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SME Instrument: an empirical analysis on the impact of the second phase on the performance of Italian enterprises

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Abstract

This article is part of the strand of research on evaluating the effectiveness of public funds in stimulating the growth of research and development activities in the private sector. The research focus is on the SME Instrument, in its original version born within Horizon 2020, and in particular Phase 2 of the instrument. The research question, therefore, is "Has the second phase of the SME Instrument had a positive impact on the Italian SMEs that have joined it? If yes, to what extent?" The evaluation will be based on quantitative data inherent in the innovation (and non-innovation) performance of individual firms. At the conclusion of the analysis, it can be concluded that the second phase of the SME Instrument did not produce significant additional effects on the performance of firms, approximated by the ratio of total sales to total assets. The only exception is for those enterprises aged between 6 and 15 years, for which there is a partially significant increase in the sales/assets ratio after receiving funding. Given the research results and given that public and private management share a common interest in making their investments effective and efficient by seeing a return on them, the implications for policymakers are twofold: personalization of policy and promotion of an integrated innovation model, both of which imply a rethinking of the instrument. However, like any

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research, the results obtained are never an end-point, but the starting point for new reflections from which to develop further research.

Keywords: R&D activities, public funds, enterprises, European funds, innovation, public management

Introduction

The importance of research and development as a driving force for sustainable growth in industrialized economies is widely shared among all economists, especially in the context of the structural shift from resource-based to knowledge-based economies[1]. This awareness has also spread among European policymakers, who aspire to make Europe the most competitive economy in the world. For this reason, during the European Council, held in Barcelona in 2002, the target of investing 3% of GDP in R&D by 2010 was included as a pillar of European policies, a target reconfirmed in the Europe 2020 strategy, emphasizing the need for combined public and private sector investment. However, this target has not been met either by the date set at the council or to date: in 2019 the EU's R&D intensity, calculated as gross domestic R&D expenditure over GDP, is around values of 2.1%, well below the values achieved by our competitors on the world market, and generally below the average of OECD countries (2.47%)[2].

EU member states spent around €311 billion on R&D in 2020, one billion less than in 2019, due to the pandemic crisis. The business and enterprise sector continues to be the sector where R&D spending is employed the most, with 66 percent of total R&D disbursed in 2020[3].

The average European R&D intensity value, below the average of OECD countries, is certainly affected by very poor innovation performance at the head of some member countries, which contrasts with the achievements of leading countries in the field such as Austria, Belgium, Denmark, Finland, Germany, France, the Netherlands and Sweden, all of which are above the European average in R&D intensity. In order to bridge the gap between member states so that they can move together and more quickly toward the common goal, the European Commission adopted a Communication in September 2020 suggesting that states, that are below the European average, increase their R&D investment by 50 percent within the next five years.

[1] Kris Aerts, Dirk Czaenitzki, (2004) *Using innovation survey data to evaluate R&D policy: the case of Belgium*
[2] Rakic R. et al., (2021), *Fostering R&D intensity in the European Union: Policy experiences and lessons learned*, Case study contribution to the OECD TIP project on R&D intensity.
[3] https://ec.europa.eu/eurostat/en/web/products-eurostat-news/-/ddn-20211129-2

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Of course, the Commission also aims to assist, actively and with numerous instruments that we will discuss later, these structural changes that member states will have to adopt in order to reach the target[4].

The reason for this economic commitment of governments, and of the EU in general, lies in the realization that, without state intervention, private companies would be engaged in developing a level of R&D and innovation activity well below the socially optimal threshold. The reason for this under-investment is inherent in the very character of activity of this kind: insofar as it is non-appropriable, non-divisible, and uncertain, R&D activity takes on the character of a public good that generates externalities that are unlikely to be internalized by the company implementing them, so as to cover the costs it incurs from the investment while also managing to maintain a certain profit margin[5]. A further justification for public intervention lies in market imperfections, first highlighted by Arrow[6] in the second half of the 1990s, and in particular in the information asymmetry that seems to be particularly pronounced in this area. Indeed, when the innovator does not coincide with the party providing the capital, there is a particularly large gap between the innovator's economic return and the cost of capital useful to finance the investment. It is logical to think that the inventor has much more knowledge of the technical details of the project and so also, to some extent, of the success rate of the project, details that either he may not want to share for reasons of secrecy and competitive advantage or, even if he wanted to, not understandable by his financial interlocutor. Because innovative activity is risky by nature and because the lender cannot understand the big picture of the investment, it will lend the capital but at a particularly high cost, thus disincentivizing innovators from applying for a private loan[7]. Firms, therefore, will only be willing to pursue projects that provide some profit margin despite these issues, but since not all will succeed, the level of innovation will be lower than the socially optimal level[8]. After clarifying the motivations behind public intervention, it is necessary to clarify what are the main channels through which support for research and development activities can be bestowed. The

[4] Rakic R. et al., (2021), Fostering R&D intensity in the European Union: Policy experiences and lessons learned, Case study contribution to the OECD TIP project on R&D intensity.
[5] Kris Aerts, Dirk Czaenitzki, (2004) *Using innovation survey data to evaluate R&D policy: the case of Belgium*
[6] Arrow K., (1962), *Economic welfare and the allocation of resources for Invention*. In: Groves, H.M. (Ed.), The Rate and Direction of Inventive Activity: Economic and Social Factors. National Bureau of Economic Research, pp. 609–626
[7] Dirk Czarnitzki (2002), *Research and Development: Financial Constraints and the Role of Public Funding for Small and Medium–sized Enterprises*, ZEW Discussion Paper No. 02-74
[8] Matthias Almus and Dirk Czarnitzki (2003) *The Effects of Public R&D Subsidies on Firms' Innovation Activities: The Case of Eastern Germany*, Journal of Business & Economic Statistics, Apr., 2003, Vol. 21, No. 2 (Apr., 2003), pp. 226- 236

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main instruments through which public institutions promote research and development are tax incentives, funds allocated directly by the public body, business cooperation pacts, public research done at research institutes and universities[9]. While the latter instrument is usually functional for national needs, the former is designed exclusively for the business world.

In this study, we will focus exclusively on the direct funds instrument. In general, the literature shows that the effects of tax incentives have a more immediate effect than direct subsidies, but have no effect in the long run, while direct funds act more slowly but are more effective in the long run[10], the reason probably lies in the fact that while tax incentives are a neutral instrument and are granted "windfall" to all enterprises that fall within the criteria set by the policy, public funds are granted on the basis of the project selected by the issuing entity. This dynamic ensures, to a certain extent, that the subsidized projects are activities that produce consistent value and new opportunities over time[11].

Effect of public funds on R&D activities of SMEs: literature review

The impact of public funding according to economic theory

According to economic theory, government subsidies for R&D directly and indirectly impact the activities of enterprises. The first direct effect expected is an increase in business investment in R&D since, by constituting low-cost capital, the borrowing costs that the company has to incur in order to obtain the capital are significantly lowered, and as a result, it will be possible to cover the costs incurred for the project, while also managing to carve out a certain profit margin. In this way, R&D investments, that were previously unprofitable, will become profitable and thus be implemented. Wallsten also points out another kind of direct effect whereby, even if public funding were not to generate an increase in R&D, it would certainly enable companies to keep those projects already underway constant, without having to divest resources due to possible economic impediments[12].

Public funding also acts indirectly, producing positive externalities even for projects that are not strictly part of the funding. It is safe to assume that, through the grants received, firms equip themselves in terms of structure, as well as personnel, to implement research and development projects, and

[9] Hans Loof, Alms Heshmati (2005), *The impact of public funds on private R&D Investment:new evidence from a firm level innovation study,* MTT Discussion papers 3
[10] David, P.A., Hall, B.H. and Toole, A.A. (2000) *Is public R&D a complement or substitute for private R&D? A review of the econometric evidence*. Research Policy 29: 497-52
[11] Becker B. (2015), *Public R&D Policies and Private R&D Investment: A Survey of the Empirical Evidence,* Aston Business School
[12] Wallsten, S. J. (2000), *The Effects of Government-Industry R&D Programs on Private R&D: The Case of the Small Business Innovation Research Program* RAND Journal of Economics, 31, 8

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that these endowments, presumably, will remain for the benefit of the firm, which will be able to take advantage of them in the future, to pursue further research that has already been started or is to be started. Moreover, there is clear evidence about the attraction of venture capital investments after a firm has received a public fund, as if being chosen by the funding body is a guarantee of reliability that reduces the information asymmetry between the investor and the firm[13], with the resulting consequences in terms of capital costs. Finally, the effects of public funds do not end with the activity of the individual firm: research and development produce knowledge that is likely to be commercialized and that will benefit the entire sector in which the firm operates and the community at large, helping to create diversity and thus competition and to propel economic growth[14]. However, the effects of public funds cannot be taken for granted: the relevant literature reveals a substantial difference between effects that generate additionality and substitution effects. The concept of additionality, as defined by Buiseret[15], is something that is achieved through public intervention, which would not exist without some kind of intervention, in this case, the subsidies that the company receives are complementary to private R&D expenditures, this happens when the policy in question has an effect on the management of activities in research and development and not only are expenditures increased, but a change in terms of the quality of resource management takes place. Firms receiving the subsidy are stimulated to do more, to undertake collaborations with research centers and universities[16], and to embark on riskier projects that would not otherwise be financed, committing themselves to spend, in the medium to long term, an even greater amount than they received from a given program. However, these positive effects run the risk of being displaced (*crowding out*) by the *substitution effect*: in fact, it is logical to think that a firm will always have an incentive to apply for public subsidies, even when it could invest in research and development through its own resources or through venture capital. This is a very normal reasoning of economic expediency whereby, in terms of cost and deployment of resources, it is always more cost-effective to apply for a public subsidy than to scrape together financing on the capital market. For this reason, the firm sees the subsidy as a substitute resource rather than a force

[13] Lerner J., (1999), *The Government as Venture Capitalist: The Long-Run Impact of the SBIR Program*, The Journal of Business, Vol. 72, No. 3 pp. 285-318

[14] Fritsch, M. (2008*). How does new business formation affect regional development? Introduction to the special issue.* Small Business Economics, 30(1), 1–14

[15] Buiseret, T.; Cameron, H.; y Georgiou, L. (1995), *What Differences Does it Make? Additionality in the Public Support of R&D in Large Firms*. International Journal of Technology Management, Vol.10, p. 587- 600

[16] Bronzini R., Piselli P. (2016) *The impact of R&D subsidies on firm innovation* Bank of Italy, Directorate General for Economics, Statistics and Research, Via Nazionale 191, 00184 Rome, Italy

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that stimulates it to implement more research and development activities[17]. The problem is that this does not generate additionality, businesses simply substitute public funds for their own resources, spending what they would have invested anyway, even if they had not received the fund[18]. The implications of these considerations are not insignificant, since a complementary relationship between investments financed through public capital and further and future business investments justifies and legitimizes the use of public funds, while a substitution relationship would constitute a misallocation of resources[19] that public agencies will be required to justify. *Crowding out* is an effect that follows more or less indirectly from the decisions of the entity providing public funds: some scholars point out that it can occur, for example, due to an increase in the cost of the resources needed to implement research and development activities, resulting from an increase in demand, driven by the companies that benefit from public funding. Scholars such as Goolsbee[20] David and Hall[21] believe that one of the effects of public subsidies is precisely to increase the wages of researchers so that even if the nominal amount of investment in research and development increases, the real amount, for example of researchers, will be lower and less efficient. Another channel through which public funds could cause *crowding out* of private investment is for the company to choose to divest resources already used in other projects in order to efficiently bring the publicly funded one to completion[22]. Finally, firms that do not receive this type of aid may be disincentivized to engage in R&D because they would have less competitive advantage over subsidized firms, for which reason they may choose not to invest and indirectly enjoy the knowledge spillovers that will come from subsidized firms[23]. Sometimes, however, *crowding out* is caused by choices made intentionally by the public agencies promoting a certain funding program. As mentioned earlier, the substitution effect occurs when funds are received by those companies that would have carried out their project anyway

[17] Lach S. (2000) *Do R&D subsidies stimulate or displace private R&D? Evidence from Israel*, Working Paper 7943 Massachusetts

[18] Aerts K, Czarnitzki D. (2004), *Using Innovation Survey Data to Evaluate R&D Policy: The Case of Belgium*, Department of applied economics Research Report

[19] Czarnitzki D., Fier A., (2002), *Do Innovation Subsidies Crowd Out Private Investment? Evidence from the German Service Sector***,** Applied Economics Quarterly 48(02-04)

[20] Goolsbee, A. (1998), *Does Government R&D Policy Mainly Benefit Scientists and Engineers*, American Economic Review, 88(2), pp. 298-302.

[21] David, P.A. and B.H. Hall (1999), *Heart of Darkness: Public-private Interactions inside the R&D Black Box*, Economic Discussion Paper, No. 1999-W16, Nuffield College Oxford, June.

[22] Lach S. (2000) *Do R&D subsidies stimulate or displace private R&D? Evidence from Israel*, Working Paper 7943 Massachusetts

[23] Guellec D., Van Pottelsberghe De La Potterie B., (2003), *The impact of public R&D expenditure on business R&D*, Economics of Innovation and New Technology, 12:3, 225-243

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through internal or external resources, i.e., those companies that are equipped with substantial internal resources or have a winning project at the outset, which would also attract the interest of venture capitalists as it is associated with a high success rate. To avoid the *crowding out* effect by generating additionality, it would therefore be necessary to finance those projects that privately would not be financed because they are not profitable: as they are highly innovative and therefore risky, the financial costs to be incurred to borrow capital would in fact be too high, assuming there is interest from some venture capital. Now, given that grant-issuing entities do not have the totality of information to distinguish between projects with a high probability of success and risky projects, it is likely that out of the total amount of funding bestowed, it will be randomly allocated to projects that could easily find other funding resources. However, it is also true that this dynamic is not entirely random, but part of a precise strategy of the entities placed to fund the projects. Indeed, for the latter, special efforts are required to justify any misallocation of resources, which is why some scholars, including Stiglitz and Wallsten, believe that public agencies are inclined to focus more on projects with a high probability of success[24] (*picking the winner strategy*), thus raising the success rate percentages of a given funding program, thereby maintaining public legitimacy over it. Or again, the decision to fund certain projects might be part of a broader strategy of developing a particular technology[25], or it might respond to a desire not to create artificial advantages for firms that are less efficient than others. In light of these considerations, it is clear that the question about the effectiveness of a subsidy is largely an empirical one.

The impact of public funds according to empirical literature

Although the evaluation of the effectiveness of public funds on business R&D activities has always attracted the attention of many economists, probably because of its managerial and policy implications, contributing to a rich literature on the subject, the research world does not seem to have reached a consensus opinion on it. In fact, the empirical evidence differs greatly as the criteria according to which the research is developed change; in particular, studies differ in terms of the object of study (e.g., a particular type of funding program, European, national, regional or ministerial), the type of sample used (e.g., small, medium or large firms belonging to one sector rather than another may be observed), the geographic

[24] Stiglitz, J. E., & Wallsten, S. J. (2000). *Public-private technology partnerships—promises and pitfalls*. In P. Vaillancourt Rosenau (Ed.), Public-private policy partnerships (pp. 37–58). Cambridge, MA: The MIT Press.
[25] Cantner U., Kosters S., (2012) *Picking the winner? Empirical evidence on the targeting of R&D subsidies to start-ups* Small Bus Econ 39:921–936

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dimension (regional, national, cross-country) of the research and, finally, the type of econometric approach employed.

Although the results are indeed mixed, in general the empirical evidence on which this study is based seems to agree, to a greater or lesser degree, that public R&D subsidies produce additionality without displacing private business investment. Guellec and Van Pottelsberghe's[26] studies on the effects of R&D funding in business go in this direction. Among their various findings, the authors come to the conclusion that direct government funds, implemented by businesses, have a positive effect on private R&D investment. In particular, this type of instrument is effective when it is stable over time: companies tend not to increase investment unless they are certain about the duration of government support.

Aert and Czarnitzki[27] in their study about the impact of policies to support Research and Innovation, in Flanders, highlight how firms that received public funds would have invested significantly less if they had not received it. So do studies by Czarnitzki and Fier[28] , Duguet[29] and again Almus and Czarnitzki[30]. The latter, in particular, seek to assess the impact of certain policies aimed at stimulating innovation activities through R&D funding, focusing on the case of East Germany, and what they find is that, on average, firms that get the subsidy achieve a higher level of R&D intensity, a result also confirmed by an individual study by Czarnitzki[31] conducted on the fabric of SMEs in Germany, with a focus on comparing East and West Germany. Another empirical study conducted on the German territory is by Czarnitzki and Hussinger[32]: the authors, in this case, analyze the effects of public funding in terms of business R&D spending and patenting activity; what emerges is a positive relationship between these factors and public intervention.

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[26] Guellec D, Van Pottelsberghe B., (2003) *The impact of public R&D expenditure on business R&D,*Economics of Innovation and new technology Volume 12- Issue 3

[27] Aerts K, Czarnitzki D. (2004), *Using Innovation Survey Data to Evaluate R&D Policy: The Case of Belgium,* Department of applied economics Research Report

[28] Czarnitzki D., Fier A. (2001) *Do R&D subsidies matter? Evidence from the German service sector,* ZEW Discussion paper No. 01-19

[29] Doguet E. (2003) *Are subsidies a substitute or a complement to privately funded R&D? Evidence from France using propensity score methods for non-experimental data,* Université de Paris I, Working paper no 2003 (75)

[30] Almus M, Czarnitzki D. (2003) *The effects of public R&D subsidies on firms' innovation activities: the case of Eastern Germany,* Journal of business and Economic Statistics 21(2), 226-236

[31] Czarnitzki D. (2002) *Research and development: financial constraints and the role of public funding for small and medium-sized enterprises,* ZEW Discussion Papers No.02-74, Mannheim

[32] Czarnitzki D. e Hussinger K, (2004) *The Link between R&D Subsidies, R&D Spending and Technological Performance,* ZEW - Centre for European Economic Research Discussion Paper No. 04-056

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Görg and Strobl[33] investigate, on a sample of manufacturing firms in the Irish Republic, the relationship between government R&D supports and privately financed R&D spending, and what they find is that subsidies received by SMEs produce additionality, especially in the case of small firms, where an even greater increase in R&D spending is observed than the amount received. Carboni[34] , in a study conducted on manufacturing firms in Italy, rejects the *crowding out* hypothesis at the expense of private R&D investment, noting rather a complementary relationship between public and private investment. Finally, Aerts and Schmidt[35] question whether or not public subsidies for R&D displace private investment led by firms in the Flanders region and Germany and come to the conclusion that the *crowding out* hypothesis can be rejected: firms that receive public funds are significantly more active in R&D than those that do not receive subsidies.

Other empirical studies find partially positive results, where additionality is found only for a certain type of firm or in some cases, and so the *crowding out* hypothesis cannot be totally rejected. In particular, these partial results emerge from analyses such as those conducted by Loof and Heshamati[36] and Lach[37]; the latter analyzing the effects of a policy promoted by the Ministry of Industry and Trade, on a sample of Israeli firms in the manufacturing sector, finds positive effects on private R&D investment, but exclusively for small firms. This kind of evidence is also endorsed by studies conducted by Becker[38] who, in her systematic and critical review of the literature, highlights how the additional effect, in the studies she reviewed, is found more in small firms. However, as she points out, these types of firms are not the ones that usually receive the funding, precisely because of the *picking-the-winner strategy* implemented by the institutions placed at the funding. This obviously results in inefficient allocation of resources.

Busom[39], in a study regarding the effects of public grants on the R&D commitment of firms and on the likelihood for a firm to participate in the

[33] Görg H., Strobl E. (2005), *The effect of R&D subsidies on private R&D*, Research Paper, No. 2005/38, Leverhulme Centre for Research on Globalisation and Economic Policy, University of Nottingham, Nottingham

[34] Carboni, O.A. (2011) *R&D subsidies and private R&D expenditures: Evidence from Italian manufacturing data*, International Review of Applied Economics 25: 419-439

[35] Aerts, K. and Schmidt, T. (2008) *Two for the price of one? Additionality effects of R&D subsidies: A comparison between Flanders and Germany*. Research Policy 37: 806-822.

[36] Loof H, Heshmati A. (2005), *The impact of public funds on private R&D Investment: New evidence from firm level innovation study*, MTT Discussion Papers 3

[37] Lach, S. (2000) *Do R&D subsidies stimulate or displace Private R&D? Evidence from Israel*, NBER Working paper No.7943

[38] Becker B, (2015), *Public R&D policies and private R&D investment: a survey of the empirical evidence*, Journal of Economic Surveys Volume 29, Issue 5 p. 917-942

[39] Busom I, (2000) *An empirical evaluation of the effects of R&D subsidies*, Economic innovation and new technology, Vol 9,111-148

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funding program, finds that public funds induce greater investment by individuals, but for 30 percent of the firms participating in the funding program, the possibility of *crowding out* cannot be totally ruled out.

However, there is no lack of empirical evidence that failed, based on the results obtained, to reject the *crowding out* hypothesis. De Blasio, Fantino, and Pellegrini[40], for example, conduct an evaluation about a funding program promoted by the Italian Ministry of Economic Development and found no evidence of the effectiveness of this program.

Another Italian study, by Bronzini and Iachini[41], analyzes the effectiveness of a tool implemented in northern Italy with the aim of stimulating R&D in the business sector, and what emerges is that in general no significant additional effect was found in the sample but, in a portion of the small businesses examined, there is a slight increase in investment. Again, authors such as Catozzella and Vivarelli[42] analyze how and to what extent the innovative productivity of firms is affected by public funding: the results show that supported firms exhaust their advantage with the mere quantitative increase in innovation spending, but do not create added value through further investment in innovation. Merito et al.[43] focus, on the other hand, on the effectiveness of subsidies bestowed in the early 2000s by the Special Fund for Applied Research, promoted by the Italian Ministry of University and Research; in this case, it emerges that additionality effects are limited to a temporally circumscribed period: after four years of receiving the subsidy, the instrument in question has an extremely marginal effect in terms of various parameters, including patenting activity. Also in Italy, Fantino and Cannone[44] investigate the effectiveness of two European programs, implemented at the regional level, that were aimed at implementing and supporting the innovative activities of SMEs; again, the results from their sample of Piedmontese firms reveal very little effectiveness. In America, on the other hand, Wallsten[45] analyzes the impact of the Small Business Innovation Research Program on

[40] De Blasio G., Fantino D., Pellegrini G., (2015), *Evaluating the impact of innovation incentives: evidence from an unexpected shortage of funds*, *Industrial and Corporate Change*, Volume 24, Issue 6, December, Pages 1285–1314

[41] Bronzini R., Iachini E., (2014), *Are Incentives for R&D Effective? Evidence from a Regression Discontinuity Approach,* American Economic Journal: Economic Policy, 6 (4): 100-134.

[42] Catozzella, A., Vivarelli, M., (2011), *Beyond additionality: are innovation subsidies counterproductive?*

[43] Merito M,, Giannangeli S., Bonaccorsi A.,(2009), *L'impatto degli incentivi pubblici per la R&S sull'attività delle PMI,* dal libro La valutazione degli aiuti alle imprese, il Mulino

[44] Fantino, D.,Cannone, G., (2011), *The evaluation of the efficacy of the R&D European funds in Piedmont*, Conference Paper, 51st Congress of the European Regional Science Association

[45] Wallsten, S. J., (2000), *The Effects of Government-Industry R&D Programs on Private R&D: The Case of the Small Business Innovation Research Program*, The RAND Journal of Economics, 31(1), 82–100

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the private R&D activities of American companies. What emerges from his study is a *crowding out* effect with respect to private R&D investment, but he admits the hypothesis that the firms that received the subsidy, thanks to it, may have kept their research activity steady, without having to decrease due to economic constraints.

Herrera and Heijs[46] analyze the impact that the subsidy system guaranteed by the Spanish government has on firms' innovative activities and their R&D intensity. What emerges from their study is that firms that have a greater chance of ensuring a positive outcome to the funded project are those that are more likely to receive the funding. Whereas, the firms that have fewer possibilities but also greater constraints are the ones that are least likely to receive the subsidy. These results clearly reveal a strategy of picking the winner by the Spanish government, a strategy that causes little additional effect on the innovative activities of firms that even invest less than the amount received as a subsidy in R&D. Kaiser[47], applying two different econometric methods, finds no significant additional effect in his study on the impact that government subsidies, aimed at stimulating R&D, have on the innovative intensity of Danish firms. Finally, Suetens[48] conducts a study of Flemish firms taking into account, as a proxy for innovation, the hiring of qualified R&D personnel: the results of this research do not allow to exclude, in most cases, a total *crowding out* effect. As evident, the empirical results discussed above do not lead to unambiguous conclusions. However, we could not expect otherwise since, as already mentioned, they differ on several research criteria and, especially, on the modeling and econometric approach. As we will see in later on, the econometric method for the evaluative study of policies of this kind has been refined over time, trying to overcome the methodological criticalities inherent in this topic.

The SME Instrument: a driver of growth and innovation for European SMEs

The European Union's ambitious goal: Horizon 2020, an unprecedented response

Under the research and innovation framework program governing the Union's support for research and innovation activities Horizon 2020, a special instrument has been designed to streamline the European Commission's

[46] Heijs, J., Herrera, L., (2004) *The distribution of R&D subsidies and its effect on the final outcome of innovation policy*, Working paper Instituto de Analisis Industrial y Financiero 46, Madrid

[47] Kaiser U., (2004), *Private R&D and public R&D subsidies: Microeconometric evidence from Denmark*, CEBR Discussion Paper 2004-19.

[48] Suetens S., (2002), *R&D subsidies and production effects of R&D personnel: evidence from the Flemish region*, CESIT Discussion Paper 2002/03, Antwerp

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support for SMEs: the SME Instrument. The purpose of the instrument is to directly develop and exploit the innovation potential of SMEs by filling funding gaps in the early and high-risk stage of research and innovation, stimulating innovative research, and increasing the commercialization of results by the private sector[49] and increase economic convergence by helping regions tap their potential and providing them with the right tools for solid and lasting growth[50]. With a budget of 3 billion, representing one-fifth of that prepared by SBIR, the SME Instrument adopts the three-phase structure of its U.S. "rival," structuring its support for SMEs as follows:

- **Phase 1** finances, with a lump sum of 50,000 euros per project, a series of preliminary analyses to be implemented by the company in order to further investigate the feasibility of its idea. These analyses can include both technical-scientific assessments and evaluations about the commercial potential of the project; thus, this phase includes funding for market studies, risk analysis, managerial activities about the intellectual property of a new product, etc. The expected outcomes, after receiving the grant, are a feasibility report and a more elaborate business plan than the initial one.
- **Phase 2**, with funding of between 500,000 and 2,500,000 million (generally covering 70 percent of the costs, or 100 percent if the projects have a strong research component), assists the company in implementing a real project. Companies, in this case, must in fact submit their proposals on the basis of an already completed feasibility analysis containing a complete business plan (these documents may have been developed both through phase 1, but also independently).
- **Phase 3**, dedicated exclusively to the winners of Phase 2, does not provide economic support to the enterprise, but is designed to provide assistance in the commercialization phase of the designed innovative solutions and in the phase of dialogue with the private capital market.

These phases, as can be seen, trace the course of the innovation cycle, starting in fact from the assessment of the feasibility of the idea, to the commercialization phase, passing through the development of the prototype and an initial application in the market. Each company, which falls under the

[49] Official Journal of the European Union, (2013), Regulation (EU) No. 1291/2013 of the European Parliament and of the Council of December 11, 2013 establishing the Framework Programme for Research and Innovation (2014-2020) - Horizon 2020 and repealing Decision No. 1982/2006/EC, Brussels.

[50] De Rose P., *L'Europa per i comuni: Strumenti per la programmazione e lo sviluppo turistico delle autonomie locali*, Aloe Editore, 2019

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EU definition of small and medium-sized enterprise[51], can decide whether to apply for a single phase, for more than one, or for all three; in fact, the phases are not sequential: it is not necessary to complete phase 1 to begin phase 2.

The SME Instrument in Italy

Since the first call for proposals in June 2014, 4151.80 million euros have been allocated to date, funding 5926 projects involving 5641 participants across Europe. From the data obtained from the EIC Accelerator hub, Italy stands out among the countries with the highest number of funded projects, second only to Spain. Out of a total of 5926 coordinated projects, 673 are Italian, thus constituting more than 10 percent of the total participations. However, participation rates in the SME Instrument are not homogeneous throughout the country; on the contrary, performance differs significantly, highlighting, again, a distinction between north and south. Based on data collected from the first call for proposals to date, at the top of the participation ranking is Lombardy, with a total of 222 participations, constituting alone almost 30 percent of the total. Lombardy is followed by Emilia- Romagna with 153 participations, Latium with 68 and Piedmont with 49. In particular, the participation rate of Lombardy companies in Phase 2 of the instrument is remarkable: detached from the national average value of 16 percent, they in fact present a participation rate of 20 percent in the second phase. At the bottom of the ranking are Basilicata, with only 2 participations, and Valle d'Aosta with 3 participations. In general, there is limited adherence to the instrument by southern firms, with participation under 10 percent of the total. The best performance is that of firms in Campania with 21 participations[52] and those in Puglia with 15.

Table 1. Projects funded and grants disbursed (TEUR)

Region	ɔnomic contribution (TEUR)	Number of beneficiary projects
Lombardia	88.764.329	222
Emilia-Romagna	44.458.881	153
Lazio	16.785.330	68
Piemonte	13.143.107	49
Toscana	5.671.930	42
Veneto	8.924.237	32
Campania	8.079.561	21
Liguria	5.756.741	19

[51] According to the Recommendation of the European Commission, dated 6/05/2003 on the definition of micro, small and medium-sized enterprises, "the category of microenterprises of small and medium-sized enterprises (SMEs) consists of enterprises which employ fewer than 250 persons, and whose annual turnover does not exceed 50 million euros or whose annual balance sheet total does not exceed 43 million euros."

[52] Eic Accelerator data hub di EASME, available here: https://sme.easme-web.eu/#

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Trentino-Alto Adige	5.243.899	19
Puglia	1.915.192	15
Marche	4.736.722	13
Friuli-Venezia Giulia	3.574.177	12
Calabria	1.097.209	8
Umbria	1.693.114	7
Sardegna	250.000	6
Sicilia	1.356.204	5
Abruzzo	3.038.126	5
Valle d'Aosta	100.000	3
Basilicata	100.000	2

Source: EIC accelerator data hub

Research design: the methodology

The present study aims to fit within the research strand of policy evaluation; the research focus is on the SME Instrument, in its original version born within Horizon 2020, and in particular Phase 2 of the instrument is being attended to. The research question, therefore, is "Has the second phase of the SME Instrument had a positive impact on the Italian SMEs that have joined it? If yes, to what extent?" The approach to this topic will be quantitative and microeconomic in dimension: in fact, the evaluation will be based on quantitative data inherent in the innovation (and non-innovation) performance of individual firms.

In essence, what is of interest in this study is the causal effect of adherence to the second phase of the SME Instrument, understood according to Rubin's definition as "the difference between the likely outcome of an individual's participation in a measure and the likely outcome of an individual's non- participation in that same measure", where in our case individuals are enterprises. The latter can be divided into two groups: participating firms and non-participating firms, since we denote by S the status of a firm, by S=1 we refer to the treatment group (i.e., the one receiving funding), and by S=0 to the group of non-treatment firms. The random effect of our interest will be identified by θ_1, the formulation of which will therefore be, by virtue of Rubin's definition, as follows:

$$\theta 1\text{: } E[Y^1 - Y^0 | S = 1] = E[Y^1 | S = 1] - E[Y^0 | S = 1] \qquad (1)$$

Where Y^1 is the outcome variable and Y^0 is the potential outcome that would have been realized if the treatment group (S=1) had not been treated[53]. Now, while the first quantity E[Y^1 ┤|S=1], i.e., the expectation of the

[53] Rubin D. B., (1974), *Estimating Causal Effects of Treatments in Randomized and Non-Randomized Studies*, Journal of Educational Psychology, 66, 688-701.

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outcome of the participating firms can be directly observed, the second counterfactual quantity E[Y^0 |S=1] is by definition unobservable, for it is not possible to observe the outcome of the treated firms in the case that they had not received treatment. Since it is unobservable it must therefore be estimated, but the counterfactual situation cannot be estimated as the simple arithmetic mean of the outcome of the firms not receiving the subsidy, for a simple but fundamental reason:

$$E[Y^0|S = 1] \neq E[Y^0|S = 0] \quad (2)$$

The expected outcome of firms that do not receive the subsidy would not be the same in the case that they do receive it, this condition, in fact, would have been true only in the case of an experimental setting in which the treatment, i.e., the funding obtained through joining the second phase of the SME Instrument, was randomized[54]. Indeed, randomized treatment assignment, if done with the proper procedures, ensures that the observable and unobservable characteristics of the units assigned to the two groups are on average equal and that therefore the difference, in terms of outcome, between the two groups is due to the treatment. However, analyses over the years have shown that firms in the treatment group and firms in the control group differ substantially in several respects. This difference is due to selection bias, i.e., bias in the selection process for treatment that stems from both the funding body, in this case, the European Commission, and the participating firms. As discussed in section 1.2, public funding agencies might decide to fund some enterprises rather than others responding to different objective functions than those stated in the intentions. Motivations may vary from case to case, for example, the public agency might decide to fund based on a larger project to stimulate a particular sector, however, in most empirical studies on this issue it has been found that this selection bias is mainly dictated by a "picking the winner strategy.". In essence, the funding body would be inclined, more or less intentionally, to select those enterprises that perform better in terms of innovation and thus tend to be guarantors of a project's success, with the aim of legitimizing the allocation of resources through positive success rates of the instrument in question. But a company's participation status is also decided, to a certain extent, by the company itself: not all those that fall within the eligibility criteria automatically decide to apply to receive funding; indeed, we have seen how participation in the second phase of the SME Instrument, in Italy as in the rest of the EU, there are significantly fewer companies responding to calls for proposals.

[54] Aerts K., Czarnitzki D,(2004), *Using Innovation Survey Data to Evaluate R&D Policy: The Case of Belgium,* K.U.Leuven - Departement toegepaste economische wetenschappen

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What distinguishes companies that decide to participate in the instrument from non-participating companies? Based on what elements, is the funding body oriented in the implementation of the winner's strategy? Answering these questions is a key node for proceeding with the empirical analysis, since in the identification of these characteristics lies the problem, but also the solution, of the empirical question regarding policy evaluation.

To do so, we need to start with empirical studies on the subject: the work of Stefania P.S. Rossi[55] et al. about the effects of firm characteristics on the likelihood of using public funding sources is an excellent starting point. From the study it appears that the characteristic with the greatest estimated impact on the likelihood of firms using public financing is past experience in using subsidies: in line with Aschoff's[56] studies of German firms, the data show that firms that have already received public subsidies in the past are more likely to participate in financing instruments.

This evidence would show the existence of information asymmetries, whereby firms that have never participated in such projects have less knowledge about possible sources of funding than those that have already taken part, but it also reveals the presence of learning-by-doing effects, which allow firms to learn the dynamics and processes aimed at selection, making them more efficient at the application stage. A second interesting result is that the probability of receiving and using public funding is closely related to the innovation activities that the enterprise has already implemented or is implementing. The results obtained by the authors, largely confirmed by other contributions cited in the paper, reveal how the innovative experience of firms acts as a signal to funding agencies, which, as reiterated extensively, would tend to provide subsidies to the most innovative firms, identifying these firms as guarantors of funding effectiveness. Or again, considering self-selection on the part of the firm, it is clear that more R&D activity requires more funding and, as discussed in previous chapters, a firm will always have an incentive to turn to publicly funded capital rather than private capital markets, if only for simple cost-effectiveness. The same positive effects are found in firms that have greater export activity, probably because the fact of entering international markets makes the innovative challenge more pressing in order to gain greater competitiveness and, as a result, obtaining public financing becomes a requirement and therefore firms will be more likely to respond to calls for proposals. The variable of financial constraints also appears to be significant,

[55] Rossi, S. P. S., Chies L., Podrecca E., (2020), *Superando il guado. Innovazione, esportazioni e strategie delle imprese tra vincoli finanziari, ambientali e di capitale umano*, EUT Edizioni Università di Trieste

[56] Aschhoff, B. (2010). *Who gets the money? The dynamics of R&D projects subsidies in Germany*. Journal of Economics and Statistics (Jahrbücher für Nationalökonomie und Statistik), 230, 522-546.

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revealing that firms that experience greater financial constraints are more likely to apply for public funding, as it represents a low-cost source of capital. Finally, with regard to key firm characteristics such as industry, age, and size, the former does not appear to be a characteristic that weakly influences the likelihood of applying for and receiving subsidies (with a higher likelihood for firms operating in industry rather than services), size, on the other hand, appears to be significant, highlighting that firms with fewer than 9 employees are less likely to use subsidies than those with more employees. enterprise facilitates the circulation of information, but also the better management of the preparatory steps to apply and the project itself. Finally, the age variable is found to be more likely to receive the subsidy for firms with less than two years of operation, compared to those that have been in the market for between 2 and 4 years; the formation of a firm usually induces innovative activities and therefore younger firms are expected to be more active in research and development[57], increase the likelihood of application for this category of firms. Other studies, such as that of Cerulli and Potì[58], also focus attention on the characteristics of firms about whether or not they belong to domestic or foreign business groups. In fact, being part of an enterprise group could promote the dissemination of information and thus increase the likelihood for an enterprise to apply for public funding. Whereas, in the event that the impact of a national financing program was to be assessed, the possible membership of firms in a foreign group would have to be taken into account; this factor could in fact reduce the likelihood for a firm to apply for the subsidy because the parent firm might choose to join financing programs implemented in the nation in which it is based.

As evident, then, firms that participate in financing programs and those that do not participate differ substantially in different respects, and this has implications not only at the theoretical level, but more importantly at the empirical level. In econometric terms, in fact, selection bias implies that the treatment variable S and the outcome variable Y are stochastically dependent and including them in a simple linear regression would cause biased estimates. For this reason, we cannot rely on the
the classical inferential approach of comparing average outcome values between treated and untreated firms; this method, in fact, assumes that the treatment variable and the outcome variable are independent, so we would have that the mean of the outcome, conditional on treatment, is equal to the

[57] Almus M,, Czarnitzki D., (2003), *The Effects of Public R&D Subsidies on Firms' Innovation Activities: The Case of Eastern Germany,* Journal of Business & Economic Statistics, Vol. 21, No. 2 , pp. 226-236
[58] Cerulli G., Potì B., (2008), *Evaluating the Effect of Public Subsidies on firm R&D activity: an Application to Italy Using the Community Innovation Survey,* Ceris-Cnr, W.P. N° 9

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unconditional mean of the outcome, that is, E(Y | S)=E(Y) (3). By definition, the average treatment effect is:

$$ATE = E(Y^1 - Y^0) \quad (4)$$

While the average treatment effect on treated units is:

$$ATET = E(Y^1 - Y^0|S = 1) \quad (5)$$

We can observe that under the assumption of independence of the mean: E(Y | S=1)=E(Y^1 | S=1)=E(Y^1); similarly E(Y | S=0)=E(Y^0 | S=0)=E(Y^0). So, we will have that the average treatment effect (ATE) and the average treatment effect on treated units (ATET) coincide and are given by the difference between the expected outcome values of treated and untreated firms:

$$ATE = ATET = E(Y|S = 1) - E(Y|S = 0) \quad (6)$$

This formulation coincides with the difference-in-mean estimator of classical inference[59], and is known to be an unbiased, consistent and asymptotically normal estimator[60]. However, the possibility of applying this estimator holds entirely on the assumption of independence of the mean (3) and that therefore the outcome variable and the treatment variable are independent, a situation which, in our case, is not verified. For this reason, the difference-in-mean estimator fails to consistently estimate the treatment additionality hypothesis. A first generation of models employed for policy evaluation ignored the endogeneity problem by assuming the treatment variable as strictly exogenous. However, we have seen how this assumption is too strong in this context, inducing biased and inconsistent estimates when included in a linear regression[61]. To overcome the estimation problem econometricians have suggested several approaches under different assumptions, each model has its own advantages and disadvantages, therefore, there is no default model for estimating the causal effect, but different methods that can be implemented. For example, implementing an instrumental variables approach can solve the problem of selection on unobserved variables, which occurs when variables not observed by the researcher are correlated with the treatment variable, causing inconsistent estimates. To implement this method, the researcher needs to know a set of exogenous variables that are correlated with the treatment variable and at the same time uncorrelated with the outcome variable

[59] Cerulli G., (2010), *Modelling and Measuring the Effect of Public Subsidies on Business R&D: A Critical Review of the Econometric Literature*, The economic record, vo. 86, N.274, 421-449

[60] Wooldridge, J.M. (2002), *Econometric Analysis of Cross Section and Panel Data*. MIT Press, Cambridge

[61] Busom, I. (2000), *An empirical Evaluation of the Effects of R&D Subsidies*, Economics of Innovation and New Technology 9(2), 111–148.

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in order to construct a 2SLS estimate for evaluating the equation[62]. Heckman uses yet another method constructed again to account for the possibility that there are unobservable variables that nonetheless have an effect on both the outcome and the state of the firm; however, the so-called sample selection approach requires making preliminary assumptions about the distribution of the variables that other methods do not require, freeing the estimation operation from theoretical plots. In the study of the recent literature on the subject, it can be seen that the methods preferred by researchers are the difference-in-differences (DID) and the matching estimator, the reason why these methods are preferred over others lies in the fact that they are considered data-driven methods, that is, methods that with a few basic assumptions and an information-rich sample, allow the estimation operation to be carried out without too many theoretical implications and complications. Lach, for example, in his study about the impact of subsidies guaranteed by the Ministry of Industry and Trade employs the DID estimator to identify the effect on firm performance. The basic idea is that the potential selection bias vanishes in the linear model when differences between treated and untreated firms are computed over time. However, as pointed out by Görg and Strobl, the DID estimator does not guarantee that similar firms to each other are compared in the comparison between treatment and control group, and this could be problematic since the theoretical framework of the DID estimator is based on the assumption that there are common trends in the macro variables and that treated and untreated firms react the same way to these trends. This assumption would be difficult to verify if very different firms are included within the sample, which therefore, presumably, have different criteria for reacting to trends. In addition, the DID estimator is unable to control selection bias on the side of firms because it does not take into account all those factors that impact a firm's decision to take part in a public financing project[63]. Finally, part of the scientific community seems to prefer the matching estimator because of some of its very advantageous properties. Basically, the matching estimator takes its inspiration from the experimental method in which it is possible to evaluate the effects of a treatment by making the difference between the values taken by the treatment and control group if and only if the starting differences between treated and untreated units are zero, and this is almost certainly the case when the treatment is administered in a completely random fashion, guaranteeing the basic condition of randomization. However, as we have

[62] Görg H., Strobl E. (2005), *The effect of R&D subsidies on private R&D*, Research Paper, No. 2005/38, Leverhulme Centre for Research on Globalisation and Economic Policy, University of Nottingham

[63] Görg H., Strobl E. (2005), *The effect of R&D subsidies on private R&D*, Research Paper, No. 2005/38, Leverhulme Centre for Research on Globalisation and Economic Policy, University of Nottingham

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discussed extensively in previous chapters, this condition is not met in our case, and in general in the vast majority of economically studied situations analyzed outside of laboratories, because treated and untreated units are self-selecting (to some extent) and the treatment is not assigned to them in a completely random manner. Having put this in place, the strategy of applying the matching estimator aims to somehow re-establish the randomization condition of the treatment so that it is possible to evaluate the treatment effect as the difference between the outcome of treated and untreated firms; in fact, if the randomization condition is true, then the untreated firms represent the counterfactual of the treated firms, so the difference in outcome between the treatment and control group will return us the treatment effect. But how can this strategy be implemented? Basically, it starts with the assumption that treatment status is related to specific characteristics that the researcher can observe on the units that, but once controlled, it reestablishes the randomized condition of the experiment. This assumption is known in the literature as "*treatment ignorance*" and was first proposed by Rubin during the late 1970s. Based on this assumption, an attempt is made to create an ex-post control group by selecting a subset of units, from the control group, that are as similar in terms of observable characteristics as possible to the units in the treatment group. In this way, the matching estimator procedure aims to eliminate the baseline differences that the selection process generates between the two groups[64]. Once the ex-post control group is chosen, the effect estimate will be given simply between the difference between the mean of the outcome variable of the treatment group and that of the new control subgroup. As evident, the matching estimator adopts a nonparametric estimation procedure; therefore, it does not require the specification of a particular parametric relationship, a requirement for an OLS model, where a linear relationship is assumed. Because of its simplified structure, in which economic theory enters only into the choice of variables to observe in order to perform the matching between treated and untreated units, and for other reasons that will be discussed in the next section, the matching estimator is one of the most widely adopted methods in the literature in the area of policy evaluation. However, as Hackman writes, "The choice of an appropriate econometric model depends critically on the data to which it is applied,"[65] so there is no ideal model, but in the complex choice of estimation tools there is some arbitrariness.

[64] Martini A., Sisti M., (2009), *Valutare il successo delle politiche pubbliche*, Il Mulino, Bologna
[65] Heckman, J.J., H. Ichimura, J. Smith e P. Todd (1996), *Characterizing Selection Bias using Experimental Data*, mimeo, revised version is published in Econometrica 66, 1017–1098.

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The sample

The treatment sample was extracted from the interactive tool that generates information about European funding programs, developed by EISMEA (European Innovation Council and Small and Medium-sized Enterprises Executive Agency). Through the filters made available by the tool, it was possible to obtain the list of Italian companies that were beneficiaries of the SME Instrument, and in particular of Phase 2, which is the subject of interest in this study.

There are 152 Italian companies that have benefited from Phase 2 of the SME Instrument, for a total of 113 coordinated projects. The total amount of contributions equals 162.84 million, out of a total of 2531.36 billion allocated for the financing of all Phase 2 projects in the European territory, just over 6 percent of the total funded.

Of these 152 companies, the observed sample considers 113; all companies that responded to calls for proposals after the specified 2020 cut-off period were excluded. This choice was deemed appropriate for two reasons: according to the literature, funding aimed at stimulating innovation, as in the case of the SME Instrument, generates effects within two years following the receipt of the grant; and secondly, projects responding to calls last on average 12 to 24 months.

For these reasons, we wanted to select only those enterprises that were beneficiaries by 2019, so that the economic and financial data of the enterprises would be available until 2020. Firms for which there was insufficient data to process this analysis were also eliminated from the sample selection. The economic-financial data for the 113 firms in the sample were extracted from the largest database available with data on global companies, Bureau Van Dijk's Orbis. The data obtained refer to a time period of 8 years, from 2014, the date of the first call for proposal to 2020.

Table 2. Variables description

Control variables	*Measure*
sales_assets	Ratio of total sales value (TEUR) to total assets (TEUR)
SME 2	from the year indicated as the start of the EMS Phase 2 funded project, equals 0 before the start
SME 1	from the year indicated as the start of the EMS Phase 1 funded project, equals 0 before the start
inn_index	Innovation index of the region where the enterprise is located
region_	Region to which the company belongs
sme	if the enterprise has received both EMS stage 1 and stage 2, equal to 0 otherwise
ICT	Dummy equal to 1 if the enterprise belongs to the ICT sector, equal to 0 otherwise
manufacturing	Dummy equal 1 if the enterprise belongs to the manufacturing sector, equals 0 otherwise

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Control variables	*Measure*
biotech	Dummy equal to 1 if the enterprise belongs to the biotechnology sector, 0 otherwise
age	Age of the enterprise
ita	Dummy equal to 1 if the enterprise is based only in Italy, 0 if it is based abroad
debt_equity	Ratio of total debt (TEUR) to equity (TEUR)
L	Number of employees
grants	Number of published patents
IMM_imm	Total intangible assets (TEUR)
IMM_mat	Total tangible assets (TEUR)

The enterprises included in the sample are Small and Medium Enterprises, according to the definition adopted by the European Union[66]. On average, the companies selected in the sampling have 27 employees; 43.6 percent of the observations have a number of employees less than or equal to 20. Only two enterprises (Antares Vision, Co.stamp) exceed a number greater than 250 employees, but at the time of participation in the calls for proposals they met the criterion. To assess the average size of the enterprises, the average value of total assets of 10216.89 can be considered. Almost half of the observations, 45 percent, were 10 years old or younger. The age of the firm was calculated for each year as the difference between the year of incorporation and the year under consideration. On average, the age of the sample is 15 years, the highest value being 76 years. The funded enterprises are from different sectors: the most frequently found sectors are the manufacturing sector, the IT sector, and the biotechnology sector. The two sectors were summarized in two dummies, and in the descriptive phase it was found that 59 out of 113 enterprises belong to the manufacturing sector, 18 to the IT sector, and 15 to the biotechnology sector, the remaining observations belong to the service sectors, trade, etc.

[66] Microenterprises are defined as those enterprises with fewer than 10 employees and that realize annual turnover or annual balance sheet total not exceeding 2 million euros. Small enterprises are defined as enterprises with fewer than 50 employees and that realize annual turnover or an annual balance sheet total not exceeding 10 million euros. Medium- sized enterprises are defined as enterprises with fewer than 250 employees and achieving annual turnover not exceeding 50 million euros or an annual balance sheet total not exceeding 43 million euros.

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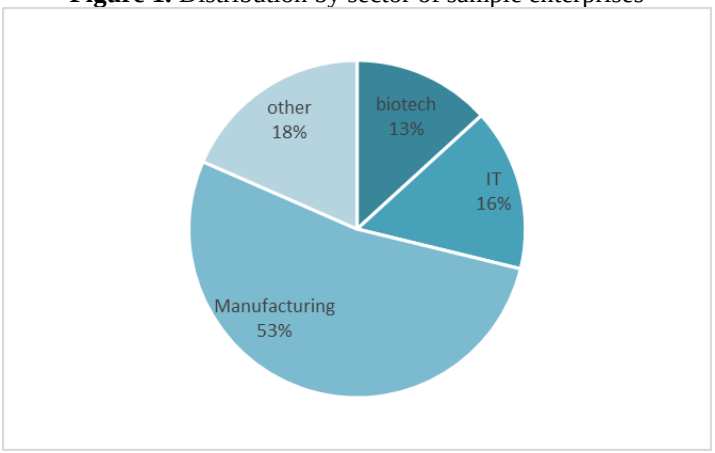
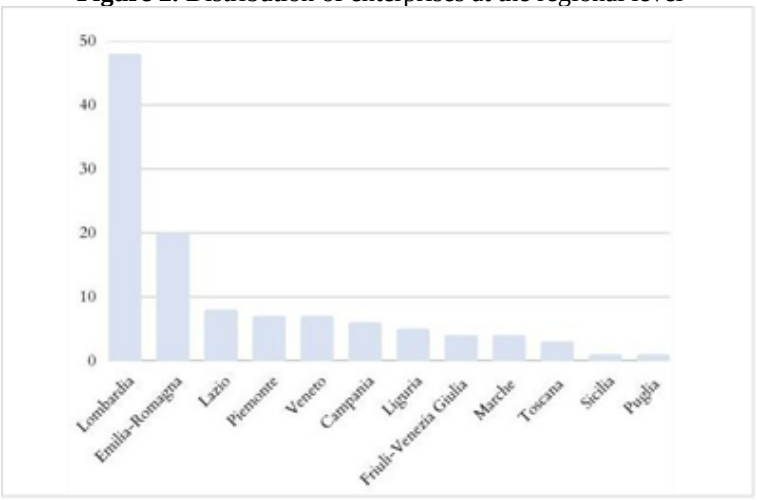
Figure 1. Distribution by sector of sample enterprises



Source: Own processing based on sample data

The companies observed in the analysis are distributed over much of Italy, with the largest presences found in Lombardy (47), Emilia-Romagna (20), Lazio (8) and Piedmont and Veneto (7), confirming the general data already discussed.

Figure 2. Distribution of enterprises at the regional level



Source: Own processing based on sample data

Wanting to summarize the innovative performance of the sample enterprises, leaving aside for the moment whether these are caused by joining Phase 2 of the SME Instrument or not, the data collected regarding patent publications(grants) and investments in intangible assets (IMM_imm) were observed, as data regarding R&D spending was not available for any sample enterprise.

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On average, the sample enterprises have the amount of intangible assets equal to the value of 1057.9 thousand euros, the highest value achieved is 229.348 thousand euros.

The enterprises considered produced an average of 8 patent publications: the highest value of patents is 129, while the lowest is 1.32 percent of the observations produced a number of 10 patent publications or less.

Companies that took part in the calls for proposals, from 2014 to 2019, for the second phase of the SME Instrument submit projects with an average scope of 2.076.170 million to the evaluation committee. The average contribution requested is 998.662 thousand euros, with almost 50 percent coverage.

Within the sample of beneficiaries of the second phase of SME2, there are also companies that received funding from phase 1 of the instrument: 48 out of 113.

Model estimation

The ratio of total sales value to total assets *(sales_assets*) was considered appropriate to use as the dependent variable. With this decision, the present study stands in contrast to the literature reviewed: for while empirical evidence about the effects of incentives on innovation inputs is copious, few papers have evaluated the effects on innovation outputs. The lack of attention with respect to the output factors of incentives would seem anomalous, considering that these are the actual goals of public management[67], yet the literature is biased toward the use of variables such as R&D Expenditure, number of researchers, human capital, rather than on output metrics such as, for example, the number of new products launched to market, profit growth, sales, etc.

This approach can be justified by a perhaps overly simplistic conception of the innovation process seen as a black box[68] in which what is entered (monetary or resource inputs) will, according to a general principle, result in an outcome (output). However, this relationship is not necessarily true in every case, which is why it is useful to look at output metrics that measure the results generated by investments in innovation, rather than input metrics that return information about the allocation of resources in innovation.

The choice of the *sales_assets* variable, based on the available data, was found to be the most useful for the present analysis for two main reasons: first, because the second stage of the SME Instrument is dedicated to

[67] Bronzini R., Piselli P., (2016), "*The impact of R&D subsidies on firm innovation",* Research Policy 442-457

[68] Meissner D., Kotsemir M., (2016), *"Conceptualizing the innovation process towards the 'active innovation paradigm'- trends and outlook",*

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commercialization of the innovative product (we are beyond stages 5-6 of the TRL), so sales is a logical proxy to use; second, because it is not necessarily the case that every input turns into an output, so observing resource allocation (e.g., R&D spending, increase in skilled employees, etc.) may not be sufficient to capture the effect.

On the other hand, in the project presentations of the beneficiary companies, among the expected results of the projects the companies explicitly mention an increase in sales due to the launch of the new innovative products; therefore, it seemed logical to use sales as a proxy for outcome of the second phase of the SME Instrument. Sales were related to total assets, so as to relate it to the size of the company, which clearly affects the size of sales. The choice was also 'forced' by the limitation of information available on the sample firms; it is believed that using targeted variables, such as new product launches in the market, would have captured additional nuances of the effect of SME2. Based on the available data, it was deemed appropriate to use a panel in which, through the construction of the SME2 step dummy equal to 1 from the year of receipt of funding, the counterfactuals for each firm are given by the firms themselves in the past. Thus, the objective is to test whether, on average, the firm had a statistically significant change in the *sales_assets* ratio as a result of participating in the second phase of the SME Instrument. The estimation technique used to build the model is backward elimination, and was structured as follows:

- After checking for possible correlations between regressors[69], we started by estimating a complete model (of all variables available in the database, which, according to the literature, affect therelationship identified as the dependent variable; the initial, complete model has such a functional form:

$$sales\_assets = \beta_0 + \beta_1 SME2 + \beta_2 SME1 + \beta_3 inn\_index + \beta_4 age + \beta_5 grants + \beta_6 L + \beta_7 IMM\_imm + \beta_8 IMM\_mat + \beta_{10} ita + \beta_{11} debt\_equity + \varepsilon \quad (1)$$

- As we proceeded, we eliminated the regressors with the highest p-value and re-estimated the model with k-1 regressors, but kept the SME2 regressor fixed to observe any changes in it and checked for fixed and time effects in each estimated model[70];
- Iterations are preceded as long as there were no insignificant regressors within the model.

[69] *Appendix 1*

[70] It was deemed appropriate to maintain control for fixed and time effects in each model because of the drastic effect that the pandemic crisis (in the year 2020) had on sales and, therefore, on the variable of interest. Since the pandemic crisis affected all firms simultaneously, by controlling for time effects we neutralize this effect.

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Interestingly, since the full model (**Model 1**) the step dummy indicating the perception of the funding of the second phase of the SME Instrument (SME2) continues to be non-significant for all iterations, while the regressors that are significant maintain their statistical significance, more or less equally until the last model (**Model 6**).

The non-significant regressors that were eliminated step by step are:

- *SME1*: the non-significance of this step dummy is consistent with the starting hypotheses; it is believed that the effect of the first step of the instrument, the output of which are feasibility studies and/or patents, cannot be captured by the evaluation of a variable such as the one used in the present study;
- *Inn_index*: the innovation index of the regions to which the firms belong does not appear to be significant, to any degree of significance, in explaining the dependent variable. The starting hypothesis was that firms located in regions with higher innovation index have a larger market in which to position their innovative products and therefore potentially have higher sales. The regression results show that this regressor is not useful in explaining the observed variable; a plausible reason may lie in the fact that the type of innovative products developed under the funded projects lend themselves as much to a regional market as to a national and international market
- *Age*: the age of the firm does not appear to be significant in explaining the dependent variable, although it is expected that a firm's seniority would positively affect the relationship of interest because, presumably, firms that have been in the market longer hold an established portfolio of customers and production system.
- *IMM_imm*: not helpful in explaining the interest ratio;
- *Debt_equity*: the ratio of total debt to equity is not statistically significant at any level of significance in explaining the dependent variable.

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Figure 3. Results of estimated regressions

Standard errors in parentheses

VARIABILI	Modello (1)	Modello (2)	Modello (3)	Modello (4)	Modello (5)	Modello (6)
SME2	0.0398	0.0401	0.0417	0.0427	0.0421	0.0432
	(0.0387)	(0.0387)	(0.0386)	(0.0386)	(0.0383)	(0.0383)
SME1	0.0228					
	(0.0483)					
inn_index	0.00570	0.00598				
	(0.00810)	(0.00807)				
age	0.0972	0.0978	0.0984			
	(0.0855)	(0.0854)	(0.0854)			
grants	0.0407**	0.0408**	0.0417**	0.0192***	0.0192***	0.0193***
	(0.0206)	(0.0206)	(0.0206)	(0.00669)	(0.00668)	(0.00669)
L	0.00397***	0.00402***	0.00400***	0.00405***	0.00409***	0.00395***
	(0.000917)	(0.000911)	(0.000910)	(0.000910)	(0.000905)	(0.000902)
IMM_imm	-4.95e-06	-4.93e-06	-5.02e-06	-5.08e-06	-5.07e-06	
	(3.21e-06)	(3.21e-06)	(3.20e-06)	(3.20e-06)	(3.20e-06)	
IMM_mat	-2.30e-05**	-2.31e-05**	-2.29e-05**	-2.26e-05**	-2.19e-05**	-2.83e-05***
	(1.01e-05)	(1.01e-05)	(1.01e-05)	(1.01e-05)	(1.00e-05)	(9.19e-06)
ita	-1.092*	-1.096*	-1.088*	-0.398***	-0.398***	-0.401***
	(0.618)	(0.618)	(0.617)	(0.153)	(0.152)	(0.153)
debt_equity	0.00668	0.00684	0.00675	0.00676		
	(0.00488)	(0.00487)	(0.00486)	(0.00486)		
Constant	0.269	0.239	0.747***	0.653***	0.662***	0.662***
	(0.704)	(0.701)	(0.139)	(0.112)	(0.112)	(0.112)
R-squared	0.778	0.778	0.778	0.778	0.777	0.776
Fixed effects	yes	yes	yes	yes	yes	yes
Time effects	yes	yes	yes	yes	yes	yes
Observations	715	715	715	715	722	722
Number of year	7	7	7	7	7	7

***p<0.01, ** p<0.05, * p<0.1

Overall, the goodness of fit of the full model (Model 1) seems positive and is approximated by the value of the' equal to 0.778. Such a value could be explained by the amount of regressors included, however, proceeding with the gradual elimination of regressors, it remains almost unchanged; in the last estimated model the' is 0.776. The consistency of this indicator, as well as the small variation in the coefficients of the regressors and their significance, is a sign of robustness of the estimates.

Model 6 is the ultimate result of this elimination process. The remaining regressors are:

- Grants: the sign and significance of the regressor, maintained throughout the elimination process, are fully consistent with expectations. A unit increase in the grants variable corresponds to an increase in the dependent variable sales_assets of 0.013.
- L: Again, the sign and consistent significance of the regressor are consistent with the hypotheses; as the number of employees in a firm increases by one unit, the ratio increases significantly by 0.004 points.
- IMM_mat: The regressor that quantifies the value of tangible assets has negative and significant sign. The negative effect on the interest ratio is consistent with expectations, since an increase in tangible

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assets leads to a growth in the value of total assets, thus reducing the total ratio. However, the effect of the ratio is totally marginal.

- Ita: Finally, the dummy summarizing membership, or not, in a foreign group is statistically significant. On average, firms that do not belong to a foreign group have a significantly lower sales_assets ratio than firms that do (-0.401). The explanation is intuitive: firms that belong to a foreign group have an easier opening to international markets to which, plausibly, corresponds greater sales opportunities and a much larger market than other firms.

The final model is as follows:

$$sales\_assets = \beta_0 + \beta_1 SME2 + \beta_2 grants + \beta_3 L + \beta_4 IMM\_mat + \beta_5 ita + \varepsilon \quad (2)$$

Net of all iterations developed, it is evident that the second stage of the SME Instrument does not assume statistical significance, to any degree and in any regression.

To test whether this is true for all firms, conditions on age were applied to the base model **(Model 6)**, constructing 3 thresholds: the first is aimed at observing firms with an age of less than 5 years, a critical threshold for the life of a firm; the second observes firms with an age between 6 and 15 years; and finally, the last observes firms with an age greater than 16 years. Imposing these conditions, **Model 7** (age < 5), Model **8** (6 < age < 15), **Model 9** (age >16) were estimated.

Figure 4. Results of estimated regressions with age conditions

VARIABLES	Modello base	Modello (7)	Modello (8)	Modello (9)
SME2	0.0432	0.0592	0.167*	-0.0265
	(0.0383)	(0.108)	(0.0918)	(0.0441)
grants	0.0193***	-0.00272	0.0290**	-0.00542**
	(0.00669)	(0.00241)	(0.0145)	(0.00237)
L	0.00395***	0.00823***	0.00429	0.000293
	(0.000902)	(0.00182)	(0.00402)	(0.00101)
IMM_mat	-2.83e-05***	-0.000185***	-3.88e-05	-3.16e-06
	(9.19e-06)	(6.08e-05)	(2.49e-05)	(9.45e-06)
ita	-0.401***	-0.0709	1.002	1.237***
	(0.153)	(0.255)	(0.647)	(0.183)
Constant	0.662***	0.562***	-0.690	
	(0.112)	(0.170)	(0.685)	
Fixed effects	yes	yes	yes	yes
Time effects	yes	yes	yes	yes
R-squared	0.776	0.811	0.781	0.847
Observations	722	146	183	280
Number of year	7	7	7	7

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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What emerges from these regressions is that SME2 continues to be non-significant for firms younger than 5 and older than 16, while, for firms between 6 and 15 years old, the effect of the second stage of EMS takes on some level of significance. On average, from the time these types of firms obtain funding to start projects under EMS2, the ratio of *sales_assets* increase by 0.167 points.

Given the low significance, it was decided to investigate the sample further: the hypothesis is that the instrument is not significant for all enterprises and that there are differences between sectors. The results show that, for manufacturing enterprises, the effect of the second stage of SME gains even more significance and power of impact. On average, manufacturing enterprises after receiving SME2 increase their sales/assets ratio by 0.288 points compared with the years before receiving it.

Table 3. SME significance matrix

sales_assets	*age<5*	*6<age<15*	*age>16*
manufacturing	SME2 statistically not significant	SME2 significant and positive	SME2 statistically not significant
ICT	SME2 statistically not significant	SME2 statistically not significant	SME2 statistically not significant
biotech	SME2 statistically not significant	SME2 statistically not significant	SME2 statistically not significant

As a result of multiple Hausman tests of the models, the null hypothesis that differences in coefficients are not systematic is rejected and models with fixed effects are preferred.

Implication for public management

The result that emerged is of extreme interest in the context of this topic. First of all, the consistent non-significance of the second phase of the SME Instrument places the present analysis in the strand of research that argues against the full effectiveness of public subsidies provided in these modes due to the *crowding out* phenomenon whereby firms intercept public financing for cost-effectiveness compared to the private financing market, which has high interest rates, but the receipt of it does not result in a systemic change that generates significant additionality.

This is true for firms older than 16 years, confirming the hypothesis shared in the literature that firms that have been in the market longer are more prone to crowding-out dynamics, and also for firms younger than 5 years. For the latter, the hypothesis is that they are not sufficiently structured to sustain the complex process that leads to product and/or process innovation.

On the other hand, firms that manage to cross the critical 5-year threshold, consolidating their structure and market presence, are able to

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conduct the innovation process more efficiently by coming to benefit from the results of it.

Now, given that public and private management share a common interest in making their investments effective and efficient by seeing a return on them, in light of the findings the implications for *policy makers* are twofold: personalization of policy and promotion of an integrated innovation model, both of which imply a rethinking of the instrument. The first solution assumes that while the SME Instrument works in the same way for all the firms that benefit from it, it cannot be said with as much certainty that the beneficiary firms work homogeneously, suffice it to say that within the sample of interest there are firms born in the period observed and firms that have been in the market for more than 50 years. Taking these two extreme cases as an example, it is logical to think that the effect of the same treatment on them differs substantially; in fact, the two enterprises will have different organizational structures, assets, customer portfolios, and resources - in general - so that the potential and resources of one are not the same for the other. For this reason, the *policy maker* should think of differentiated instruments based on certain key and structural characteristics that condition the output of the policy, regardless of the efficiency of an enterprise. However, it is a common understanding that adapting such measures to all the specifics of the case is a complex and costly process, so the second alternative, i.e., promoting an integrated innovation model, might be the one that is easiest to apply and theoretically could achieve the best results. The formula envisaged for the SME Instrument seems to suffer from an outdated view of the innovation process, imagined as a succession of black boxes from the different functions covering the stages of the process: basic research, applied research and product development. In this view, any input given to the "black box" goes through all these stages and automatically results in an output.

This perspective, in addition to not always being empirically verified, as in this case, has two main effects: on the one hand, it burdens companies with the burden of supporting the entire innovation process, with the risk that the costs-despite the financial contributions-exceed the benefits; on the other hand, it runs the risk of de-responsibilizing public management by limiting its action in the field of innovation to a shower of funding for SMEs, under the illusion that this will suffice. The ineffectiveness of such funding instruments implies a rethinking of innovation policies, starting first and foremost with the urgency of opening that "black box," scrutinizing its interior without merely observing inputs and outputs, but thinking about the entire innovation process.

With these assumptions, the *policy maker* could consider as a viable alternative the expansion of this model, moving from a linear view of the innovation process, to a more complex one that takes into account within it not only different stages but also multiple actors, including firms, partners,

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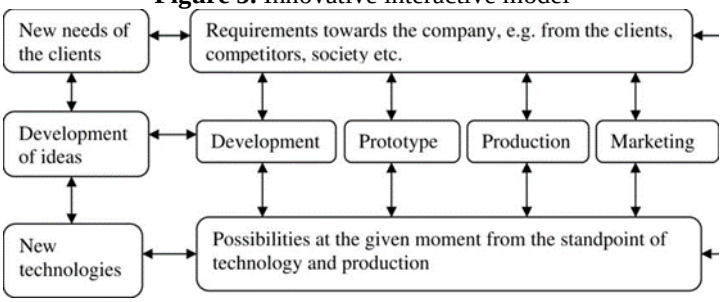
customers, universities and research centers and their continuous interactions at every moment of the innovation process, as envisioned in the interactive model.

Figure 5. Innovative interactive model



Source: Turbulence and Organizational Flexibility, Economic Printing House,2007

In this model, innovation arises from the interaction between market needs and the new technologies available at the state of the art,[71] from a collaboration between enterprises - which intercept market needs - and research institutions. In this view, the enterprise is no longer an exclusive incubator of the innovation process, but is the node of a much wider network that, due to its variety of composition and nature, can facilitate the matching of supply and demand of technologies.

Against the backdrop of today's extremely complex market environment, promoting a dynamic model such as the interactive model seems to be the optimal solution for at least two reasons: on the one hand, companies, by alienating entire stages of the innovation process to research organizations, would significantly reduce the efforts aimed at supporting the complexity of the innovation process, increasing the margin of benefit derived from innovation and generating additionality[72]; on the other hand, the collaboration between actors acting in the market and the world of research would help to give specific trajectories to technological progress, so that inventions are not left inside laboratories, but find concrete application in the market.

Conclusions

Like any research, the results obtained are never an end point, but the starting point for new reflections from which to develop further research. The question at the beginning of this study was whether the second phase of the SME Instrument had produced an impact on firms' performance and, if so, to what extent. At the conclusion of the analysis and estimation process, it can

[71] Maione A., "*Innovazione e trasferimento tecnologico dei sistemi produttivi avanzati basati sull'impiego dei materiali compositi"*

[72] This would be relevantly true for younger and smaller companies in terms of size that face, in implementing these processes, not only huge costs, but also problems in terms of organization and project management.

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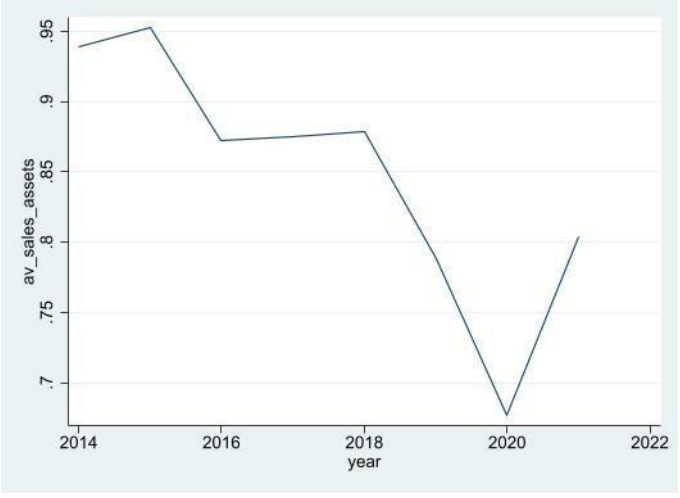
be concluded that the second phase of the SME Instrument did not produce significant additional effects on the performance of firms, approximated by the ratio of total sales to total assets. The only exception is those enterprises aged between 6 and 15 years, for which there is a partially significant increase in the sales/assets ratio after receiving funding.

The non-additionality that emerged from this analysis, contrary to initial expectations, certainly does not mean that *policy makers* should stop designing and implementing instruments to support the innovative development of SMEs that suffer from one of the most important credit market failures; rather, it leads one to question why the expected effect was not achieved and to think about what the implications of these results are. Regarding the lack of significant additionality, there are several assumptions that can be made: first, as commented in *Section 5.3*, the linear model of innovation in which resources are given to firms, entrusting them with the entire burden of the innovation process, may not be sufficient to produce additional effects; a second assumption is that the observed period from 2014 to 2020 does not span the post-pandemic economic recovery.

In fact, it is safe to assume that due to the pandemic, performance slowed down and that in the years after 2020 firms experienced enough growth to positively affect the non-significance of the SME Instrument. This hypothesis might have some basis if we look at the average trend of the sales/assets ratio by increasing the time frame under consideration by one year; in *Figure 18* we observe a collapse in the ratio coinciding with the year the pandemic began, and then starting to grow soon after. However, to ascertain this hypothesis would require the study of a longer period, extending at least a minimum of 3 years from 2020 to observe the performance of firms once they return to pre-pandemic rates.

Figure 6. Time series of sales/assets ratio



Source: Own elaboration

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In case it is not just a problem of time sample, but of criticality at the formulation level of the measure, two avenues have been identified for policy makers to pursue: customizing policies and promoting an innovative interactive model.

While the former seems a less viable route-especially in an extremely diverse context such as the European SME market-the latter is certainly an interesting tool to promote and is already in place in some regional realities in Italy (Region of Sardinia[73]) where collaboration between research institutions and clusters of companies in a process of co-designing innovative projects is promoted and financed.

Theoretically, financing innovation through these dynamic, varied and participatory models, in which the innovative process is developed within the laboratories of research organizations and not directly within companies, would relieve the latter of the costs of such a complex process, managing to obtain a larger margin of return on innovation development. However, the effectiveness of this type of tool should be verified empirically.

At the conclusion of this study, it is necessary to emphasize that the results obtained pertain exclusively to the sample of Italian companies that benefited from the second phase of the SME Instrument. Italian innovative small and medium-sized enterprises undoubtedly have different characteristics than their peers in other European countries; therefore, it is not possible to generalize the results of this analysis to the entire population of European companies benefiting from the SME2.

Finally, it is worth pointing out that these results are the result of an extreme synthesizing of much more articulated processes, the overall analysis of which - therefore - should be accompanied by a qualitative assessment that reveals the dynamics that escape quantitative schemes.

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Data Availability: All data are included in the content of the paper.

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Appendix

Table 1. Correlation table

	inn_in~x	age	grants	L	IMM_imm	IMM_mat	ita	debt_e~y
inn_index	1.0000							
age	-0.0263	1.0000						
grants	0.0444	-0.0098	1.0000					
L	0.0190	0.1461	0.3784	1.0000				
IMM_imm	0.0705	0.0014	0.2608	0.4582	1.0000			
IMM_mat	0.0127	0.1526	0.1353	0.6849	0.2834	1.0000		
ita	-0.0479	0.1304	-0.0830	0.0458	-0.0102	0.0550	1.0000	
debt_equity	-0.0105	0.0027	-0.0460	-0.0223	-0.0207	-0.0251	0.0177	1.0000

Table 2. Descriptive statistics

Variable		Mean	Std. dev.	Min	Max	Observations	
inn_in~x	overall	93.99052	9.738789	58.8	113.4	N =	791
	between		7.82561	64.57143	103.6714	n =	113
	within		5.836862	85.24766	107.6477	T =	7
age	overall	15.43995	14.11718	0	75	N =	791
	between		14.03257	.8571429	72	n =	113
	within		1.96911	12.43995	18.43995	T =	7
grants	overall	8.530973	19.27703	0	129	N =	791
	between		19.35065	0	129	n =	113
	within		0	8.530973	8.530973	T =	7
L	overall	28.43616	48.06768	0	373	N =	791
	between		41.42287	0	198.2857	n =	113
	within		24.65115	-169.8496	203.1504	T =	7
IMM_imm	overall	825.9509	4661.487	0	106307	N =	791
	between		2602.359	0	24650.86	n =	113
	within		3874.097	-23824.91	82482.09	T =	7
IMM_mat	overall	1687.37	4405.723	0	42026	N =	791
	between		3851.058	0	21781.14	n =	113
	within		2166.191	-20093.77	21932.23	T =	7
debt_e~y	overall	.685255	2.819176	0	60.92377	N =	721
	between		1.863184	0	18.44431	n =	112
	within		2.058178	-16.76136	43.16472	T-bar =	6.4375

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Table 3. Results of estimated regressions

VARIABLES	Modello (6)	Modello (7)	Modello (8)	Modello (9)
SME2	0.0432	0.0592	0.167*	-0.0265
	(0.0383)	(0.108)	(0.0918)	(0.0441)
grants	0.0193***	-0.00272	0.0290**	-0.00542**
	(0.00669)	(0.00241)	(0.0145)	(0.00237)
L	0.00395***	0.00823***	0.00429	0.000293
	(0.000902)	(0.00182)	(0.00402)	(0.00101)
IMM_mat	-2.83e-05***	-0.000185***	-3.88e-05	-3.16e-06
	(9.19e-06)	(6.08e-05)	(2.49e-05)	(9.45e-06)
ita	-0.401***	-0.0709	1.002	1.237***
	(0.153)	(0.255)	(0.647)	(0.183)
Constant	0.662***	0.562***	-0.690	
	(0.112)	(0.170)	(0.685)	
Fixed effects	yes	yes	yes	yes
Time effects	yes	yes	yes	yes
R-squared	0.776	0.811	0.781	0.847
Observations	722	146	183	280
Number of year	7	7	7	7

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4. Results of regressions with age conditions

Standard errors in parentheses

VARIABILI	Modello (1)	Modello (2)	Modello (3)	Modello (4)	Modello (5)	Modello (6)
SME2	0.0398	0.0401	0.0417	0.0427	0.0421	0.0432
	(0.0387)	(0.0387)	(0.0386)	(0.0386)	(0.0383)	(0.0383)
SME1	0.0228					
	(0.0483)					
inn_index	0.00570	0.00598				
	(0.00810)	(0.00807)				
age	0.0972	0.0978	0.0984			
	(0.0855)	(0.0854)	(0.0854)			
grants	0.0407**	0.0408**	0.0417**	0.0192***	0.0192***	0.0193***
	(0.0206)	(0.0206)	(0.0206)	(0.00669)	(0.00668)	(0.00669)
L	0.00397***	0.00402***	0.00400***	0.00405***	0.00409***	0.00395***
	(0.000917)	(0.000911)	(0.000910)	(0.000910)	(0.000905)	(0.000902)
IMM_imm	-4.95e-06	-4.93e-06	-5.02e-06	-5.08e-06	-5.07e-06	
	(3.21e-06)	(3.21e-06)	(3.20e-06)	(3.20e-06)	(3.20e-06)	
IMM_mat	-2.30e-05**	-2.31e-05**	-2.29e-05**	-2.26e-05**	-2.19e-05**	-2.83e-05***
	(1.01e-05)	(1.01e-05)	(1.01e-05)	(1.01e-05)	(1.00e-05)	(9.19e-06)
ita	-1.092*	-1.096*	-1.088*	-0.398***	-0.398***	-0.401***
	(0.618)	(0.618)	(0.617)	(0.153)	(0.152)	(0.153)
debt_equity	0.00668	0.00684	0.00675	0.00676		
	(0.00488)	(0.00487)	(0.00486)	(0.00486)		
Constant	0.269	0.239	0.747***	0.653***	0.662***	0.662***
	(0.704)	(0.701)	(0.139)	(0.112)	(0.112)	(0.112)
Observations	715	715	715	715	722	722
Number of year	7	7	7	7	7	7

***p<0.01, ** p<0.05, * p<0.1

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Table 5. Results of regressions with sector conditions

VARIABLES	Modello 10	Modello 11	Modello 12
SME2	0.289***	0.346	0.194
	(0.0833)	(0.314)	(0.318)
grants	-0.00401**	0.347*	0.0822*
	(0.00180)	(0.199)	(0.0437)
L	0.00132	-0.0497	0.00273
	(0.00418)	(0.0541)	(0.0275)
IMM_mat	-3.17e-05	0.00930	0.00191
	(4.04e-05)	(0.0326)	(0.00124)
ita	0.0552	0.169	
Constant	0.964***		
	(0.157)		
Fixed effects	yes	yes	yes
Time effects	yes	yes	yes
R-squared	0,889	0,925	0,661
Observations	91	29	40
Number of id	26	9	9

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1