



R&D Subsidies and SMEs Indebtedness*

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**The contents of this work do not necessarily reflect the opinion of the European Commission.*

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Motivation



1. R&D is the key drivers of competitiveness, productivity and economic growth for advanced economies.
2. However, imperfections of capital markets may imply that the level of private investments in innovation activities is lower than the socially desirable level (*Arrow, 1962*).
3. Frictions (asymmetric information) that occur between banks and investing firms (Small and young) imply relevant financing constraints for firms, which hinder their R&D expenditure and development.
4. Public subsidies for R&D may help to overcome market failures and firms' financial constraints by reducing the uncertainty between financiers and firms

Aim



- ✓ Although recent literature provides evidence that obtaining public support for R&D enhances firms' access to external sources of financing, (*Lerner, 1999; Feldman & Kelley, 2006; Meuleman & De Maeseneire, 2012; Demeulemeester & Hottenrott, 2017; Howell 2016; Hottenrott & Demeulemeester, 2017; Czarnitzki and Hottenrott, 2017*) the impact of subsidies for R&D on firm's indebtedness and cost of debt remains almost uncharted.

- ✓ The aim of this work is to investigate, in short and medium run, whether R&D subsidies:
 - (1) Improve access to finance reducing indebtedness of recipient firms
 - (2) Reduce the cost of debt of recipient firms

Theoretical Background (1)



- ✓ Public instruments (R&D subsidies, Tax incentives, etc), in addition to support private investments, can reduce financing constraints (*Takalo & Tanayama, 2010*)

- ✓ Public R&D subsidies may produce two effects:
 - 1) Subsidies reduce the overall amount of financial resources
 - R&D subsidies allow firms to finance their projects with a smaller part of debt
(*Czarnitzki, 2006*)
 - Lowering the external debt reduce the cost of financing

Theoretical Background (2)



- 2) Recipient firms of the subsidy provide an informative signal to venture capitalists and banks

Therefore, R&D subsidies may:

- reduce information problems facilitating the access to external financing
- reduce the screening costs and consequently the cost of debt

The program (1)



- ✓ Marche region has implemented several policies to support firms' innovation, granting local firms with more than 113 million of euro in the period 2003-2009.
- ✓ The aim of such regional policy programs - in the form of direct grants for industrial research projects and experimental development activities - was to promote firms' R&D investments leading to radical or incremental innovations of products, services and processes.
- ✓ Only firms belonging to specific sectors considered as having strategic importance for local economy could apply for public funding. The sectors range from traditional sectors (e.g., food or apparel industries), to more technology-intensive ones (e.g., ICT, nanotechnology, building automation, new materials).
- ✓ Our empirical evaluation focuses on one program implemented and managed at regional level but funded by European Regional Development Fund. This program is specifically oriented towards the supporting of firms' R&D spending

The program (2)



The program is targeted to SMEs headquartered in the region.

Eligible criteria:

- Firms **headquartered** in the region.
- **SMEs** (employees <250; turnover <50 million or Tot Assets < 43 million).
- **Actives** and not in bankruptcy or in liquidation;
- **No other public subsidies** for R&D, excluding potential confounding factors allows for a causal effect identification of regional programs.
- **Individual applications**
- Funded projects had to start within one month and concluded within 18 m.
- Total cost of the projects at least €200,000.
- The maximum non-repayable grant accounts for 35% of total costs of the project, while the maximum interest on the subsidy was 10%.

The Program



Descriptive statistics of the regional program (two rounds, mln of Euro)

	2005	2007	
Total amount of grants	15.3	28.4	
Projects funded	103	179	
Projects approved but not funded	0	0	
Projects not approved	90	69	
Admissible amount of projects			
Min.	0.1	0.2	
Max.	1	2	
Average amount of funded projects	0.185	0.212	

Dataset (1)



1. Firms balance sheets data from AIDA – Bureau van Dijk
2. List of firms financed by the regional subsidy
3. We merged these two lists of firms to identify the financed ones
4. We select the entire universe of the firms in the region available in AIDA to identify the control group.
5. We exclude: large firms (tot sale up to 50 mid), firms operating in sectors not involved in public policies, distressed firms and firms financed by other regional funds.
6. **Final Sample**
 - ✓ Funded firms: 138 (60, 78)
 - ✓ Firms not funded (control group): 4529 (1,813; 2,963)
 - ✓ Time span: 2003-2012 (Panel data)

Dataset (2)



Notes: ^a Thousands of euros. ***, **, * statistically significant at the 1, 5 and 10%	Subsidized	Non-subsidized	Mean difference test
	<i>Mean</i>	<i>Mean</i>	<i>t-statistic</i>
Age	18.6	8.1	7.26***
Sales^a	8,946	3,900	9.11***
Value added^a	2,460	837	10.74***
Employees	58.1	31.1	5.93***
Total assets^a	7,908	3,636	10.39***
EBITDA/sales	12.8	9.3	4.36***
ROE	3.4	8.2	-9.64***
Tangible assets^a	1,266	1,012	1.57*
Intangible assets^a	173.3	45.5	11.70***
R&D intensity (%)	0.5	0.3	1.68*
Wages^a	1,108	679.6	5.66***
Patents	0.06	0.2	16.06***
Borrowing cost (%)	4.8	5.8	-2.38**
Short-term borrowing	2.2	0.9	6.35***

Evaluation design (1)



- ✓ The panel data structure of the sample allows us to rely on the ***DID estimator*** that ***compares treated*** and ***non-treated*** units in terms of outcome changes before and after the treatment.
- ✓ However, neither firms receiving the subsidy nor those not applying for it constitute random samples. Hence, the comparison of the two groups could lead to ***biased conclusions***.
- ✓ Also in our sample ***subsidized and non-subsidized firms show differences*** (in t-1 the subsidized firms were older, larger and more profitable). Hence, public grants across firms could be not random distributed.
- ✓ Then, in order to select appropriate comparison groups and to reduce selection bias, we combine DID with propensity score matching (PSM). PSM identify comparison groups based on the probability of receiving public funds, conditioned on firms' observed characteristics.

Evaluation design (2)



- ✓ The validity of PSM depends on two assumptions:
 - i) unconfoundedness, that is unobserved factors do not affect the probability of funding (Rosenbaum & Rubin, 1983);
It is a strong assumption, which cannot be defended in many cases. However, combining PSM and DID we can offset this limitation.
 - ii) presence of common support, that is subsidized firms have to be similar to non-subsidized firms in terms of observed characteristics (Heckman et al., 1999).
Common support is plausible in our sample due to the large number of potential controls. However, in order to ensure the overlapping of subsidized and non-subsidized firms we perform matching with the option of common support.
- ✓ DID, relaxes the assumption of selection only on observed characteristics, taking account unobserved time-invariant heterogeneity in the receipt of grants.

Evaluation design (3)



- ✓ The estimation procedure is implemented in two steps:
 1. **PSM** based on observed firm characteristics (sector, total assets, cash flow, ROA, ROE, sales, juridical form, age, tangible and intangible investments, intensity of innovation technology, location) in the baseline year (one year before the subsidy) and using the Kernel matching algorithm.
 2. **DID** to estimate the average effect of the public programs.
(We run DID in different years after the treatment to capture short-term (1-2 years) and medium-term effects (3-5 years)).



The financial **outcome variables** are:

- (1) **Indebtedness** (*Tot Assets/Equity*)
- (2) **Short-Term debt** (ST debt / ST debt + LT debt)
- (3) **Medium-Term debt** (LT debt / ST debt + LT debt)
- (4) **Cost of debt** (Tot Debt charges/Debt vs Banks ST + Debt vs Banks LT)*100

Results:



Subsidized firms (respect to firms not applying for the subsidy) experience:

1. Indebtedness:

- ✓ Decreases in the short-run (1-2 yrs) and medium-run (3-5 yrs)

2. Short-Term debt:

- ✓ Decreased in the short- and medium-term
- ✓ The effect is stronger for 2005 wave

2. Medium-Term debt:

- ✓ Increased in the short- and medium-term
- ✓ The effect is stronger for 2005 wave

4. Cost of debt:

- ✓ Decreased in the short- and medium-term
- ✓ The effect is stronger for 2005 wave

Robustness (1):



- ✓ we replicate our analysis by using the nearest-neighbor matching algorithm, where each subsidized firm is matched to the comparable non-subsidized firms with the closest propensity score.
- ✓ For our test, we run matching without replacement and with five nearest neighbors for each treated unit.
- ✓ In general, the statistical significance is lower and the estimates are more volatile – particularly for 2007 wave - than those obtained by Kernel matching but the main findings are confirmed.

Robustness (2):



- ✓ we replicate our analysis by using Random Effect estimator:
- ✓ **Outcome = treated firms (0/1) + year of treatment (0/1) + treated firm*year of treatment time + controls + re**
- ✓ RE estimates confirm the results of the diff-and-diff analysis

Conclusion



- ✓ We analyze the effects of a regional subsidy program for R&D on the access to external finance - in term of indebtedness – and on the cost of debt for SMEs.
- ✓ The subsidy program was successful in reducing the overall indebtedness, both in short- and medium run.
- ✓ Obtaining a public subsidy seems to reduce the cost of debt
- ✓ In general, our evaluation analysis suggests that the public intervention based on “traditional” monetary subsidies has a beneficial effect on firms’ financial variables in term of reduced indebtedness and cost of debt.
- ✓ To support small and young firms in accessing public programs may help them to reduce financial constraints.



THANK YOU FOR YOUR ATTENTION