability of being funding by private investors (Business angels and venture capitalists). The latter mechanism that shows a re-allocation process of production factors from human to technological capital finds support when turning to the accumulation of tangible assets. This last aspect is essential for debt financing instruments but appears less relevant when discussing equity financing (Bernanke and Gertler, 1986). The fact that tangible assets accumulation is not different from both groups leads us to conclude that collateral accumulation is not a critical concern compared to innovative aspects supporting the re-allocation process depicted above.

³⁹ The dynamics of the work force is greater for non-invested firms can be interpreted as a indirect impact of ecosystem creation which can be beneficial for firms subsequent development. Unfortunately, these stages are not covered by our sample. Further insights are needed in this regard with data with longer temporality.

⁴⁰ We lack of Enquête "R&D" in which R&D spending are recorded.

Third, results lead us to question rationale and objectives related to the use of mezzanine instruments. Theoretically, the use of participative loans and, more broadly, of mezzanine finance is motivated by the instrument's hybrid nature, which reinforces the capital structure while not increasing the equity and thus without diluting the ownership.⁴¹ Besides, mezzanine instruments allow a leverage effect without requiring any collateral from the lender. Moreover, it will enable a tax-deductible interest payment while taking the most suitable form given the invested company's characteristics. As every medal has its flip side, the use of mezzanine finance is not without caveats. First, the availability of mezzanine finance is not yet widespread across all sizes of firms. Second, since mezzanine finance requires stringent transparency requirements for opaquer ones, the availability may be limited. Also, the loan is in principle unsecured and subordinated to senior debt in case of bankruptcy. Finally, this financing form is not relevant for all business phases (restructuring or firms losing market position) and for all capital structure (firms with high debt to equity ratio).

In addition to providing an application on the theoretical use of mezzanine finance, we argue that research framework structure allows us to investigate the screening efficiency of public agents (impact on input) and the firms' capability to use public spending (impact on output) efficiently. A positive global impact on both input and output indicators could help to conclude that firms are efficiently screened. A positive effect on output can be interpreted as the firm's capacity to use public money efficiently. Opposite mechanisms are found according to the screening aspect insofar there is a positive impact on intangible and a negative effect on employment dynamics. These antagonists' results do not allow us to draw a clear conclusion on screening processes' effectiveness. In turn, this may explain the lack of significant effects on firms' outcomes and do not allow to investigate the firm's capability to benefit from capital buffering. Still, on the performance enhancing impact of program participation, we acknowledge that the lack of significant results may be due to both the early stage focus of the research design and to the innovative character of firms that may take time to commercialize the innovative project for which they have been funded (Norrman and Bager-Sjögren, 2010).

Finally, although our research design moves away from mediation models (Söderblom et al. 2015), the inclusion of lagged dependent variables to explain each other could be informative regarding treatment effect mechanisms. In this regard, we can notice that the accumulation of human capital (proxied by the number of employees) is positively associated with increased *Sales*, *Productivity*, and a greater extent to *tangible* and *intangible assets* accumulation (Söderblom et al., 2015). Interestingly high autonomy ratio (i.e., lower autonomy) is negatively and significantly associated with productivity growth while not being significantly associated with increased sales. This finding supports the early-stage innovation financing literature that shows opaque firms are reluctant to ownership losses, particularly in innovative contexts (Colombo et al., 2014). The convergence of objectives from insiders and outsiders creates agency costs that could negatively affect firm performances proxied here by labour productivity. Finally, in line with Business angel literature (Politis, 2008) we show that the presence of investors is associated to higher resource accumulation (in terms of tangible and intangible assets accumulation) while the impact on performance is limited (in terms of *Sales* and *Labor Productivity*).

Results are not discussed without presenting some caveats, inherent to any observational study and specific to the studied instrument. First, given the non-randomness of treatment assignment, whether the control group can effectively account for differences both on the observable and unobservable may be asked. In this regard, the implementation of a RDD could have been performed if firms had been ranked according to the project's quality (or with their credit risk rank).

On the limits of the framework, firms used as control group can be financed elsewhere than by BPifrance, which is not covered by our data, reducing the control group's quality to take account of the

⁴¹ In France, for the legislator and from a financial viewpoint participative loans are considered as equity but is considered a debt from fiscal accounting and judicial viewpoint.

counterfactual situation. In this regard, the use of MCDiD design lowers without omitting the bias on invariant unobservable. On the scope of the paper, further investigations are necessary both on the investment timing and on the threshold effect to disentangle the importance of the design of the participative loan that encompasses: age of beneficiaries (when receiving the loan), timing of investment (early or later, following innovation grants or not) and amount of loan (does low versus high loan amounts produce same effects ?)

7. Conclusion

This paper investigates the average causal treatment effect on a French starting loan covering 921 YICs firms from 2006 to 2014. Taking insights into entrepreneurship and innovation literatures, we use a PSM-DiD framework to evaluate program participation's impact on two main aspects of a firm's development: resource accumulation and performance-enhancing. The developed research hypotheses regarding resource-accumulation on tangible assets and performance-enhancing, proxied by sales and labour productivity dynamics, do not find strong support.

Besides, a negative influence on human capital attractivity, proxied by the number of employees is highlighted fogging the positive impact of public certification through resource attractivity. However, treatment assignment seems to stimulate the dynamic of innovative activities, proxied by the stock of intangibles assets. Besides, the research design allows exploring the impact of the financing instrument's design on the treatment effect. Notably, we investigated the "earlier is better" hypothesis regarding investment timing, which does not find support. In line with governmental innovation financing literature, we conclude to substitutability between production factors asking for the unconstrained nature of financed firms (McKenzie, 2017) and more broadly on the target of public financing instruments.

Enrichment of both conceptual and empirical framework could improve the estimation of public funding influence. Although our empirical framework controls many traditional biases in quasi-experimental studies, the techniques involved only weakly meet the most rigorous natural experiment framework. Moreover, the paper only estimates linear relationship while possible threshold effect could occur regarding both timing and amount of funding. Information on the nature of firms' innovation projects could also help refine the framework and explore how the nature of innovation product (product, service, process) could influence developments compared to other types of innovation.

By discussing mechanisms behind effects, the paper could have policy implications to improve business practices in terms of public financing of innovative projects in early. Although reduced due to the research design, traditional limitations of observational studies hold in our context, and further sectorial studies could be performed to improve operational implications to improve the financing of innovative activities, notable in terms of investment timing.

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Appendix A

Table A.I Financing instruments (demand side)

Low Risk/ Return	Low Risk/ Return	Medium Risk/ Return	High Low Risk/ Return
Asset-Based Finance	Alternative Debt	"Hybrid" Instruments	Equity Instruments
<ul style="list-style-type: none"> • Factoring • Leasing • Purchase Order Finance • Warehouse Receipts 	<ul style="list-style-type: none"> • Corporate Bonds • Securitised Debt 	<ul style="list-style-type: none"> • Subordinated Loans/Bonds • Silent Participations • Participating Loans • Profit Participation Rights • Convertible Bonds • Bonds with Warrants • Mezzanine Finance 	<ul style="list-style-type: none"> • Private Equity • Venture Capital • Business Angels • Specialised Platforms for Public Listing of SMEs • Equity Derivatives

Source: Cusmano and Thompson (2018)

Figure A.II Mezzanine Finance Landscape

Instrument	Description	Place in the balance sheet
1. Junior loans	Tailored loan design and repayment structure and flexibility regarding collateral requirement. Payback of principal and/or interests can take several forms (e.g. escalating or bullet loan, rolled up interests, redemption premium)	Liabilities  Stockholders' Equity
2. Royalty based lending	Interest based payment plus royalties (payments that are dependent on the performance of the company, usually a percentage of revenue or EBIT(DA))	
3. Convertible loans	Traditional maturity date and repayment scheme but provides an option to convert the loan into shares of the company. The use of the option closes the debt feature. In the same way, the conversion option is ended once the debt payment occurs	
4. Preferred stock	Preferred to ordinary shares, it includes a priority right in receipt of dividends and upon liquidation. Frequently associated with annual dividend but not to a voting right, in opposition with common stock.	
5. Redeemable equity	Like ordinary shares, but with a right to sell the shares back to the firm using a predetermined price or a formula. Does not encompass common stock issued by the firm to employees and managers that are susceptible to be repurchased by the company according to the employment agreement.	

Table A.III Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age (1)	1							
Leverage (2)	0,03	1,00						
Autonomy (3)	-0,15	0,11	1,00					
Employees (4)	0,24	0,09	0,21	1,00				
Tangibles (5)	0,31	0,20	0,11	0,36	1,00			
Intangibles (6)	0,34	0,16	0,05	0,51	0,35	1,00		
Labour Productivity (7)	0,24	0,04	-0,05	0,30	0,15	0,17	1,00	
Sales (8)	0,12	0,03	-0,02	0,15	0,08	0,17	0,09	1,00

Table A.IV Loan amount Distribution

Variable	Min	1%	10%	25%	50%	75%	99%	Max
Loan Amounts in €	30 000	50 000	60 000	75 000	100 000	150 000	450 000	500 000

Table A.V: Step (2) Adjustment quality

Year	Variable	Sample	Mean			% bias reduction	T-statistics	p>t
			Treated	Control	bias			
2006	RA	U	0,43	0,29	30,40		2,14	0,03
		M	0,43	0,43	0,00	100,00	0,00	1,00
	generation	U	2005	2006	-41,30		-2,04	0,04
		M	2005	2005	-32,30	21,90	-1,88	0,06
	SUB	U	0,46	0,62	-34,00		-2,32	0,02
		M	0,46	0,46	0,00	100,00	0,00	1,00
	Age (i,t-1)	U	0,92	1,02	-24,20		-1,71	0,09
		M	0,92	0,90	6,00	75,30	0,28	0,78
	Employees (i,t-1)	U	1,70	1,64	5,10		0,29	0,78
		M	1,70	1,68	1,90	62,90	0,13	0,90
	Sales (i,t-1)	U	1,09	1,43	-15,10		-0,94	0,35
		M	1,09	1,09	0,00	99,70	0,00	1,00
2007	RA	U	0,41	0,27	30,80		2,97	0,00
		M	0,41	0,41	0,00	100,00	0,00	1,00
	generation	U	2006	2007	-40,80		-2,77	0,01
		M	2006	2007	-43,70	-7,10	-3,61	0,00
	SUB	U	0,49	0,67	-35,00		-3,31	0,00
		M	0,49	0,49	0,00	100,00	0,00	1,00
	Age (i,t-1)	U	0,78	1,00	-48,40		-4,47	0,00
		M	0,78	0,78	1,10	97,70	0,07	0,94
	Employees (i,t-1)	U	1,70	1,51	18,00		1,38	0,17
		M	1,70	1,69	0,60	96,90	0,05	0,96
	Sales (i,t-1)	U	0,96	1,41	-21,00		-1,72	0,09
		M	0,96	0,95	0,80	96,00	0,06	0,95
2008	RA	U	0,43	0,25	39,10		3,90	0,00
		M	0,42	0,42	0,00	100,00	0,00	1,00
	generation	U	2007	2008	-60,60		-4,25	0,00
		M	2007	2009	-98,20	-61,90	-5,59	0,00
	SUB	U	0,53	0,69	-33,40		-3,23	0,00
		M	0,54	0,54	0,00	100,00	0,00	1,00
	Age (i,t-1)	U	0,85	0,95	-23,10		-2,18	0,03
		M	0,87	0,84	5,20	77,40	0,36	0,72
	Employees (i,t-1)	U	1,71	1,47	23,40		1,81	0,07
		M	1,68	1,65	2,60	88,80	0,26	0,80
	Sales (i,t-1)	U	0,93	1,25	-15,00		-1,31	0,19
		M	0,59	0,59	0,00	100,00	0,00	1,00
2009	RA	U	0,6	0,22	84,2		7,04	0,00
		M	0,59	0,59	0,00	100	-0,00	1,00
	generation	U	2008	2008	-28,10		-1,67	0,09
		M	2008	2008	-14,80	47,40	-0,91	0,37
	SUB	U	0,33	0,70	-81,00		-6,38	0,00
		M	0,34	0,34	0,00	100,00	0,00	1,00
Age (i,t-1)	U	1,11	1,15	-14,00		-1,30	0,19	

		M	1,11	1,07	16,50		-17,80	0,82	0,41
	Employees (i,t-1)	U	1,66	1,47	19,30			1,28	0,20
		M	1,66	1,65	0,50		97,60	0,03	0,97
	Sales (i,t-1)	U	1,07	1,47	-19,00			-1,34	0,18
		M	1,16	1,16	-0,30		98,30	-0,02	0,99
	RA	U	0,45	0,24	46,00			4,67	0,00
		M	0,45	0,45	0,00		100,00	0,00	1,00
	generation	U	2009	2010	-35,60			-2,58	0,01
		M	2009	2010	-39,80		-11,80	-2,73	0,01
	SUB	U	0,46	0,68	-45,60			-4,43	0,00
		M	0,46	0,46	0,00		100,00	0,00	1,00
2010	Age (i,t-1)	U	0,78	0,91	-25,30			-2,46	0,01
		M	0,78	0,76	4,40		82,50	0,30	0,77
	Employees (i,t-1)	U	1,51	1,29	21,80			1,80	0,07
		M	1,51	1,52	-0,30		98,60	-0,03	0,98
	Sales (i,t-1)	U	0,49	1,07	-31,90			-2,51	0,01
		M	0,49	0,47	1,20		96,30	0,11	0,91
	RA	U	0,42	0,23	42,20			4,73	0,00
		M	0,42	0,42	0,00		100,00	0,00	1,00
	generation	U	2010	2011	-34,20			-2,80	0,01
		M	2010	2011	-53,60		-56,40	-4,67	0,00
	SUB	U	0,50	0,65	-31,40			-3,34	0,00
		M	0,50	0,50	0,00		100,00	0,00	1,00
2011	IFL	U	0,02	0,05	-17,20			-1,52	0,13
		M	0,02	0,02	0,00		100,00	0,00	1,00
	Age (i,t-1)	U	0,67	0,81	-28,20			-2,89	0,00
		M	0,67	0,66	1,90		93,20	0,15	0,88
	Employees (i,t-1)	U	1,46	1,26	20,60			1,91	0,06
		M	1,46	1,44	1,80		91,30	0,16	0,87
	Sales (i,t-1)	U	0,80	1,04	-12,50			-1,19	0,24
		M	0,80	0,78	0,90		92,60	0,08	0,94
	R.A.	U	0,48	0,29	39,10			4,46	0,00
		M	0,47	0,47	0,00		100,00	0,00	1,00
	generation	U	2011	2007	130,60			10,23	0,00
		M	2011	2011	-18,40		85,90	-3,50	0,00
	SUB	U	0,43	0,60	-34,10			-3,73	0,00
		M	0,44	0,44	0,00		100,00	0,00	1,00
2012	IFL	U	0,02	0,05	-17,10			-1,55	0,12
		M	0,02	0,02	0,00		100,00	0,00	1,00
	Age (i,t-1)	U	0,53	2,22	-246,50			-22,55	0,00
		M	0,54	0,54	0,00		100,00	0,00	1,00
	Employees (i,t-1)	U	1,57	2,37	-65,50			-5,77	0,00
		M	1,56	1,56	0,50		99,20	0,06	0,95
	Sales (i,t-1)	U	0,45	2,05	-66,90			-5,61	0,00
		M	0,45	0,45	0,30		99,60	0,04	0,97
	R.A.	U	0,34	0,17	39,30			5,04	0,00
		M	0,34	0,34	0,00		100,00	0,00	1,00
	generation	U	2012	2012	16,00			1,51	0,13
		M	2012	2012	9,10		43,00	0,82	0,42
	SUB	U	0,55	0,71	-33,70			-4,05	0,00
		M	0,56	0,56	0,00		100,00	0,00	1,00
2013	IFL	U	0,05	0,05	-0,10			-0,01	1,00
		M	0,04	0,04	0,00		100,00	0,00	1,00
	Age (i,t-1)	U	0,59	0,74	-29,30			-3,41	0,00
		M	0,60	0,60	0,20		99,30	0,02	0,99
	Employees (i,t-1)	U	1,44	1,36	8,50			0,90	0,37

		M	1,44	1,46	-1,90	78,20	-0,18	0,85
	Sales (i,t-1)	U	0,64	0,84	-11,40		-1,21	0,23
		M	0,64	0,60	2,60	77,50	0,25	0,81
	RA	U	0,40	0,17	51,90		7,27	0,00
		M	0,40	0,40	0,00	100,00	0,00	1,00
	generation	U	2013	2012	55,20		5,72	0,00
		M	2013	2013	24,30	56,00	2,29	0,02
	SUB	U	0,50	0,73	-48,60		-6,38	0,00
		M	0,50	0,50	0,00	100,00	0,00	1,00
2014	IFL	U	0,05	0,04	2,40		0,30	0,76
		M	0,05	0,05	0,00	100,00	0,00	1,00
	Age (i,t-1)	U	0,61	0,78	-33,50		-4,13	0,00
		M	0,61	0,60	0,30	99,10	0,03	0,98
	Employees (i,t-1)	U	1,39	1,32	7,70		0,89	0,37
		M	1,39	1,38	0,90	87,80	0,09	0,93
	Sales (i,t-1)	U	0,50	0,74	-14,90		-1,69	0,09
		M	0,50	0,50	0,10	99,60	0,01	1,00

Notes: This table present of the adjustment of the Mahalanobis matching process following the cross-sectional logistic regression presented in Table 4. The Standardized Difference is defined as the difference of means normalized by the square root of the sum of estimated variances of the variables in both subsamples. R.A., SUB and IFL which respectively refer to refundable advance, subsidy and interest free loan records the nature of the innovation aid received. Generation refers to the obtention year of the innovative aid.

