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The performance of innovative Italian SMEs: a comparative analysis of structural characteristics



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The results of the analysis show that innovative SMEs present a satisfactory situation, with viable profitability and a fair economic and financial balance compared to the average of non-innovative SMEs that do not benefit from the supports offered by this legislation.

Abstract

Many scholars believe that the presence of innovative SMEs in a territorial context is of fundamental importance for its social and economic development. To this end, in Italy, DL 3/2015 established a special register where SMEs that intend to systematically pursue paths of technological innovation can register. The Decree provides that registered SMEs can obtain a package of advantages and financial facilities in order to mitigate the problems that SMEs usually encounter when trying to undertake the complex and uncertain paths related to the systematic introduction of innovations; starting precisely from the hull of monetary resources and financing capital.


Against the above, this paper proposes an analysis of the economic and financial performance achieved by these innovative SMEs during the five-year period 2016-2020; the last year of availability of balance sheet data extracted from the AIDA database. The objective is to verify whether the presence of these supports actually helps SMEs compensate for the increased riskiness associated with the introduction of technological innovations by achieving sound economic and capital performance. To this end, six hypotheses were identified to be tested through the analysis of seven common balance sheet indicators.

At the methodological level, the analysis conducted followed two steps. In a first step, the performance of the seven financial and capital ratios was examined with respect to three structural variables (size class, macro-area of location, and macro-sector of membership) considered by most scholars to be largely influential on the same firm performance. In a second step, through the statistical test of analysis of variance (ANOVA) the existence of significant differences between the averages of the indicators considered as a function of the structural variables was then tested.

The results of the analysis show that innovative SMEs present a satisfactory situation, with viable profitability and a fair economic and financial balance compared to the average of non-innovative SMEs that do not benefit from the supports offered by this legislation. It is therefore to be assumed that the aforementioned decree is positively manifesting its effects, encouraging many SMEs to open up to technological innovations. Some policy directions also emerge from this study. Among the latter, it seems appropriate for policymakers to promote more of a culture of innovative entrepreneurship among aspiring entrepreneurs and to take action to improve the business climate in which SMEs operate, as such SMEs are more sensitive to environmental influences than large enterprises. In addition, evidence shows the usefulness of proposing instruments that incentivize SMEs' participation in knowledge flows and the strengthening of human capital, which seem to make firms more receptive to innovation. Last but not least, the importance of belonging to networks for the interchange of knowledge and experience is confirmed, an aspect in which smaller units without a track record are particularly disadvantaged.



Sommario

Molti studiosi ritengono che la presenza di PMI innovative in un contesto territoriale sia di fondamentale importanza per il suo sviluppo sociale ed economico. A tal fine, in Italia, il DL 3/2015 ha istituito un apposito albo dove possono iscriversi le PMI che intendono perseguire sistematicamente i percorsi di innovazione tecnologica. Il Decreto prevede che le PMI iscritte possano ottenere un pacchetto di vantaggi e agevolazioni finanziarie al fine di mitigare i problemi che solitamente le PMI incontrano quando tentano di intraprendere i percorsi complessi e incerti legati all'introduzione sistematica delle innovazioni; a partire proprio dalla carena di risorse monetarie e capitali di finanziamento. A fronte di quanto sopra, il presente contributo propone un'analisi delle performance economiche e finanziarie ottenute da queste PMI innovative nel quinquennio 2016-2020; ultimo anno di disponibilità dei dati di bilancio estratti dalla banca dati AIDA. L'obiettivo è verificare se la presenza di questi supporti aiuta effettivamente le PMI a compensare la maggiore rischiosità associata alla introduzione di innovazioni tecnologiche, raggiungendo valide performance economiche e patrimoniali. A tale scopo sono state identificate sei ipotesi da verificare attraverso l'analisi di sette comuni indicatori di bilancio. A livello metodologico l'analisi condotta ha seguito due step. In un primo momento si è esaminato l'andamento dei sette indici finanziari e patrimoniali rispetto a tre variabili strutturali (classe dimensionale, macroarea di localizzazione e macrosettore di appartenenza) ritenute dalla maggioranza degli studiosi ampiamente influenti sulle stesse performance aziendali. In un secondo step, attraverso il test statistico dell'analisi della varianza (ANOVA) è stata poi verificata l'esistenza di differenze significative tra le medie degli indicatori considerati in funzione delle variabili strutturali. I risultati dell'analisi mostrano che le PMI innovative presentano una situazione soddisfacente, con una redditività valida ed un discreto equilibrio economico e finanziario rispetto alla media delle PMI non innovative che non beneficiano dei supporti offerti dalla normativa in oggetto. È quindi da presumere che il citato decreto stia manifestando positivamente i suoi effetti, incoraggiando molte PMI ad aprirsi alle innovazioni tecnologiche. Da questo studio emergono anche alcune indicazioni di policy. Tra queste ultime, sembra opportuno che i decisori politici promuovano maggiormente una cultura dell'imprenditorialità innovativa tra gli aspiranti imprenditori ed intervengano per migliorare il clima economico nel quale operano le PMI, in quanto tali PMI sono più sensibili alle influenze ambientali rispetto alle grandi imprese. Inoltre, le evidenze mostrano l'utilità di proporre strumenti che incentivino la partecipazione delle PMI ai flussi di conoscenza e il rafforzamento del capitale umano, che sembrano rendere le aziende più ricettive all'innovazione. Non ultimo, si conferma l'importanza di appartenere a network per l'interscambio di conoscenze ed esperienze, un aspetto che vede le unità di dimensioni minori e prive di un track record particolarmente svantaggiate. 



1. Introduction

1. Introduction

Nearly all economic analysts agree that the 2008 financial crisis and the 2019 pandemic-related crisis are amplifying some well-established structural weaknesses of the Italian country system.

These weaknesses have a deeper impact on smaller companies. In the face of this, there are still no policies able of countering the negative dynamics by mobilising resources capable of fostering, if not recovery, at least the maintenance of the competitiveness of these small and medium-sized enterprises (SMEs) as well as of the country as a whole; especially when compared with the resources deployed by other advanced nations. On the other hand, for many decades the real and financial services and infrastructures that should provide an optimal environment for the development and growth of economic units - the business climate - have on the whole not been widespread and functional to the needs of companies that have to operate in an economy with a well-known fragmentation of conditions and policies among the different areas of the country. Italy, in fact, is characterised by different roots in terms of history, culture, behavioural patterns, development rate, per capita income and infrastructure endowment. Moreover, the entire country is characterised by the absence of large multinationals that have a driving effect on the network of suppliers and on the territorial fertilisation mechanisms, while as whole, the economic system is often defined as crystallised on production activities linked to the so-called traditional sectors, whose products are more exposed to international competition from foreign competitors which benefit of lower production costs.

It is not surprising, therefore, that a field of study that has been attracting both economic and management scholars and policy makers for some years now concerns the promotion of innovative SMEs in territorial contexts. This is because empirical evidence (Acs et al., 2008; Thurik et al., 2013; Anyadike-Danes and Hart, 2018) undoubtedly demonstrates that these enterprises play a fundamental role in the economic and social progress of a context, becoming a flywheel for economic development, industrial renewal, and the dissemination of skills and knowledge. In this way, innovative SMEs also improve entrepreneurial processes and the competitiveness of the environment system (Hart, 2003; Lundstrom and Stevenson, 2005; Mason and Brown, 2013).

In fact, these findings constitute a reversal of the original theses on the dynamics of innovation, which can even be traced back to the positions of the first theorist of the link between company size and innovation adoption, Joseph Schumpeter (1934, 1939). According to this scholar, there is a positive relationship between company size and technological progress. In more

1. Introduction

recent years, the existence of a critical size value below which it would not be profitable to innovate has even been hypothesised (David, 1969; Davies, 1979).

This is therefore a radical change in approach whereby, in light of the aforementioned potential benefits, the Italian legislature also decided to support the spread of this type of company by introducing specific legislation, Decree Law No. 3 of 24 January 2015. The legislation extended most of the measures already provided for innovative start-ups to a new group of companies, the Innovative SMEs, by establishing a special register dedicated to SMEs aspiring to acquire the character of systematic innovation. The aim of the law is to propose a set of instruments to facilitate the adoption of innovations by economic units.

As regards SMEs, after seven years, the number of companies on the register has grown rapidly, reaching more than 2,300 in May 2022. Due to this interest and the confidence placed in the standard's ability to free SMEs from the typical limitations that characterise them in relation to the regular adoption of innovations (Storey and Greene, 2010; Rosenbusch et al., 2011; de Koc et al., 2012), this contribution aims to provide an economic-financial analysis of the performance recorded in the five-year period 2016-2020. 2020 is the last year of financial statements available on the Aida databases. The objective of the analysis is to verify whether, in undertaking the complex and uncertain paths of innovation, the companies in question are able to exploit the benefits provided by the regulations; at least on the side of profitability and equity balance.

The study is organised as follows. The next section describes Decree Law 3/2015. Section 3 provides the literature framework. Section 4 discusses the assumptions. Section 5 presents the sample of SMEs and section 6 discusses the development of the budget indicators over time. Section 7 outlines the methodology. Section 8 shows the main results. Discussion, concluding remarks and implications are set out in the final sections 9, 10 and 11.



The performance of innovative Italian SMEs: a comparative analysis of structural characteristics

2. Decree Law 3/2015

2. Decree Law 3/2015

There is no single or shared definition of an innovative company in the economic and managerial literature. In general terms, we can agree with the OECD (2005) statement, which reads "An innovative firm is one that has implemented an innovation during the period under review". More precisely, in line with the pioneering teachings of Schumpeter's innovation theories (1934; 1939), any company that successfully introduces any change concerning an existing status quo can be defined as innovative. Of course, this broad definition may not be suitable for all policy and research needs. Therefore, in many cases more restrictive definitions can be functional, particularly for comparisons between types of innovation, sectors, and size categories of companies or countries.

With this in mind, in order to strengthen the competitiveness of the national production fabric by promoting a more widespread dissemination of technological innovations in all sectors, the Law Decree of 24 January 2015, no. 3 ("Investment Compact"), converted with Law no. 33, has assigned a large part of the measures already envisaged for the benefit of innovative start-ups to a broader range of companies: the Innovative SMEs. The legislation in question has first proposed a definition of innovative enterprise that is somewhat restrictive and seeks consistency between the pervasive support tools offered, the policy objectives and the characteristics of the management of the economic units.

Although innovative companies are often operating in high-tech, cutting-edge, knowledge-intensive sectors or refer to technological and technical innovations, the Decree defines a series of objective parameters independent of the industry of operation.

Specifically, pursuant to national legislation 3/2015, a company that can be defined as an SME in accordance with the well-known Recommendation of the European Commission 2003/361, i.e., companies that employ fewer than 250 people and whose annual turnover does not exceed 50 million of euros or whose balance sheet total does not exceed 43 million euros, can request registration in the newly established register of Innovative SMEs when you can demonstrate continuous possession of the following requirements, here summarised:

- it is established as a capital company, also in a cooperative form;
- it is resident in Italy or one of the member states of the European Union or in states adhering to the agreement on the European economic area, provided that it has a production site or a branch in Italy;
- it has the certification of the latest financial statements and any consolidated financial statements prepared by an auditor or by an

2. Decree Law 3/2015

- independent auditing company registered in the register of auditors (therefore, newly incorporated companies are excluded);
- its shares are not quoted on a regulated market;
- it is not registered in the special section of the Register of companies dedicated to innovative start-ups (but they can possibly be deleted from the latter register) and certified incubators
- the innovative content of the company is identified with the possession of at least two of the following three criteria: i) volume of expenditure in research, development and innovation in an amount at least equal to 3% of the greater amount between cost and total value of the production of the SME innovative; ii) to employ as employees a share of at least 1/5 of the total workforce personnel in possession of a PhD or who is carrying out a research doctorate at an Italian or foreign university, or in possession of a degree and who has carried out certified research activities for at least three years in public or private research institutes, in Italy or abroad, or, in a proportion of at least 1/3 of the total workforce, of personnel with a degree masterful; iii) ownership, even as depositories or licensees, of at least one industrial property, relating to an industrial or biotechnological invention, a semiconductor product topography or a new plant variety or ownership of the rights relating to an original computer program registered with the Special public register for computer programs, provided that this patent is directly related to the corporate purpose and to the business activity.

The art. 4, paragraph 2 of Legislative Decree 3/2015 for innovative SMEs declares that they have to register in the special section of the Register of companies created ad hoc at the Chambers of Commerce. Similarly to what is already provided for innovative start-ups, registration takes place by electronically transmitting a declaration of self-certification of possession of the above requirements to the competent territorial Chamber of Commerce. Enrollment in the aforementioned register allows innovative SMEs to take advantage of various concessions.


A first relief concerns, starting from 1 January 2017, an important tax relief for investors who invest for a minimum of three years (holding period) in risk capital in innovative SMEs. This tax relief provides, for individuals, a deduction from gross income tax equal to 30% of the amount invested, up to a maximum of 1 million euros; for legal persons, a deduction from the IRES taxable amount equal to 30% of the invested amount, up to a maximum of € 1.8 million.

These SMEs also benefit from a simplified, free and direct intervention to the Guarantee Fund for small and medium-sized enterprises with capital, which facilitates access to credit through granting guarantees on bank loans. The

2. Decree Law 3/2015

guarantee covers up to 80% of the credit granted by the bank to innovative SMEs with a minimum rating of up to a maximum of 2.5 million euros. The third facility relates to the exemption from the payment of stamp duty usually sufficient for registration in the special section of the Business Register and for documents connected with the Register, as well as a 30% discount on the purchase of services in the catalog of the 'Institute of Foreign Trade. Furthermore, these units have the possibility, under the responsibility of Consob, of raising capital through equity crowdfunding campaigns. This possibility is now extended to all Italian SMEs.

Innovative SMEs set up in the form of limited liability companies are also allowed, by way of derogation from the regulations in force, to: create categories of shares with particular rights (for example, it is possible to provide for categories of shares that do not assign voting rights or who attribute it to an extent that is not proportional to the shareholding); carry out transactions on their own quotations; issue equity financial instruments; offer the public capital quote. In addition, by way of derogation from the Code, in the event of loss of time for the year which entails a reduction of the company capital by more than one-third, the term within which the civil loss must be reduced to less than one-third is postponed to the second subsequent year (instead of first subsequent exercise). In the event of a reduction in the capital due to time wasters below the legal minimum, the shareholders' meeting may resolve to postpone the decision to the end of the following year as an alternative to the immediate reduction of the capital and its simultaneous increase to a figure of no less than to the legal minimum. Furthermore, innovative SMEs are excluded from the discipline of shell companies and companies with systematic loss. Therefore, if they "inadequate" revenues or are in a systematic tax loss, the tax penalties envisaged for the so-called shell companies are not applied to them; for example the attribution of a minimum income and a minimum taxable base for IRAP purposes, the limited use of the VAT credit, the application of the Ires increase of 10.5%.

Innovative SMEs are then allowed to remunerate their collaborators with share capital participation instruments (such as stock options) and external service providers through work for equity schemes. The income from the assignment of these instruments does not contribute to the formation of taxable income, neither for tax purposes nor for contributory purposes. Furthermore, without prejudice to a minimum stipulated in the category contracts, the parties can independently establish the fixed and variable components of the remuneration; for example, by agreeing on them based on the efficiency or profitability parameters of the company, the productivity of the worker or the team, or other objectives or performance parameters, 

2. Decree Law 3/2015

also through instruments of participation in the company capital. The “Relaunch” Decree (Legislative Decree 34 of 19 May 2020) following the 2019 pandemic has very recently introduced further measures for the strengthening and support of innovative SMEs. First of all, the assignment of additional resources equal to 200 million for the year 2020 to the Venture Capital Support Fund aimed at participating in capital investments, also through the resource of financial instruments, as well as through the provision of loans was resolved subsidized, the contribution of other convertible debts, or financial instruments specifically directed to support innovative SMEs (and startups). A share of 200 million euros was therefore reserved for the resources already allocated to the Central Guarantee Fund for SMEs specifically dedicated to the provision of guarantees in favor of innovative startups and innovative SMEs. Thirdly, they were compared to the minimum Incentives in “de minimis” to invest in innovative SMEs for individuals by proposing a 50% IRPEF deduction on the investment amount, up to a maximum of € 300,000, such as investment for a minimum of 3 years.



3. The theoretical framework

3. The theoretical framework

3.1 From the SMEs policies to the entrepreneurial policies

As widely known and documented by official statistical sources, the productive Italian fabric is made up for the vast majority of SMEs. They mostly operating in so-called traditional joint sectors that are particularly exposed to turbulent fluctuations and international competition from the cost side of production inputs. A circumstance that for several decades has been having heavy repercussions on the industrial and competitive dynamics of these same economic units as well as of the national context in general.

Starting from the well-known financial crisis of 2008, for example, Italy has no longer been able to grow, at least in terms of GDP, and a long period of impoverishment has begun. The country has thus experienced alternating periods of stagnation with real periods of recession, with the further aggravating factor that up to 2008 our economy was not in step with that of other European countries which, on average, starting from 2001 are grown more than Italy. In numerical terms, between 2008 and 2013, production decreased by about 20% in two-thirds of the economic sectors while, in the period 2011-2013, national sales decreased by about 17% (Istat, 2014). As verified in various surveys, the smaller companies are those that have been most affected by the crisis in terms of reduction in turnover (Carnazza, 2014), worsening of the income situation (Pace, 2013), of the liquidity (Nicolai, 2014), contraction of access to credit (Marinangeli and Thomas, 2015), marked by the increase in business death rate (Cerved, 2014). In reality, the loss of competitiveness of SMEs is of an older origin. Not surprisingly, numerous economic policy interventions have been proposed since the 1990s aimed at stimulating recovery of competitiveness which, however, have contradictory and non-decisive effects (e.g., Thomas, 2008; Passaro et al., 2019). Frequently these interventions are significant in the disbursement of contributions in favor of the undifferentiated start-up (Law 44/1986, 215/1992) or investments for the construction of plants and devices (Law 488/1992) without removing the multiple causes that determined lower competitiveness of these units in an increasingly globalizing context (Thomas and Mancino, 2007; Altobelli, 2014).

First, policies have failed to undermine the widespread defensive approach adopted by most national SMEs (Passaro and Thomas, 2010; Cesaroni and Sentuti, 2014; 2016). An approach, that is to say, aimed at favoring a short-term perspective with the adoption of measures aimed at maintaining the efficiency and survival of the company from the cost side. On the other hand, few SMEs have adopted an offensive approach in the medium-long

3. The theoretical framework


term based on investments in innovations to maintain or even strengthen the competitive advantage or increase the output's qualitative content (Fink and Kraus, 2009; Antonelli and Viganò, 2012). But this type of approach often represents an instinctive reaction to adverse market conditions; it does not determine any strategic repositioning of the company, with the possible consequence of a further weakening of its competitive and income capacity; therefore, with greater difficulty in successfully facing the subsequent phases of the economic recovery (Richini, 2012; Cesaroni and Sentuti, 2016). In general, therefore, the experience of SMEs policies "mainly concern an organizational level - the company - and almost exclusively aimed at the existing stock of companies and practically all the instruments included in the portfolio of policies are aimed at promoting feasibility. Of SMEs" (Audretsch, 2002: p. 46), has obtained unsatisfactory results, making economic and managerial theory skeptical about the effects of undifferentiated support for SMEs. In particular, regarding innovation, SME policies sought to help SMEs escape the financial resource constraints that were believed to be the main obstacle to adopting innovations. For these SMEs, due to the scarce resources notoriously dedicated to the research and development function, the objective of the policies was the use of external sources (Marchini, 1998; Marinangeli and Thomas, 2015). In practice, however, the forecast grants were not able to support the push towards innovation but have turned out to sustain the renewal of the plants with the correlated tendency to their over-dimensioning with respect to actual needs, with repercussions on management costs. In other words, there has been no solicitation for making investments of an anti-cyclical nature and the launch of systematic processes of innovation, both technological and organizational-managerial, aimed at better facing the phase of economic crisis, but also to make the company more prepared and more competitive for the post-recession phases (Thomas et al., 2005; Thomas and Mancino, 2007; Kim and Park, 2016). Therefore, although since the 1970s SMEs have represented an important element of stabilization of Western economies, capable of expanding their employment base, by the end of the 1980s Italian SMEs no longer appeared able to compensate large companies, in line with what has occurred in many other Western contexts (Istat, 1987). Specifically, the surveys conducted in the United States (Birch, 1979) and in Great Britain (Storey and Johnson, 1987) showed that SMEs had been the net creators of employment the decline recorded by large companies, especially in the manufacturing sector. A trend also in Italy, where SMEs between 20 and 50 employees represented almost the totality of the industrial occupational variation between 1971 and 1981. From the following decade, however, even the employment

3. The theoretical framework

levels of smaller dimensions decreased, and to the more, we can speak of maintenance of previously acquired levels. In other words, there has been an accentuated process of deindustrialization which has shown a decrease in competitive capacity for SMEs as well as for the entire economic context (Istat, 1990).

This negative dynamic can be interpreted as the consequence of a lack of polarization on innovation and development strategies. Compared to choices based on cost containment, the strategies are offensive-type strategies oriented towards the outside, aimed at restricting themselves to the reduction of the demand by the company through redefined innovation initiatives of new products and processes, business diversification, endorsement of new organizational and production methods, promotion and communication activities (Antonelli and Viganò, 2012; Altobelli, 2014). Obviously, these are not always easy to implement initiatives, which imply both a long-term vision and the availability of substantial financial resources and adequate managerial and technical skills (Cesaroni and Sentuti, 2014). Compared to large companies, in fact, SMEs have lower resources; in particular, in terms of resources, skills, managerial and financial skills, systems and organizational structures (Marchini, 2000). For example, in a large company strategic activities (market analysis, strategic planning, strategy implementation and control) are often carried out by different teams or by dedicated organizational structures. On the contrary, in a small business, strategic activities are conceived and conducted, often informally, by a single person who typically coincides with the entrepreneur, with all the limits of the case. A typical example is family businesses (Sciascia et al., 2015).

On the other hand, it is known that compared to larger companies, SMEs have financial constraints, information limits linked to poor knowledge of the market and accentuated by the globalization of markets, as well as organizational constraints. The ability to acquire knowledge outside the company, as well as R&D and register patents, is also inversely linked to the company's size (Fink and Kraus, 2009). The importance of differentiating the different types of innovation was also underlined (Ahn et al., 2015). The traditional sectors prevalent in the national economy, for example, are mainly process innovators, with reference to products already in place, while SMEs have a greater emphasis on product innovations (Baussola, 1994; Costa et al., 2014).

In any case, although innovation is linked in a relevant way to the size of the company, this does not exclude the role of SMEs in the innovation process of the national economic system; were it only for the significant percentage incidence that they represent in the economic fabric. In view of the above, 

3. The theoretical framework

in order to support SMEs more effectively, in more recent times, attention has thus been focused on entrepreneurial policies: “those measures aimed at directly influencing the level of entrepreneurial vitality in a country or region” (Lundstrom and Stevenson, 2005). The latter extensively focuses on multiple organizational and analytical levels and addresses potential entrepreneurs, but without resorting to undifferentiated company birth rate policies (Hart, 2003). Furthermore, by focusing more on the process of change, “entrepreneurship policy also has a greater sensitivity to the framework or environmental conditions that shape the decision-making process of entrepreneurs” (Audretsch, 2002: p. 47). These include measures in favor of the corporate climate and selective interventions in favor of innovative companies (incubators, start-up cups, ex-ante screening of potential entrepreneurs...) (Mason and Brown, 2013).

The focus on highly innovative SMEs also belongs to the sphere of entrepreneurial policies, aimed at the possibility that these SMEs reach competitive levels suitable for quantitative expansion in a short time, with positive effects on employment dynamics (Demirkan et al., 2022). A position consistent with that of scholars who believe that the greatest net contribution to employment absorption is offered by a limited number of companies experiencing significant periods of expansion (Daunfeldt and Halvarsson, 2015; Anyadike-Danes and Hart, 2018). A thesis, moreover, in line with both the pioneering evidence of Birch (1981), according to which the greater net absorption is linked above all to young high-growth companies (gazelle), rather than to large units (elephants) or the myriad of small and tiny businesses of a purely commercial or family-based nature (mice), and with the most recent findings from other renowned scholars who underline the qualitative aspect of the businesses created (e.g. Acs et al., 2008; Shane, 2009). The entry of these new SMEs improves the economy’s aggregate productivity, stimulating the entry of imitation processes of incumbents with lower productivity but not replacing them. In this way, these economic units become net job creators (Smallbone and Welter, 2006). Moreover, the diffusion of innovative SMEs is indispensable when there is often an excessive polarization on startups which appears inconsistent with the objective of greater employment, given that “the high incidence of start-ups in most countries has not led to a high incidence of young, fast-growing companies” (Napier and Hansen, 2011: 5). Startups, in fact, are extremely fragile organizations and by their nature temporary; that is to say destined to transform into structured companies, generally of small dimensions or, in the majority of cases, to disappear or be taken over by other companies entirely or solely for the business idea. Only those (few) who will be able to make their business repeatable and scalable will be able to expand (Blank, 2013).

3. The theoretical framework

3.2 Innovation and high-grow firms

For some time the company literature has pointed out the presence of at least two small business models that coexist almost everywhere in the world economic systems (Marchini, 1988): a “small stable business” that stabilizes itself in the small size and operates in fragmented and mature sectors on local basis; an “emerging small business” that is located in newly formed or mature sectors that have undergone radical restructuring. A choice that, however, leads back to the expectations of the subjective entrepreneurs, who, in the creation phase of the company, select the sector in which to enter, based on the creation of personal preferences and values, the capacity of the company’s motivations, of the company’s objectives, and selected experiences. In order to develop, this second type of business passes through several phases that cannot be defined a priori in which it is necessary to seek the consonance between the external environment, the business structure, company resources, and strategy; thereby explaining the heterogeneity of the behavior of smaller companies (Rhee et al., 2010; Ciambotti and Palazzi, 2015b).

These firms are somewhat comparable to high-growth firms (HGFs); units that not necessarily innovative, young or small (Acs et al., 2008) and very high-tech intensive (Brown et al., 2017), by virtue of the high content of their business model, manage to obtain economic opportunities that allow to increase competitive levels and to penetrate or expand into new markets, mainly foreign. Compared to start-ups, that is to say, small and medium-sized companies are more likely to be able to undertake internationalization paths (Passaro et al., 2018). As specified in paragraph 3.1 above, innovative companies tend to fall within the scope of HGFs.

By fostering innovation in a broad sense, regulation 3/2015 also responds to the empirical evidence from various territorial contexts according to which SMEs innovate less than large companies in a range of categories, including product and process innovation, non-technological innovation, new product innovations on the market and collaboration in innovation activities (OECD, 2010). In this way, another risk related to excessive polarization on high-tech companies is minimized; that is to say the possibility of obtaining disappointing results if the learning and adoption times of technology are long and inconsistent with the resources available to the companies present or with the technological level of the surrounding area (Busenitz et al., 2000; Pederzoli et al., 2013). Not surprisingly, although the technological advances of a disruptive nature that create “discontinuities” are those that generate the greatest opportunities, the inherent capacity sectors allow most of the HGFs and the component of innovative SMEs included in them to place themselves in so-called traditional innovations (Brown et al., 2017).

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Another aspect concerns the existence of an unequal distribution of SME innovation among a few highly innovative companies with high growth potential and the vast majority of SMEs that innovate little compared to their larger counterparts. It follows that policies must primarily aim at ensuring that set of resources capable of favoring the emergence of innovative SMEs with another potential for development, competitiveness, and territorial fertilization (Mason and Brown, 2013; González-Loureiro and Pita-Castelo, 2012). Not an easy goal considering that these SMEs are quite heterogeneous in terms of sectors, business models, management, ownership structures, and paths to achieve expansion (Daunfeldt and Halvarsson, 2015). Moreover, there is no specific target to be identified as the population of innovative SMEs is constantly changing (Thomas et al., 2015). It should also be noted that if rapid dimensional growth is not synonymous with a parallel qualitative development or a guarantee of success and future survival, the high innovative intensity improves the probability of this happening (Brugnoli, 2003). Furthermore, the development phases may have an episodic and persistent nature, it is unlikely that a company can experience constant expansion without facing the imbalances that this entails. In any case, even in the worst circumstances, SMEs can still be protagonists of a territorial cross-fertilization and knowledge diffusion that otherwise would not remain large research companies (Simmie, 2002; Giampaoli et al., 2021).

Another aspect that the legislation addresses concerns the significant burdens underlying innovation of SMEs related to the compliance costs of the administrative process for starting a business. Charges have a much greater impact than for the largest unit. Then there is the well-known question of access to financial resources and the availability of qualified personnel (Sgrò et al., 2020). For example, in Italy, about 11% of small enterprises report the lack of skilled personnel as an obstacle to innovation, compared to 6% of large enterprises. While only 15% of large companies report a lack of external finance as an obstacle, nearly 20% of SMEs do. However, while policymakers have admitted SMEs financing problems, the skills barrier in SMEs has received less attention (OECD, 2018). Given these findings, decree 3/2015 focuses, as mentioned, on the intrinsic potential of management's intellectual capital (Passaro et al., 2018; Giampaoli et al., 2021); moreover, it enhances the idea that SMEs do not innovate alone, but rather in collaboration with other organizations, including their suppliers and customers, universities and research organizations (Ciambotti and Palazzi, 2015). Collaboration is an essential element in the strategies of innovative SMEs to overcome some of the barriers they face, including limited funding and the lack of management resources, technological skills,

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and adequate time horizons to invest in a long-term strategy (Sciascia et al., 2015; Sgrò et al. 2020).

On the other hand, the scientific literature (Del Baldo and Aureli, 2012; Brown and Mawson, 2016; Audretsch et al., 2022) underlines how the external context strongly influences the birth and diffusion of innovative SMEs. It emphasizes that their incidence is more marked in environments that keep from high mobility, openness to the outside and increased presence of the aforementioned knowledge resources that support individual training, the generation and dissemination of innovations, the availability of personal resources, and the presence of knowledge-intensive services.

In addition, evaluating its requirements as well as the expected benefits, decree 3/2015 appears particularly functional to the objective of reducing the well-known phenomenon of the equity gap that characterizes many SMEs and the tendency to undercapitalization that mortifies their potential for expansion. As Gualandri and Schwizer (2008, pp. 132-133) specify "... interventions on the supply side of risk capital are not enough, but it is also necessary to operate on the demand side. In particular, for the most problematic areas, evidence emerges of the limited effectiveness of public interventions in stimulating the private development of venture capital and the related managerial skills. More effective policies must therefore include actions aimed at creating contextual conditions that encourage the entry of more capable and prepared entrepreneurs in key sectors of innovation, such as technology. Furthermore, the action plans must have in mind the entire chain of possible financial interventions to identify those most suitable for the specific needs and phases of the life cycle of the target companies. In any case, in the presence of public involvement of a financial nature, the intervention is always brought back into the context of market mechanisms and in compliance with commercial logic".



4. The Hypotheses

4. The Hypotheses

Evaluating all these preconditions, one can fully understand the legislature's goal of breaking free from the simple encouragement of undifferentiated business start-ups, which in the authoritative opinion of Shane (2009) is not a good policy choice since generic business start-ups do not guarantee economic vitality or net job creation. Depending on the above, the study is developed around four primary hypotheses.

The first hypothesis argues that Innovative SMEs can reap the benefits of their innovative activity by mitigating risks due to the presence of the pervasive support offered by Decree-Law 3/2015, which reflects, therefore, a public investment aimed at fostering the diffusion of such enterprises (Passaro et al., 2018; Manelli et al., 2022). Consequently, it is expected that: H1) SMEs' profitability is positive and high.

The second hypothesis focuses on the internal competencies of the management of these units which are associated with the existing entrepreneurial experience as well as strengthened by networking with external stakeholders (Del Baldo and Aureli, 2012; Hervas-Oliver et al., 2016; Sgrò et al., 2020). With this in mind, it is believed that: H2) Innovative SMEs move on tracks of financial-equity balance.

Consistent with the heterogeneous Italian business climate, it is safe to assume that the territorial context grasps business continuity (Passaro et al., 2018; Nicolò and Ricca, 2019). Therefore, the following hypothesis is formulated: H3) the location context influences earnings results and capital balances.

The aggregate of SMEs is notoriously too large and varied to be considered in homogeneous terms. At a mere size level, micro-enterprises with up to 10 employees tend to experience greater difficulties in pursuing their innovation goals and generally ensuring continuity in periods of economic uncertainty than SMEs in the upper size range (Palazzi et al., 2018; Thomas et al., 2020). Therefore, we expect that: H4) the income performance and capital balances of Innovative SMEs with more than 50 employees will be better than those of microenterprises¹.

It is believed that SMEs operating in the industrial macro sector are more oriented to operate in so-called traditional sectors than those working in the so-called advanced tertiary sector. Typically, such units experience better performance than conventional service sector firms (e.g., Cavallo et al., 2021), a residual component in this sample. The literature on SMEs also argues that tertiary sector firms operating in its so-called advanced component exhibit higher riskiness accompanied by higher potential profitability related to working in areas of foreseeable future expansion with a lower level of competition (Passaro and Thomas, 1999; Doloreux et al., 2010). In this case,

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the higher riskiness could be balanced by the presence of incentives. It follows that: H5) Innovative SMEs operating in the advanced service sector could experience higher economic-financial performance than Innovative SMEs in manufacturing.

Related to the previous hypothesis, it can be assumed that corporations have a higher average capitalization than partnerships and still follow more structured decision-making paths involving more expertise. A parameter of capitalization repeatedly emerged as a discriminant of SME continuity (Nicolò and Ricca, 2019; Sgrò et al., 2022). Therefore, it is safe to assume that: H6) the income performance and capital balances of Innovative SMEs with legal forms of corporations are better than those with the legal form of partnerships.



5. Methodology

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The companies were identified by consulting the electronic database "AIDA". It contains data on the balance sheets of Italian companies and reports all structural characteristics and financial and business information on so-called Innovative SMEs in a special session. It is necessary to point out that the companies taken into consideration are those that are registered until April 30, 2022. On that date, there were 2189 companies, variously distributed throughout the country and active in various sectors of economic activity, with a dominance of companies operating in the tertiary sector, mainly advanced.

The number of companies registered in this section of the registry changes frequently. In fact, a previous sample survey carried out by Carfora et al. (2021) showed that the Innovative SMEs listed as of April 30, 2019, were 1035, marking an increase of 100 percent in three years; a significant growth, especially that framed within the national and international economic conditions, which have worsened dramatically due to the recent pandemic wave that resulted in the adoption of special emergency measures that have weakened the business economic fabric. Evidently, the strong dynamism that identifies this section of the registry, characterised by a progressive expansion as the applications from the business community to be registered and, consequently, to be able to benefit from the facilities provided by the current legislation is accepted, means that, from a methodological point of view, the series of economic-financial indicators are marked by the presence of numerous missing data.

The presence of missing data is evidently expected; it is mainly due to the gradual entry of new firms in the register section and the presence of firms that cease to be active.

This feature of the initial database, and the need to analyze the temporal dynamics of Innovative SMEs' balance sheet indicators over the last 5 years (from 2016 to 2020 - the last year available at the date of consultation) to verify the effect of the facilities provided by Decree-Law 3/2015 on the profitability of companies, makes it necessary to carry out an initial exploratory analysis to eliminate, progressively, all companies that have more than two years missing in at least one of the balance sheet indicators taken into consideration.

The baseline analysis significantly reduced the number of firms from 2186 to the current 617. The latter are the firms with missing data in at least one indicator. In this case, the missing data were imputed.

As is well known, the presence of non-response causes problems at the data analysis stage.

The presence of so-called missing causes, for example:

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- loss of estimation efficiency due to the reduction of the predetermined sample size generating larger standard error values and, consequently, wider confidence intervals and reduced test power;
- bias in estimates, especially if in the presence of systematic nonresponse (respondents are systematically different from nonrespondents);
- greater difficulty in performing analyses on incomplete data (incomplete data sets require complex methods for parameter estimation that may not be available in statistical software usually used for the study of complete data sets).

Thus, it is necessary to implement appropriate strategies to counter the problem of non-response, especially partial non-response (or item non-response). Many methodologies have been proposed for correcting partial nonresponse, and many of them directly reference statistical tools commonly used for full data set analysis, including *i*) complete – case analysis, *ii*) available case analysis, and *iii*) single imputation.

Complete-case analysis involves analyzing only the statistical units with complete observations. In this case, the presence of units with missing data (item non-response) causes a reduction in sample size. It can introduce bias in parameter estimates unless the nonresponses are totally random (Little and Rubin, 2002). In other words, units with nonresponse can be equated with a random sample of the entire data set. In this case, the mechanism of partial nonresponse is known as Missing Completely at Random or MCAR. If this is the case, the probability that a value is missing must be independent of the observed and unobserved data. Moreover, even if the missingness mechanism is MCAR, reducing the units on which to perform the analyses results in a loss of the precision of the estimates.

From an operational point of view, if the omitted observations represent a marginal share of the sample size and the profile of individual characteristics has no particular patterns, proceeding with an analysis of the complete data only is undoubtedly a simple and reasonable procedure. In practice, however, the consequences of omission are difficult to ascertain based on a priori information. Available-case analysis involves using the largest subset of available cases for estimating distinct parameters (available-case analysis). The major disadvantage of this approach concerns the possible inconsistency of the results of different analyses conducted on the same incomplete data set due to the set of variables used in the analyses (e.g., the covariance matrix estimation may not be positive definite).

The single imputation approach is undoubtedly the most widely used in current practice.

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It consists of assigning a plausible value to each missing value so as to obtain a complete data set on which different analyses, carried out using standard statistical tools, produce consistent results. This feature makes the single imputation approach the choice of choice for National Statistical Institutes obliged to provide complete and consistent (in the sense of meeting compatibility rules) data sets for public use. The single imputation approach can also have drawbacks: for example, there is no guarantee that the estimates obtained from the imputed data set will be less biased than those obtainable from the incomplete data set or that the marginal and joint distributions of the variables will mirror those of the hypothetical complete data set (much depends on the type of non-response, the imputation procedure used, and the kind of estimation). The most obvious drawback, however, is that related to the lack of knowledge of missing values and the automatic application of methods for analyzing complete data to the imputed data set: when imputed values are treated as if they had actually been observed, the variability of the nonresponse mechanism and the additional variability due to imputations are not taken into account causing an underestimation of the standard errors of the estimates (for a review of methods proposed in the literature for correctly estimating the variance of estimates in the presence of single imputation see, for example, Rao, 1996). Several single imputation methods have been proposed for the integration of MRPs (e.g. Kalton and Kasprzyk, 1982; Quintano and Castellano, 2001). Whichever method is chosen, imputing means assigning a value to each missing value. Imputed values are generally estimates obtained by explicit or implicit modeling of available information. The extensive literature (e.g. Rubin, 1976; Schafer, 1997) on the subject of imputing missing data presents several practical methodologies for correcting the so-called “blanks” in datasets, which take into account the quantity and distribution of missing data, as well as the structure of the data and the nature of the variables involved.

For example, an explicit model underlies imputation by regression, while the model that in nearest-neighbor donor imputation places the variable to be imputed in relation to auxiliary variables used for donor identification is not as explicit.

The quality of the imputed values, and consequently of the estimates obtained from the imputed data set, depends strongly on the imputation procedure used. It is generally recognised that, to predict the value to be imputed, the use of available information on the nonresponding unit improves the quality of imputations because it reduces bias due to nonresponse and variability due to imputation (Little, 1988; Kalton and Kasprzyk, 1986; Kovar and Whitridge, 1995). In addition, measures of

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association (e.g., covariances and regression coefficients) between the variable affected by nonresponse and other fully observed (auxiliary) variables turn out to be unbiased if the auxiliary variables are used to predict the values to be imputed (Kalton and Kasprzyk, 1982). Another general approach to predicting values to be imputed conditional on the values of auxiliary variables is to introduce a concept of similarity between units, based on an appropriate distance function, defined on the auxiliary variables. For each receiver, the choice of donor from which to draw values is limited to those units that minimize the distance function (nearest-neighbors).



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5.1. Imputation by the nearest-neighbor donor

In order to preserve the relationships between the identified indicators, imputation by donor (nearest-neighbour imputation) was used. It replaces the missing value with the value of a “nearest-neighbor” firm identified through the Euclidean distance measure, calculated on some of the structural, or registry, variables (sector of economic activity, size, and location). Imputation with nearest-neighbors donor (hereafter, NN) selects the donor from which to draw values among the units “closest” to the recipient. Closeness is defined as a multivariate distance measure between the donor and the recipient based on the auxiliary variables X. The variables to be imputed and the auxiliary variables can be either quantitative or qualitative in nature. The total distance function is given by the sum of the elementary distances concerning all auxiliary variables. Different distance functions have been proposed in the literature (e.g. Sande, 1979). It should be noted that elementary distances are generally calculated on preliminarily standardised auxiliary variables to prevent the different contributions to the total distance function from depending excessively on the unit of measurement of the variables. In cases where, for a given receiver, there are several units with the same minimum total distance, the donor is randomly selected from among them.

A system of weights can be used to assign different importance to individual variables in computing the total distance, while a penalty factor associated with each use of the same donor can be introduced to reduce multiple use of a donor (and avoid bias in the final distribution caused by overrepresentation of responses from the same donor). The entire data set can be considered as a single imputation class, or units can be divided into distinct strata, defined by the values of qualitative variables, within which to perform NN imputation. In this case, for each recipient classified within a stratum, the closest donor within the same stratum is selected (similar to what is done by the Tree-NN method). It may happen that in the recipient record an auxiliary variable used to define the distance function, has a missing value. In this case, the variable is excluded from the total distance computation. In practice, the elementary distance for an auxiliary variable with a missing value cannot be computed, so its contribution to the total distance is assumed to be zero. This admits the absence of value for the variables used to define the distance function, that is, for the variables used to select the donor record. Note that the missing value is not allowed for the auxiliary variables used to define the strata, i.e., for the variables used to construct the donor reservoirs: the stratification variables must be observed on all units (recipients and donors). It is also worth noting that an auxiliary variable can have missing value only in the receiving records and not in the records that make up the donor reservoir: donors are all and

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only the records in which all auxiliary variables (used to define distance or strata) and the variables to be imputed are observed.

Once the imputation phase was completed, it was possible to analyze the set of Innovative SMEs active in Italy at least as of 2016. The analysis was then based on the characteristics of the companies, emphasizing their distribution according to certain structural, or registry variables, namely sector of economic activity, location, and size. Next, an analysis was carried out to highlight the temporal dynamics of the index averages. In other words, the averages of the eight balance sheet indicators examined were calculated for each year (from 2016 to 2020). The evolution over time was described as a function of the structural variables considered. Lastly, the data collected for each company in the years under consideration were aggregated through averaging and differences were checked as a function of the known structural variables. In order to preserve the relationships between the identified indicators, imputation by donor (nearest-neighbor imputation) was used. It replaces the missing value with the value of a “nearest-neighbor” firm identified through the Euclidean distance measure, calculated on the structural variables (location, industry, and size). Having completed the imputation of item non-responses, it was possible to analyze the set of Innovative SMEs operating in Italy since at least 2016. The analysis was then based on the main characteristics of the companies, emphasizing their distribution according to specific structural or registry variables, namely sector of economic activity, location, and size.

Next, an analysis was carried out to highlight the temporal dynamics of the index averages. In other words, the averages of the eight balance sheet indicators examined were calculated for each year (from 2016 to 2020), and the evolution over time was described as a function of the structural variables considered. Lastly, the data collected for each company in the years under consideration were aggregated through averaging, and differences were checked as a function of the known structural variables.



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5.2 Sample

As regards the characteristics of sampled innovative SMEs (Table 1), the majority (45.7%) belong to the 10-49 employees group (small-sized), while just 11.8% exceed 50 employees (medium-sized). These enterprises basically operate in the advanced tertiary sector (54.5%) composed of so-called *Knowledge-Intensive Business Services*, such as ICT, financial and consulting services (Passaro and Thomas, 1999; Doloreux and Frigon, 2020). Only a remaining 5.7% operate in the traditional tertiary sector (Table 2)².

Table 1. Innovative SMEs by size

Company size	Frequency	%
Micro (employees < 10)	219	35.5
Small (employees between 11-49)	282	45.7
Medium (> 50 employees)	116	18.8
Total	617	100.0

Table 2. Companies by sector of economic activity

Sector	Frequency	%
Industry	208	33.7
Tertiary	35	5.7
Advanced tertiary	374	60.6
Total	617	100.0

At the territorial level (Table 3), just over half of the SMEs are located in the northern regions, while 26.3% are located in the southern regions, including Sicily and Sardinia. In more detail, the largest Italian region (Lombardy) encompasses 24% of SMEs, followed – at a great distance – by Lazio and Emilia-Romagna (Table 4). Molise is the only region to be not represented in the sample. This scenario appears broadly in line with the entire population of Innovative SMEs surveyed in 2017 (Calenda, 2017); scenarios, however, that are rapidly changing and are not comparable with those referring to innovative start-ups.

Table 3. Companies by geographical macro area.

Macro area	Frequency	%
South and large islands	162	26.3
Centre	119	19.3
North	336	54.5
Total	617	100.0

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Table 4. Companies by Italian regions.

Region	Frequency	%
Piemonte	48	7,8
Valle d'Aosta	1	0,2
Lombardia	148	24,0
Trentino A. Adige	12	1,9
Veneto	37	6,0
Friuli V. Giulia	16	2,6
Liguria	12	1,9
Emilia Romagna	62	10,0
Toscana	24	3,9
Umbria	6	1,0
Marche	23	3.7
Lazio	66	10.7
Abruzzo	13	2.1
Molise	-	-
Campania	60	9.7
Puglia	39	6.3
Basilicata	4	0.6
Calabria	9	1.5
Sicilia	31	5.0
Sardegna	6	1.0

In terms of legal form (Table 5), the predominant one is the limited liability company (*società a responsabilità limitata*) (72.6%) followed by the joint stock company (*società per azioni*) (25.3). Only a few other companies have the form of cooperative or consortium companies (jointly 2,1%).

Table 5. Companies by legal form.

Legal form	Frequency	%
Joint stock companies	156	25.3
Limited liability companies	448	72.6
Cooperatives	7	1.2
Consortium	6	0.9
Totale	617	100.0

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5.3 The indexes

As it is widely known, balance sheet analysis aims at verifying the ability of a company to guarantee economic equilibrium, relating to costs and revenues, financial equilibrium, inherent to the relationship between debits and credits, monetary equilibrium, relating to the income and expenditure of monetary resources, as well as equity equilibrium, relating to the composition of balance sheet items in its three traditional sections of assets, liabilities, and profit and loss account. Economic stability, in particular, aims to consider whether the company can produce sufficient income to cover its costs and generate an economic result that justifies the investments made; the purpose, in essence, is to measure the profitability of the economic unit. As shown in Table 6, the proposed balance sheet analysis was based on eight common indicators (Brunetti and Minoja, 2000; Migliaccio and Pavone, 2021). They represent the dual perspectives of profitability and equity to minimize the risk that a bias on mere profitability could be at the expense of equity soundness, i.e., the economic unit's conditions for survival (Giunta and Pisani, 2016; Ricciardi, 2020). For the sake of consistency, these indexes are taken from the Aida database, as is their calculation methodology.


Table 6. The considered balance sheet indices

	Budget indexes	Budget indexes considered by AIDA
1	Return on Equity (ROE)	Net profit/Equity
2	Return on Investment (ROI)	Ebit/Net invested capital
3	Financial Independence index	Equity/Assets
4	Liquidity index	Current assets/Current liabilities
5	Coverage ratio of fixed assets	Tangible fixed assets/Equity
6	Debt Equity Ratio	Net invested capital/Equity
7	Net debt to EDIBTA ratio	Ratio between net debt and EBITDA.
8	Value added per capita	Value added/employees

Regarding the concept of profitability, it should first be recalled that it has a contingent value because there is no absolute parameter but is dependent on various quantitative and qualitative factors. These include, for example, *i)* the level of indebtedness with the associated timing of repayment; *ii)* the amount and quality of the capital invested with the correlated prospects of adequate remuneration with respect to alternative uses; *iii)* the conditions of the reference context in relation to the prospects of the business undertaken; *iv)* the subjective propensity to risk; *v)* the general economic trend in terms of recessionary or expansive phases; *vi)* the riskiness of investments, the time horizon in which the reintegration of invested resources is expected; *vii)* the quality of profit intended as sustainability over time.

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The two best-known and most widely used *profitability indicators* are ROE and ROI.

- 1 The return on equity (ROE) expresses the profitability of equity and is equal to the ratio between operating profit, usually net profit, and equity. The latter includes both the resources contributed by the shareholders in the phases of creation of the enterprise and subsequently with capital increases (or reductions), as well as that formed over time as a result of profits realised and not distributed to the shareholders (earmarked). ROE, therefore, measures the return on the investment made by the shareholders themselves in the company with respect to alternative uses of their capital and in light of the risk assumed: a generic risk for the conduct of the business activity and a specific one depending on the characteristics of the business. For this reason, it is not a priori determinable what value an optimal return on this indicator should assume, as it varies depending on the sector and the entrepreneur's risk propensity. It is, however, certain that it must at least be higher than the return guaranteed by investments considered 'riskless', i.e. with a degree of risk tending towards zero (e.g. yields on government bonds).
- 2 The return on investment (ROI) measures a company's profitability, i.e. the appropriateness of the result of its core business with respect to invested capital. It therefore indicates whether the operating income produced by the company adequately remunerates the investments made. This index is normally calculated through the ratio of the *net operating margin* or EBIT (*earning before interests and taxes*) to total assets or invested capital. In this study, consistent with the Aida database, ROI is computed as the ratio of EBIT to net invested capital. The latter is given in turn by shareholders' equity plus all sources of coverage of financial requirements (bonds issued, financial debts and other financing)³. Sources of coverage of financial requirements normally do not include operating liabilities such as settlement debts, employee severance indemnities and accruals and deferred liabilities (accruals and prepayments). In more detail, in the AIDA database, the denominator includes equity or shareholders' equity summed with bonds, bank debts owed to shareholders and other financing regardless of duration. Even for ROI, it is difficult to identify a theoretical optimum value; but it is clear that the higher it is, the greater the ability of the operating result to remunerate investments.
- 3 The *financial independence ratio* (or capitalisation ratio) compares the proportion between financing obtained from own means (equity) and that guaranteed by external sources (acquired assets: shareholders, 

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external capital, loans, etc). It is, therefore, the ratio of the company's net capital to its invested capital (or net worth over assets). It therefore measures, from the point of view of the company's assets, its ability to contain its recourse to credit capital and debt in general. It is part of the structural indicators reflecting the soundness of the company's balance sheet. According to the index ratio, there are six types of financial structures:

- 0: the company has no equity, and finances itself completely externally;
 - 0 to 0.33: the financial structure of the company is severely unbalanced;
 - 0.34 to 0.55: the financial structure of the company is unbalanced;
 - 0.56 to 0.66: the financial structure of the company is balanced;
 - 0.67 to less than 1: the financial structure of the company is balanced, and the most suitable for the company's development;
 - 1: the company uses only its own means.
- 4 The *liquidity ratio* (also called current ratio or availability ratio) is one of the most commonly used ratios for examining the liquidity conditions of a company. It expresses a company's ability to meet its current outgoings (or current liabilities) with current income (or current assets); hence, it is calculated as the ratio of the two quantities. As a thermometer of the financial health of a company, the liquidity ratio can take on values:
- > 1: current assets are greater than current liabilities, so the company is in good financial health and is able to meet future outgoings;
 - = 1: current assets and current liabilities are equal and the company's liquidity situation is weak as future revenues are barely sufficient to cover future outgoings;
 - < 1: current assets are less than current liabilities and the company's liquidity situation is critical as future revenues are insufficient to cover future outgoings.
- 5 *Fixed Assets Coverage Ratio*. Among the balance sheet ratios, the fixed assets coverage ratio refers, at least in the version used by AIDA, to the ratio of tangible fixed assets to equity. This ratio assesses whether investments with a duration of more than one year are covered and to what extent by equity. In an ideal condition, the ratio should be equal to 1 (values lower than unity are better because they show that equity in the denominator is greater than fixed assets), i.e. a company should be able to finance 100 per cent of its investments with equity. In this way, the organisation reduces the erosion of each year's profit

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to pay interest and minimises exposure to market conditions. In fact, the credits obtained rarely have a duration that coincides with the expected duration of the fixed assets, so they need to be refinanced over time. In a climate of rising interest rates, such transactions clearly result in higher costs. On the other hand, however, one must also take into account alternatives to equity capital and the fact that a company's shareholders may not always be willing to finance for such transactions. In addition, a company that fully finances fixed assets by resorting only to equity capital may reflect a low creditworthiness, i.e. a low ability to apply for and obtain financing from the banking system or by drawing on capital on the market, for example, by issuing bonds. In essence, the degree of coverage greatly depends on the sector. Utilities, for example, are generally highly indebted as they are forced to invest heavily in building infrastructure, such as electricity, gas and telephone cables. Their degree of self-hedging is on average low, which is why they tend to be more exposed than others in cases of rising market rates, as they will have to refinance their debts at a higher cost, or because they have borrowed at variable rates, especially by issuing bonds. This is also why, when the cost of money goes down, utility stocks tend to outperform the market, while when the cost of money goes up, they tend to do worse than average. To summarise, the fixed asset coverage ratio provides a signal on the degree to which a company is leveraged to finance medium- to long-term investments. It is not always possible or preferable to finance the latter entirely from equity, especially if market conditions allow us to borrow relatively cheaply, or if the resources required appear high. Finally, low or no debt could signal not only a financially optimal condition, but also the company's limited ability to resort to external sources of financing, perhaps due to its poor reputation on the market.

- 6 The *Debt Equity Ratio* is part of the capital analysis to evaluate the degree of consistency between uses and sources of financing, while the financial analysis concerns the company's ability to meet its financial commitments in the short, medium and long term with ordinary means and policies.

In European countries, particularly in Italy, the Debt Equity Ratio is usually calculated by comparing net invested capital, i.e. net financial debt, with shareholders' equity; where net financial debt results from the difference between total onerous short-term and long-term financial debts minus liquidity (cash, banks and short-term securities). Some companies, normally Anglo-Saxon, do not consider short-term

5. Methodology

liabilities (within one year) when calculating debt. In the Italian case, on the other hand, it is customary to consider it given its importance in covering structural investments (Anthony et al., 2021).

The AIDA database calculates the Debt Equity Ratio as the ratio of total assets (liabilities) to equity. Using this formula, the absolute value of debt decreases and the ratio improves.

The result of the Debt Equity Ratio can be expressed as a number or a percentage. In the case of values greater than 1 (or 100%), the total amount of debt exceeds the total amount of capital or equity. In the case of results between 0 and 1, the value of debts is lower than that of capital. The Debt Equity Ratio is zero if a company has no debts. To measure the equilibrium level of a company in this respect, there are standard values:

- $D/E < 0.50$ positive situation;
- $0.50 < D/E < 1$ situation to be monitored;
- $D/E > 1$ risk situation.

According to analysts, therefore, the ratio should be at most 1; values in or below the range 0.3-0.5 are considered signs of a balanced financial structure, with a value of zero if hypothetically the company had no debts. Conversely, as this value increases, the company would lose its economic and managerial autonomy due to third party claims on the company. Values above 2, for example, are considered worrying. In any case, the sustainability of a company's debts does not only depend on overall debt volumes in relation to equity, but also on maturities. For example, a concentration of debt maturities in the short term could create solvency problems. On the other hand, while the debt ratio may describe a risky financial structure because there is interest to pay and it increases the solvency risk, it does not necessarily imply a bad financial situation. While it is true that the figure partly reflects the financial situation of a company, it must always be compared with the historical data of the company and its competitors. In addition, a high cash value could relate to liquidity needed for current operations or for an upcoming investment; just as there is no equal level of debt for every company. Some companies are more indebted than others because of the need to make large investments. Similarly, a very low debt equity ratio could reflect the condition of a company that is reluctant to invest and, for that reason, could be negatively affected in the future. For example, industries such as shipbuilding and construction finance their projects almost entirely through debt, but do not necessarily run a real risk of insolvency.

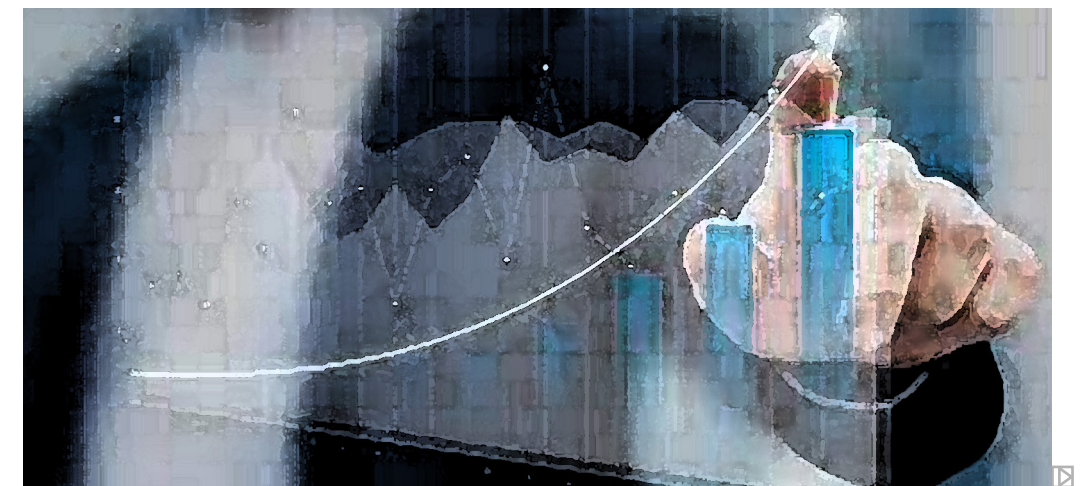
5. Methodology

7 The *net debt/EBITDA* ratio is a solvency indicator that measures a company's ability to pay off debts by comparing net financial debt or Net Financial Position (company financial debts regardless of maturity minus liquid assets - cash, current accounts receivable, marketable securities and financial receivables) with EBITDA⁴. EBITDA is equal to the aforementioned EBIT including, however, depreciation and amortisation allowances⁵.

Normally, this ratio is expressed as a rational number indicating how large the net debt is relative to EBITDA. As the ratio increases, the ability of the enterprises' core operations to support debt worsens. A low ratio indicates that the company is not overly indebted. A high ratio indicates that the company has high debt levels and, as a result, may receive a lower credit rating forcing the company to offer higher yields on bonds. In general, a net debt/EBITDA ratio above 4 or 5 is considered high and is seen as a red flag raising concerns for rating agencies, investors, creditors and analysts. However, the ratio varies significantly between sectors.

In fact, AIDA counts this ratio as part of the onerous debt (only banks and other lenders excluding bonds and shareholders)/Ebitda.

8 Per capita added value, calculated as added value per employee, should be interpreted as an indicator of company efficiency and development. From a comparative and temporal perspective, this index makes it possible to establish a relationship between wealth produced by the company and the number of employees. In some respects, it also makes it possible to assess the effectiveness of the business model, i.e. the company's ability to generate value with its transformation processes (Silvi, 2012). From another perspective, the increase in this indicator reflects the constant improvements brought about by productivity growth associated with the introduction of innovations and the exploitation of various types of economies.





6. Results

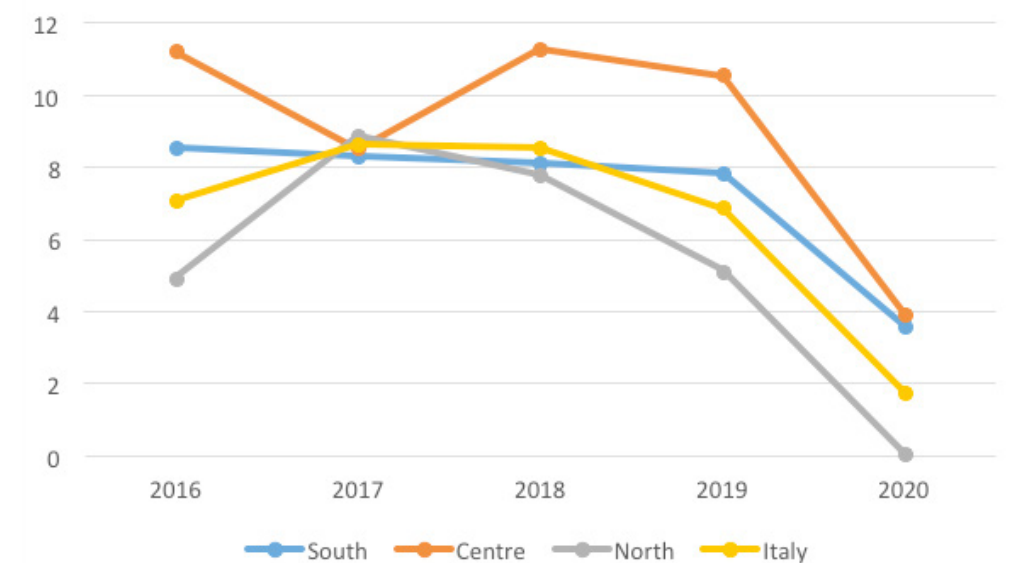
6. Results

With regard to profitability, the ROE trend was essentially stable over the five-year period, except in 2020, when the heavy effects of the pandemic became apparent (Figs. 1-3). The impact of Covid is particularly evident, reaching a negative result for micro-enterprises; while it seems to be more uniform at the territorial level, although it primarily affected service sector enterprises.

Enterprises located in central Italy show the best performance; as the size increases, performance improves, and industrial enterprises show a higher average value than those in the service sector. The absolute values, however, are not despicable considering the economic period. Beyond the impact of the pandemic, Innovative SMEs show high profitability. Interestingly, the trends of this indicator are in line with the Migliaccio and Pavone's (2021) survey on the economic-financial performance of innovative start-ups. Also, with regard to ROI (Figs. 4-6), the highest values are also found for companies in the Centre, in particular for larger companies operating in the advanced service sector. In this case, however, the ROI of industrial companies is equal to that of companies in the advanced tertiary sector. Overall, ROI appears lower than ROE, reflecting favourable leverage. In practical terms, this occurs when the return on investment is higher than the return on debts. Therefore, either the return on investment in innovative activities is very high, or the return on debt is assumed to be particularly low due to the subsidies (Bedu and Vanderstocken, 2020).

Moreover, the ROI trend appears more stable than the ROE trend. However, a clear decline in gross profitability in 2020 is noticeable; it nevertheless remains at consistently positive levels.

Figure 1. ROE by geographical macro-area



6. Results

Figure 2. ROE by company size

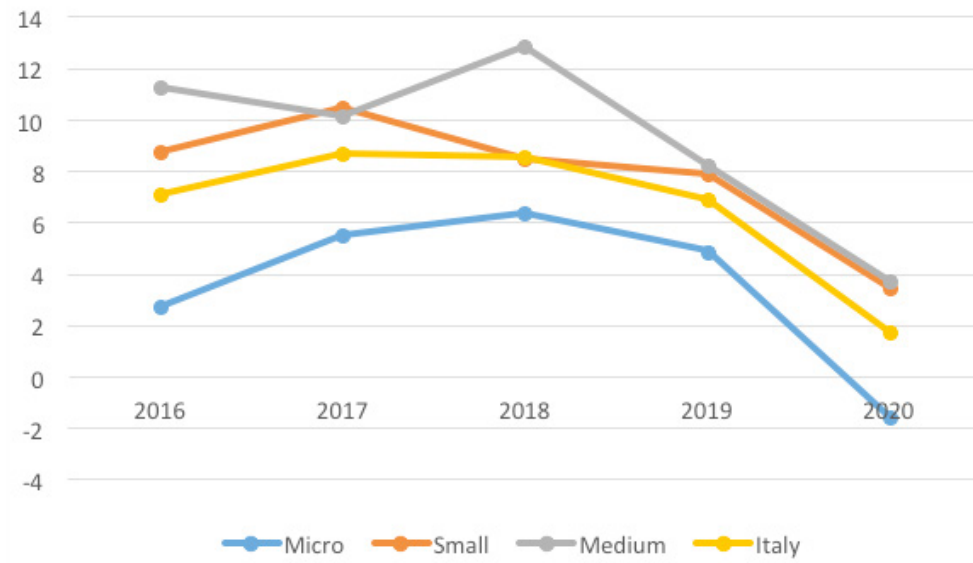


Figure 3. ROE by company activity sector

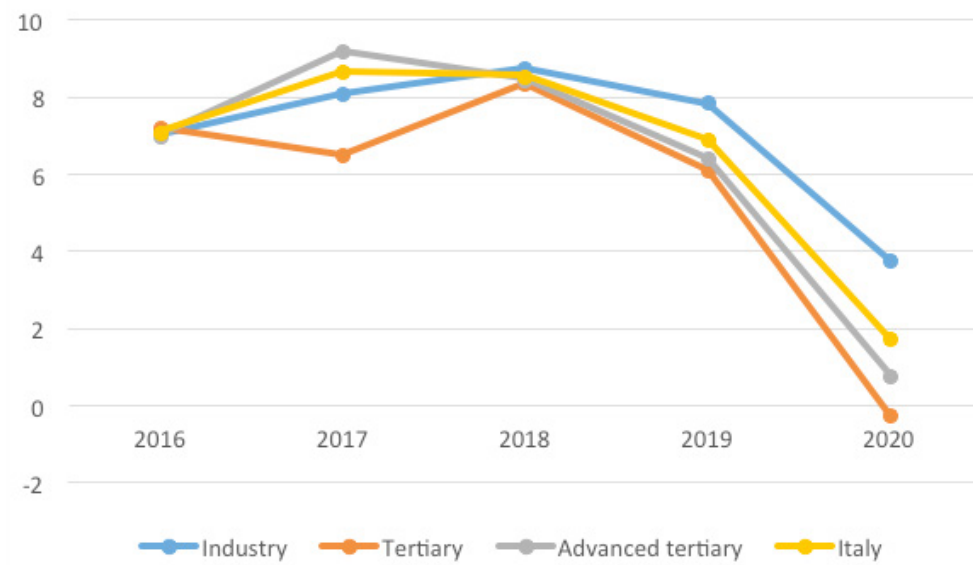
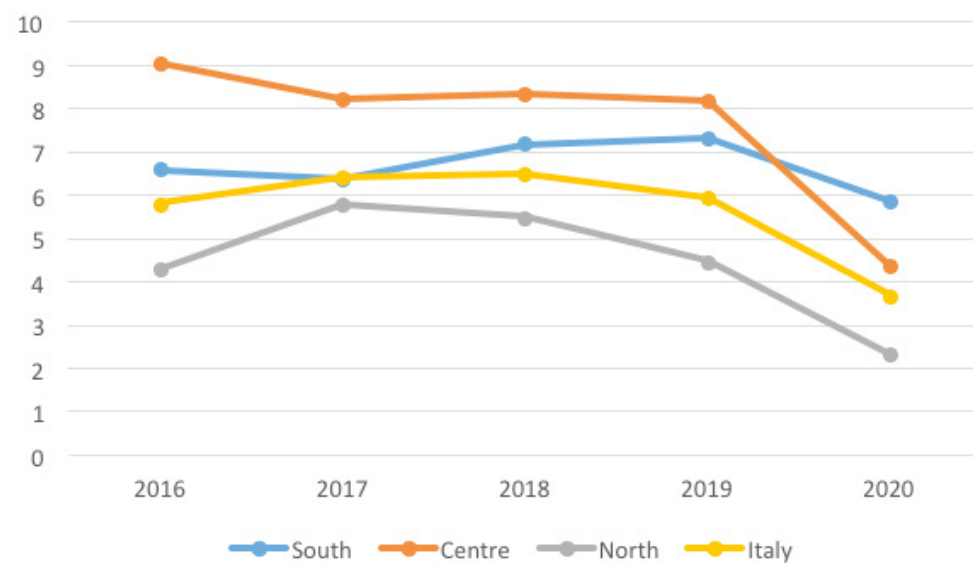


Figure 4. ROI by geographical macro-area



6. Results

Figure 5. ROI by company size

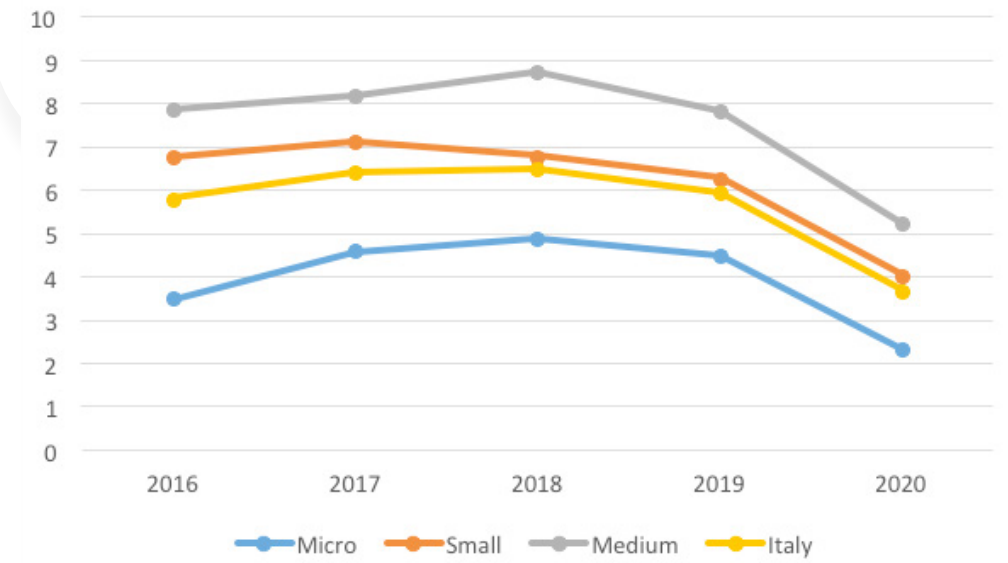
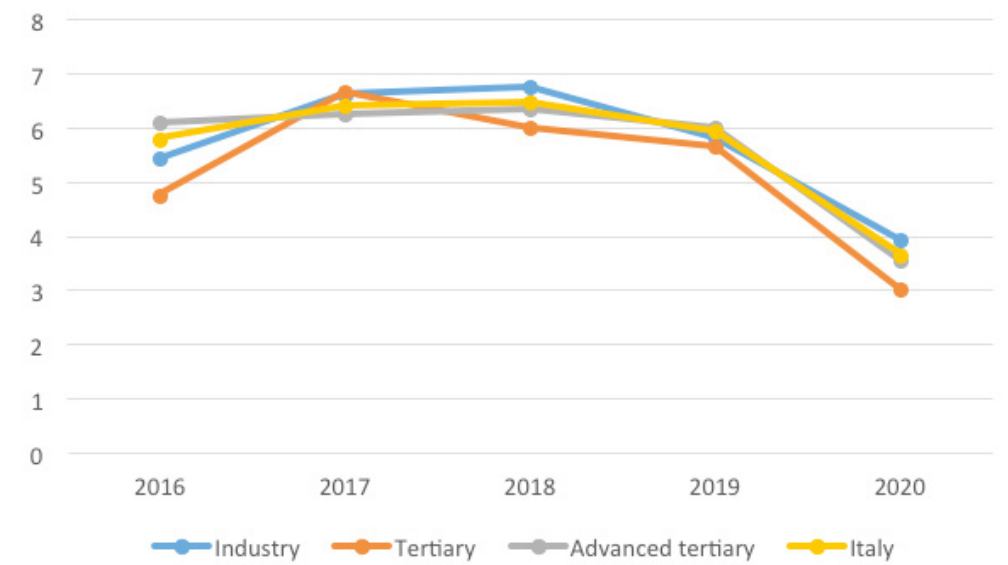


Figure 6. ROI by activity sector



From the ratio of current income to current expenditure, it is clear that the former are always higher than the latter, with an improving trend (Figs. 7-9). This suggests the good health of SMEs in terms of solvency. The highest index values are found for SMEs in the South, for micro-enterprises and, in particular, for enterprises operating in the advanced service sectors. This value, consistent with the findings of Migliaccio and Pavone (2021), suggests a positive effect of the benefits and concessions enjoyed by innovative SMEs.

6. Results

Figure 7. Liquidity ratio by geographical macroarea

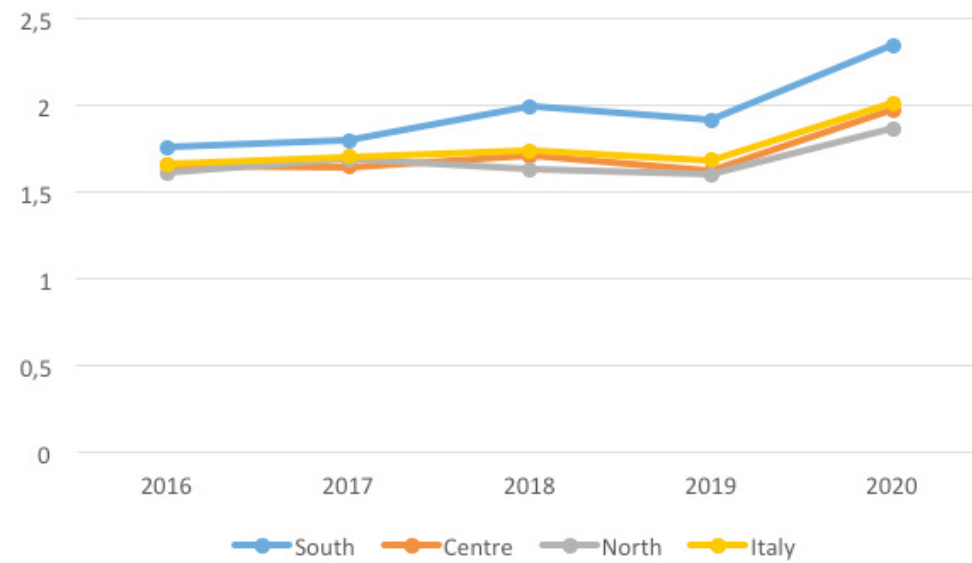


Figure 8. Liquidity ratio for activity sector

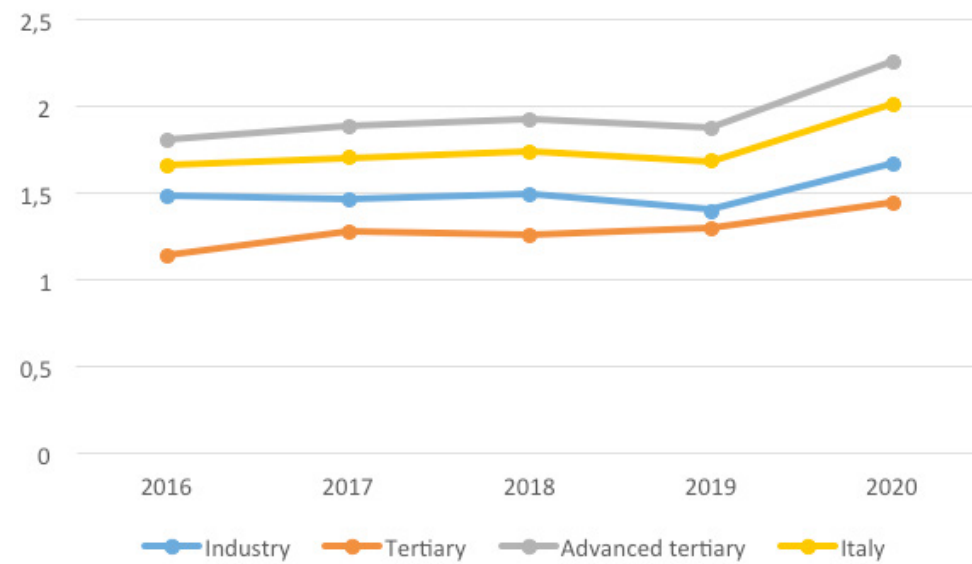
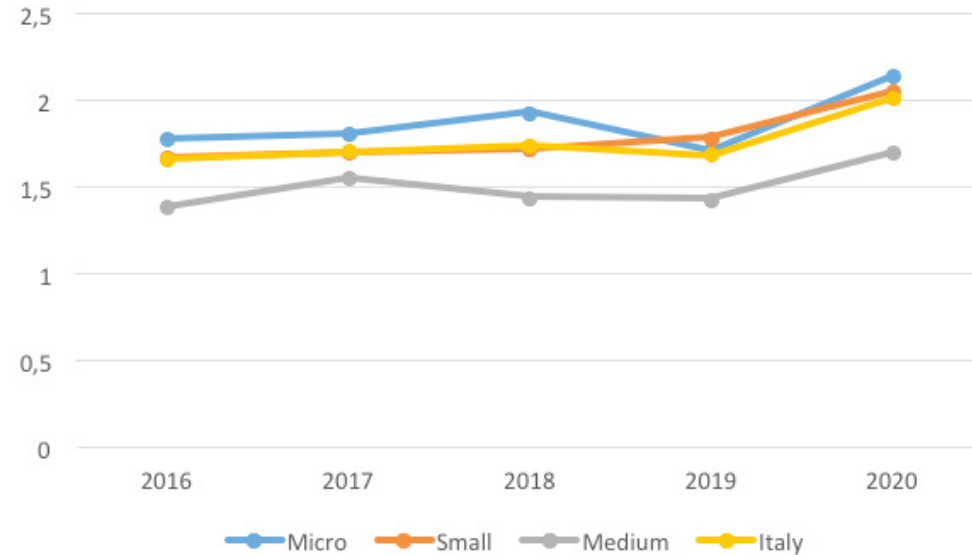


Figure 9. Liquidity ratio for company size



6. Results

With regard to the net debt/EBITDA ratio (Figs. 10-12), innovative SMEs show an interesting dynamic, since the values are not particularly high compared to the theoretical threshold of 4-5. Moreover, these values appear to be homogeneous and constant over time, even for 2020, when one could expect a decrease in EBITDA and, as a consequence, an increase in the ratio. A slightly more pronounced decline in the index affects SMEs located in Central Italy, medium-sized and operating in the traditional service sector. On average, the best values are obtained by the innovative SMEs in the Centre, the micro-enterprises and those operating in the advanced tertiary sector, without any particularly large differences.

Figure 10. Debt/EBITDA ratio by geographical macro area

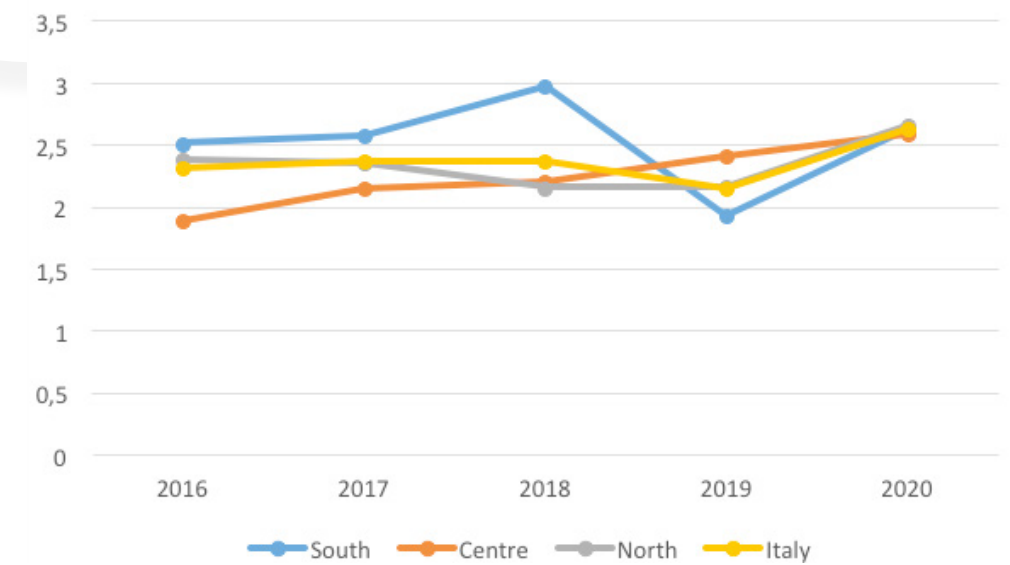
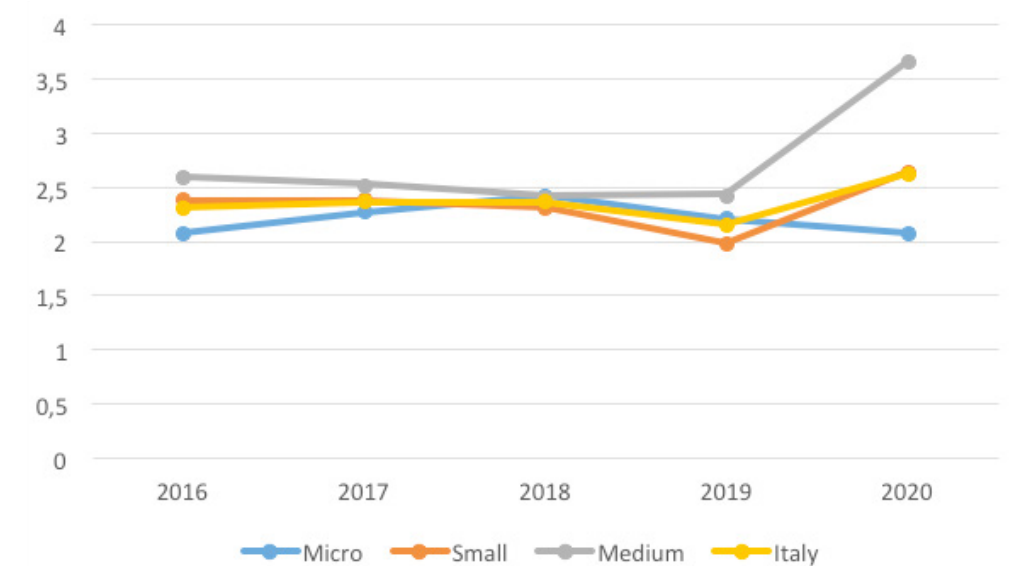
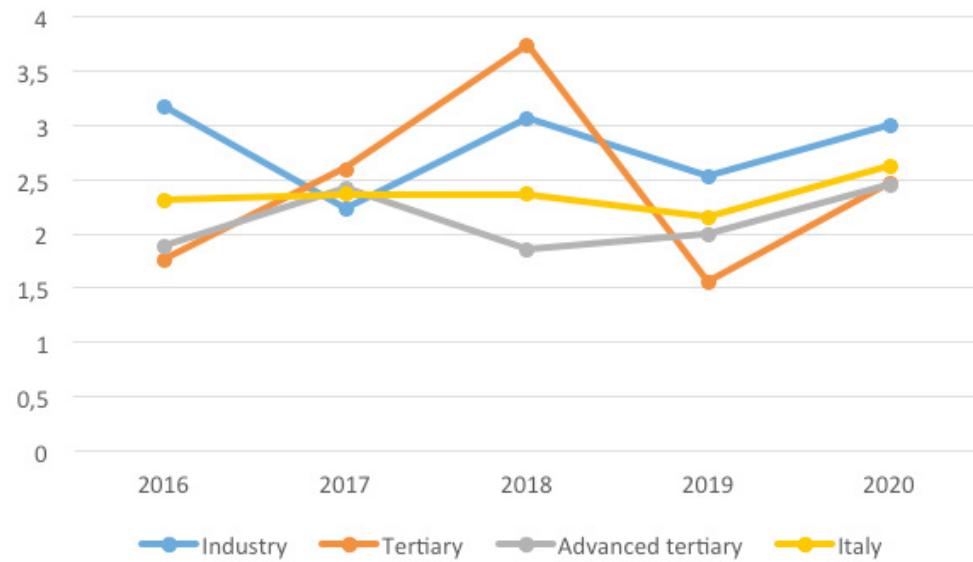


Figure 11. Debt/EBITDA ratio by company size



6. Results

Figure 12. Debt/EBITDA ratio by activity sector



Capitalisation ratios are quite homogeneous and appear to be slightly increasing over time, denoting an improvement in the financial structure from what can currently be defined as an unbalanced situation (Figs. 13-15). This is probably due to the effect of obtaining subsidies and facilities that reduce the need to increase traditional debt exposure. It is noteworthy that the ratio seems to improve everywhere, even in 2020, the year of the Covid pandemic; this is probably a consequence of the loss of asset value that may have reduced the amount of assets, rather than an increase in equity. The traditional tertiary sector has the greatest imbalances because they are companies that generally need a lower capitalisation from their shareholders against a lower volume of tangible investments. On the other hand, no major differences emerge between territorial areas, with SMEs in the Centre having the best indicator, or according to the size of the SMEs; however, larger innovative SMEs are favoured.

Interestingly, the trend of this indicator is opposite to that found by Migliaccio and Pavone (2021). This confirms the scholars' view that, since they are not fully structured, start-ups cannot be equated tout court with SMEs in terms of entrepreneurial policies and the creation of the related environment-system (Passaro et al., 2016). It is, therefore, fair to consider them as two separate categories.

6. Results

Figure 13. Financial independence index (%) by geographical macro area

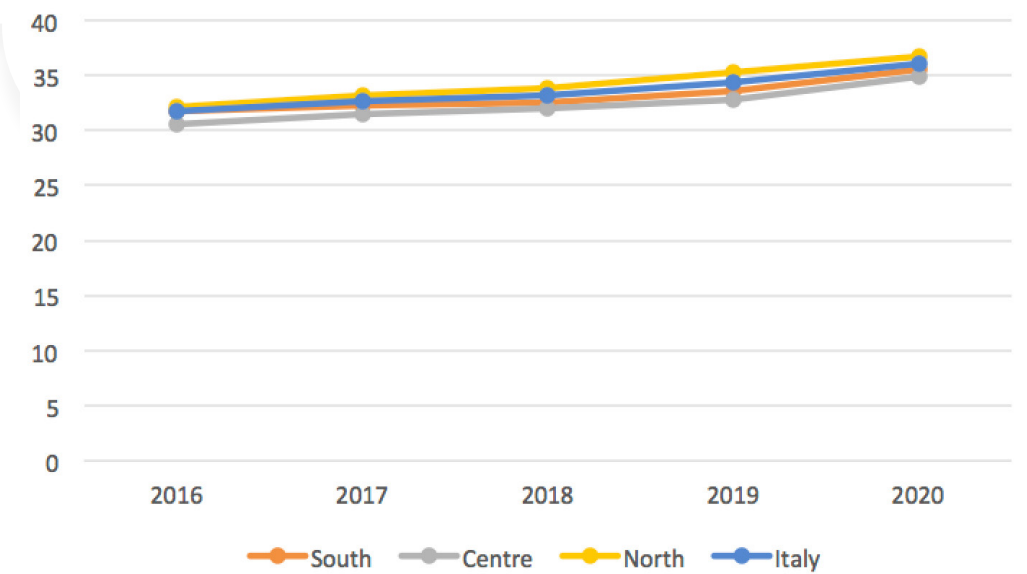


Figure 14. Financial independence index (%) by company size

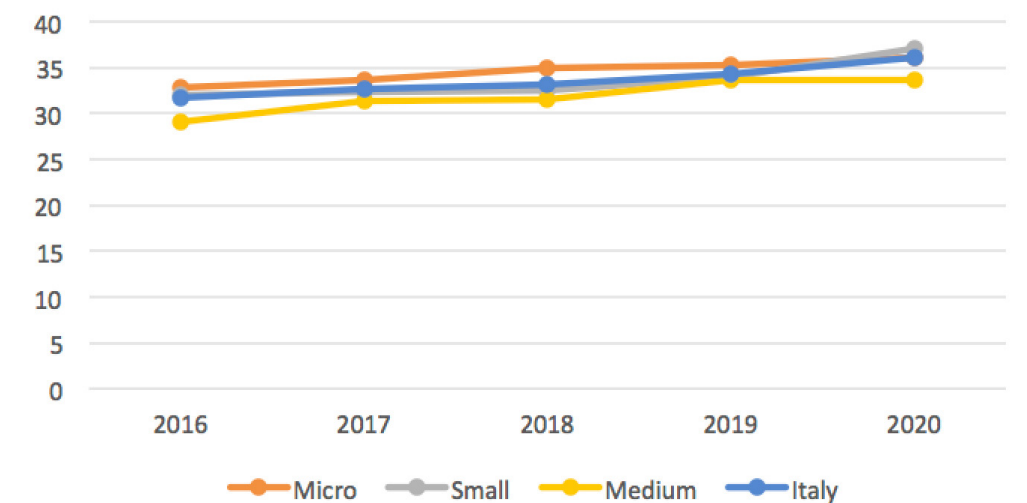
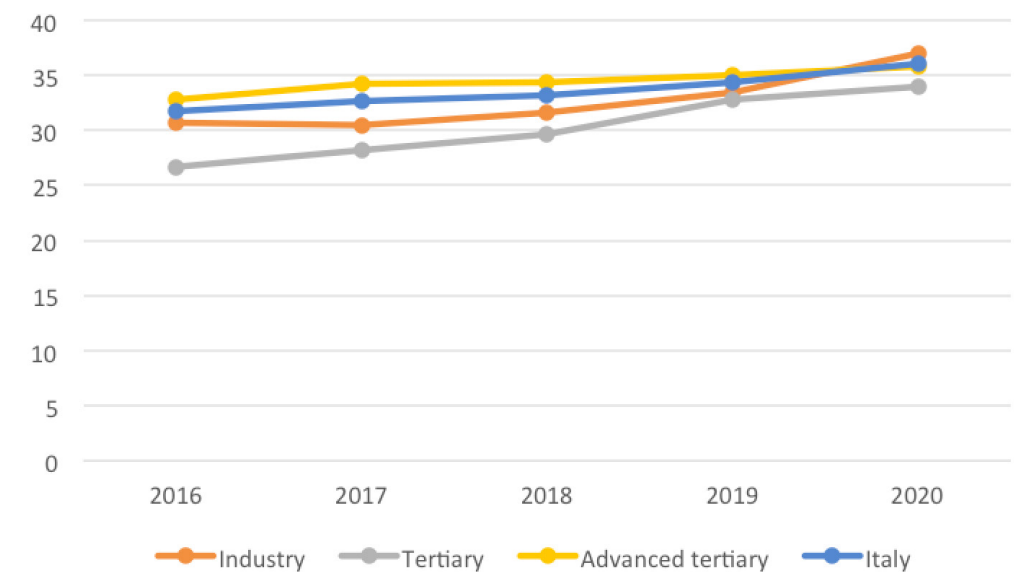


Figure 15. Financial independence index (%) by activity sector



6. Results

The fixed asset coverage ratio (Figs. 16-18), i.e. the ratio of tangible assets/equity, should theoretically be equal to or less than unity (or 100 per cent), attesting that with the equity inextricably linked to the company at least tangible assets are covered. This ratio is clearly improving for all types of SMEs, even in 2020. For the latter year, however, the improvement could also be due to a reduction in investments.

In absolute terms, the fixed asset coverage ratio is lower for SMEs in the advanced tertiary sector. The latter frequently perform knowledge-intensive services and, therefore, need lower fixed assets. As expected, the tertiary sector has the best values, given the lower average level of fixed assets. Central Italian companies have better values than the Italian average. The trends for this indicator are also somewhat in line with those for the start-up survey mentioned above (Migliaccio and Pavone, 2021).

Figure 16. Fixed Assets Coverage Ratio by geographical macro area

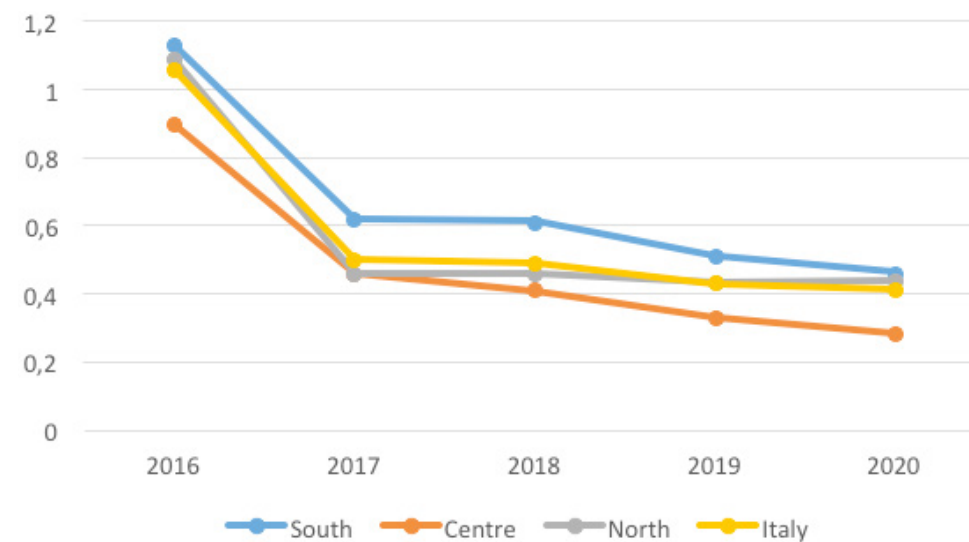
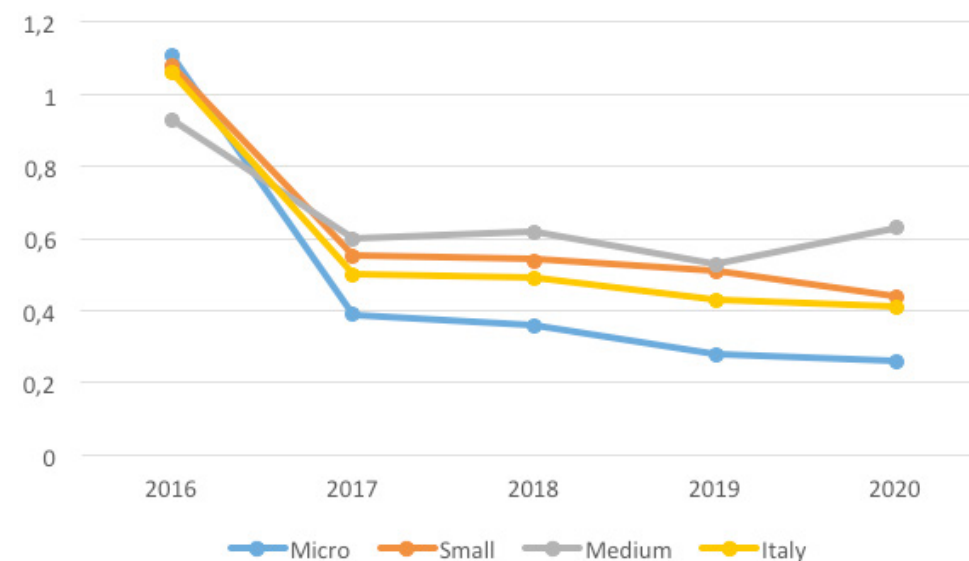
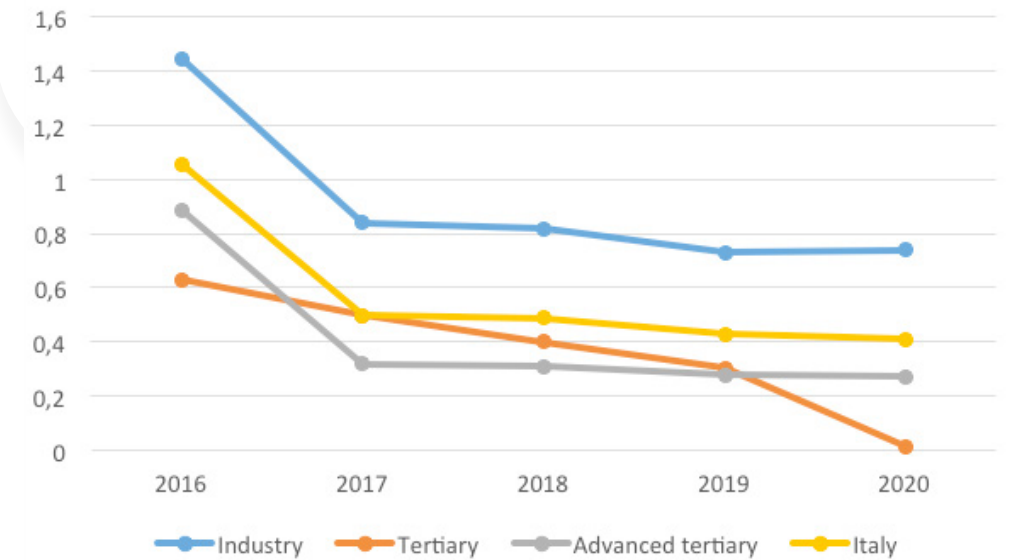


Figure 17. Fixed Assets Coverage Ratio by company size



6. Results

Figure 18. Fixed Assets Coverage Ratio by activity sector



The debt equity ratio – the ratio of net invested capital to net worth (Figs. 19-21) – does not appear particularly attractive, being almost always above unity and also above the corresponding values in a similar survey in the Milan context (Brunetti and Minoja, 2000). However, it tends to improve, except in 2020. A debt-equity ratio equal to 1 denotes that investors and creditors have an equal stake in the business. A value above 1 indicates that creditors have financed more than investors; in this case, companies are considered ‘highly indebted’ since they mainly use debt to finance their business.

With regard to company size and geographical macro area, there are no important differences in debt equity ratios, although the best situation characterises innovative micro-enterprises and those located in the North, while companies in the traditional service sector are clearly the most indebted

Figure 19. Debt equity ratio by geographical macro-area

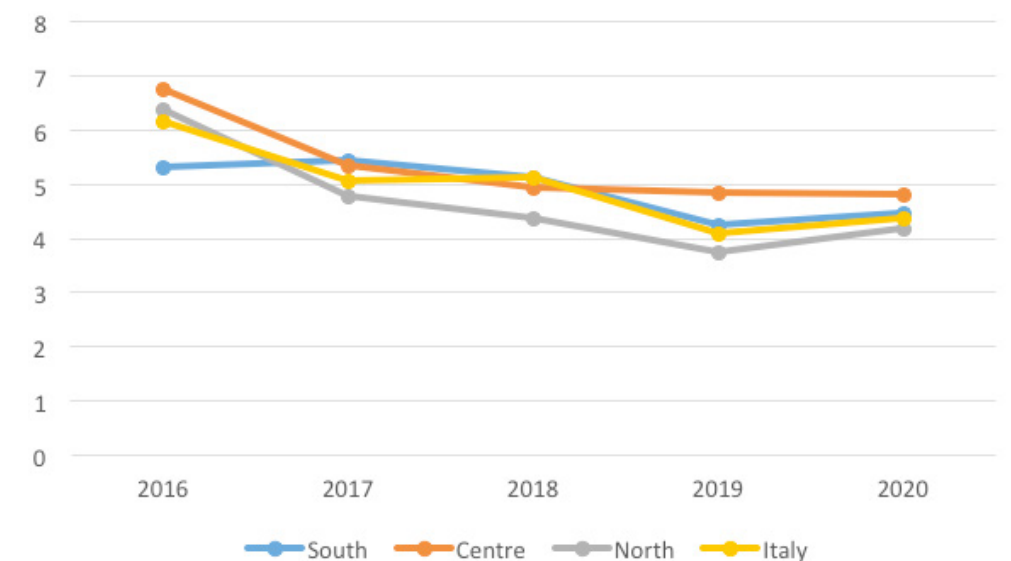


Figura 20. Debt equity ratio by company size

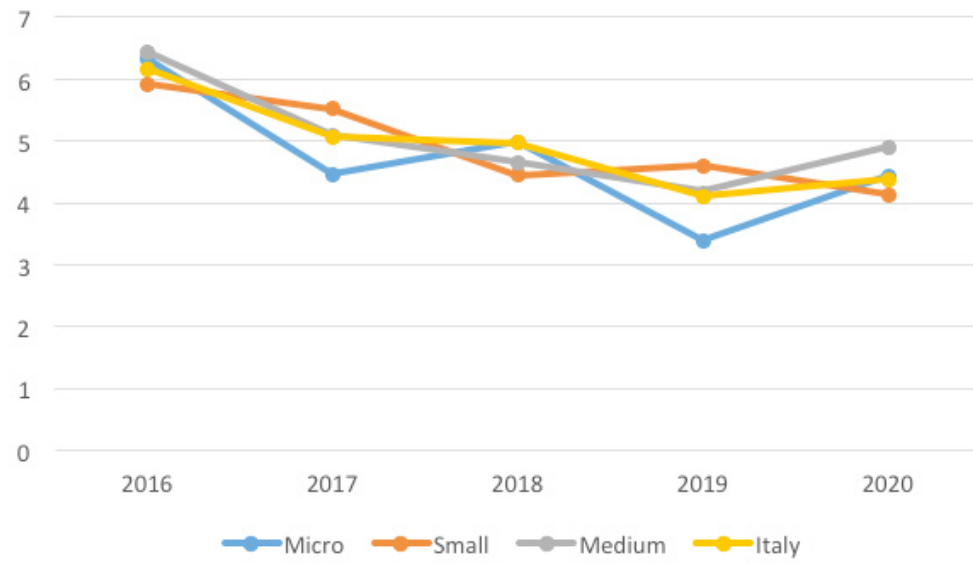
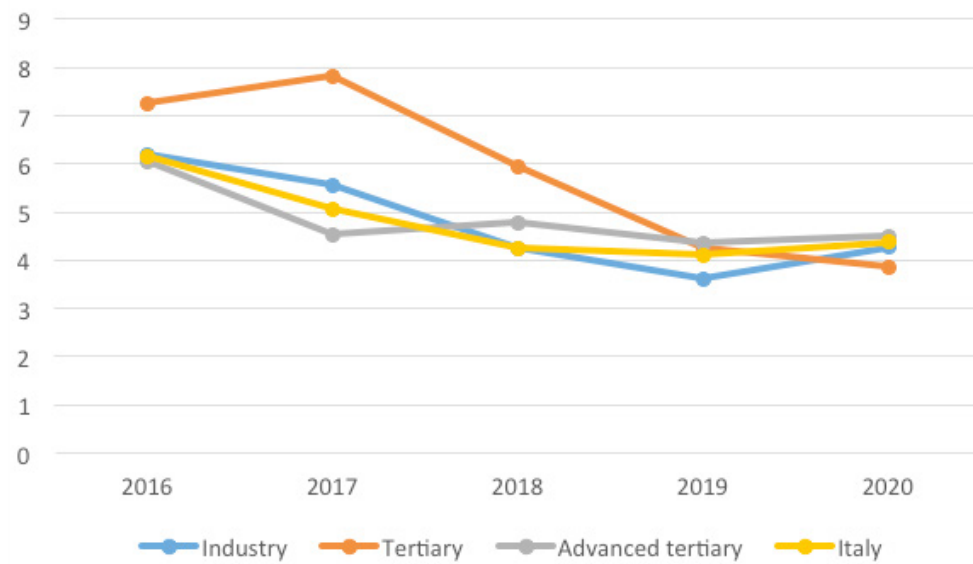


Figura 21. Debt equity ratio by activity sector



The analysis of the added value per capita shows that productivity is everywhere increasing over time, as a presumable effect of innovations (Figs. 22-24). Only in 2020, due to the marked Covid, productivity appears to be declining; a presumable effect of falling sales with the same number of employees.

While there are no differences at the territorial level, micro enterprises have a significantly lower productivity than larger units, just as the industrial sector has higher values than the tertiary sector.

Figure 22. Value added per capita by activity sector

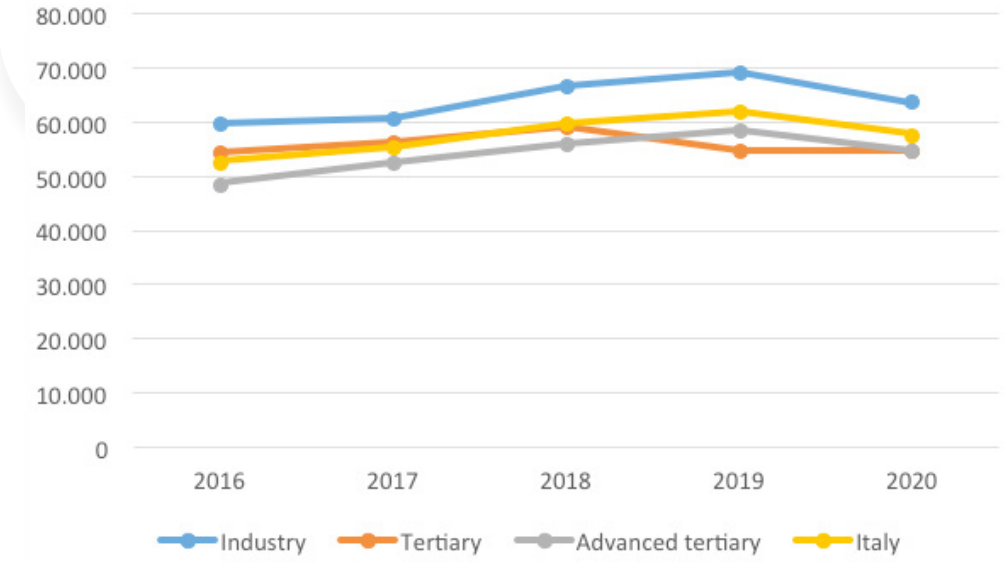


Figure 23. Value added per capita by company size

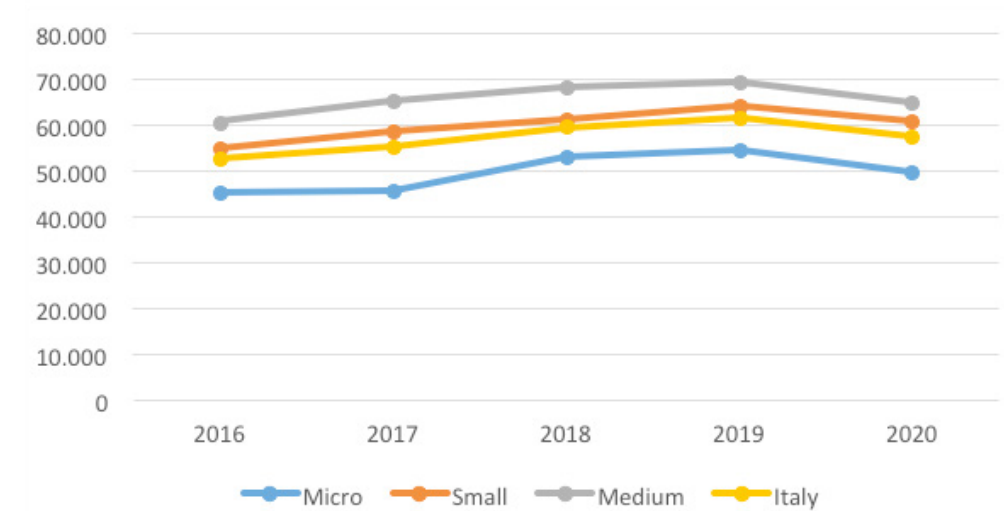
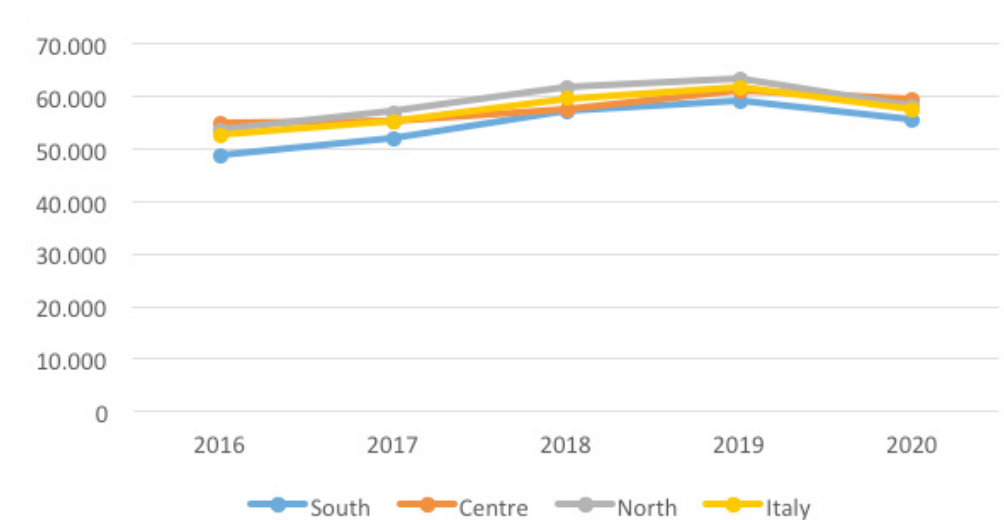


Figure 24. Value added per capita by geographical macro-area



6. Results

6.1 Profitability and performance by legal form

First of all, it can be seen that over the last five years, limited liability companies have proven to be more profitable than joint-stock companies. The few other companies with a different legal form show a much lower level of profitability. Joint-stock companies, however, retain a distinct advantage in terms of productivity gains. With regard to capital and financial strength, solvency and the coverage ratio of fixed assets appear aligned for all legal forms, with a slight prevalence of joint-stock companies in both cases. With regard to the debt equity ratio, on the other hand, joint-stock companies show a high debt position, but significantly better than limited liability companies. The financial independence index confirms a better situation for joint-stock companies, whose equity value covers a higher proportion of assets. Finally, with regard to the Debt/EBITDA ratio, limited liability companies present a slightly better situation than joint-stock companies probably due to the higher profitability as well as the presumably lower level of debt because their activities are less material capital-intensive and more intellectual capital-intensive.

Figure 25. ROE by legal form

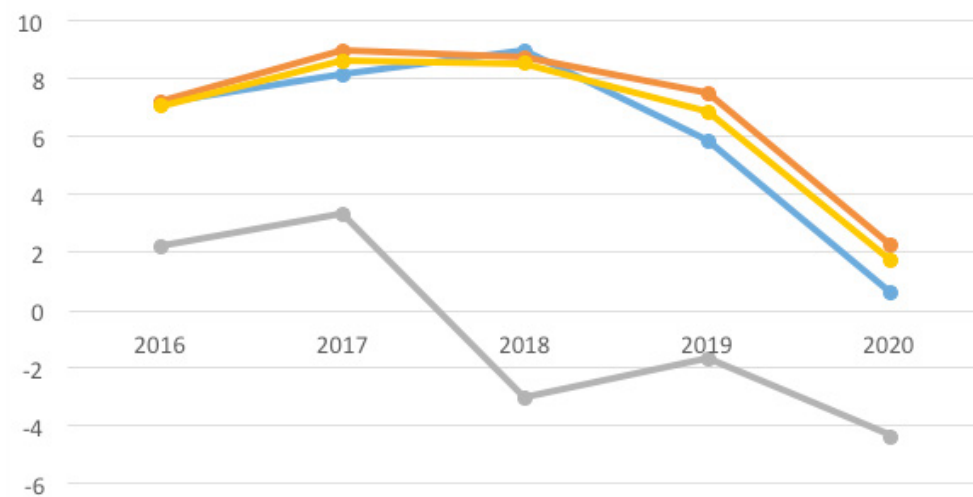
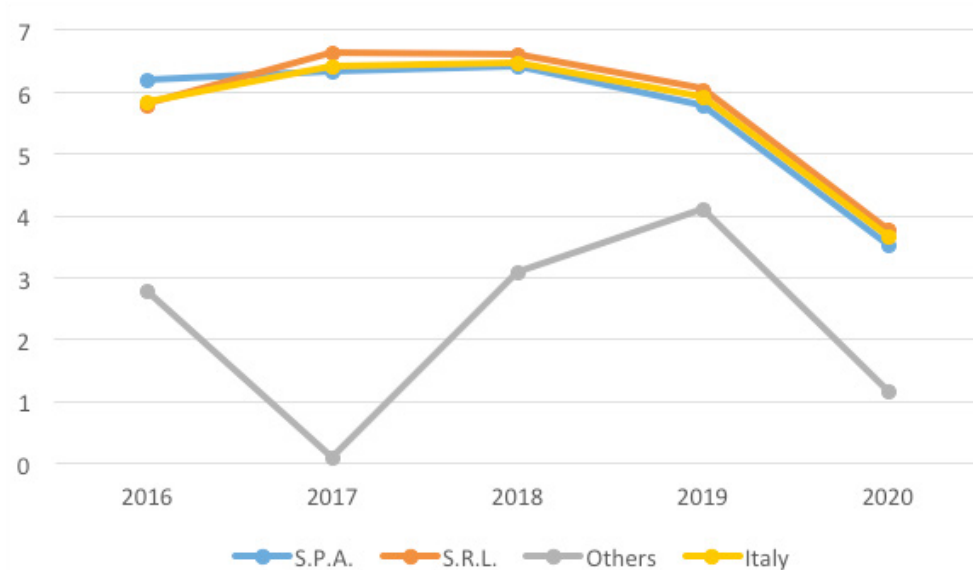


Figure 26. ROI by legal form



6. Results

Figure 27. Liquidity ratio by legal form

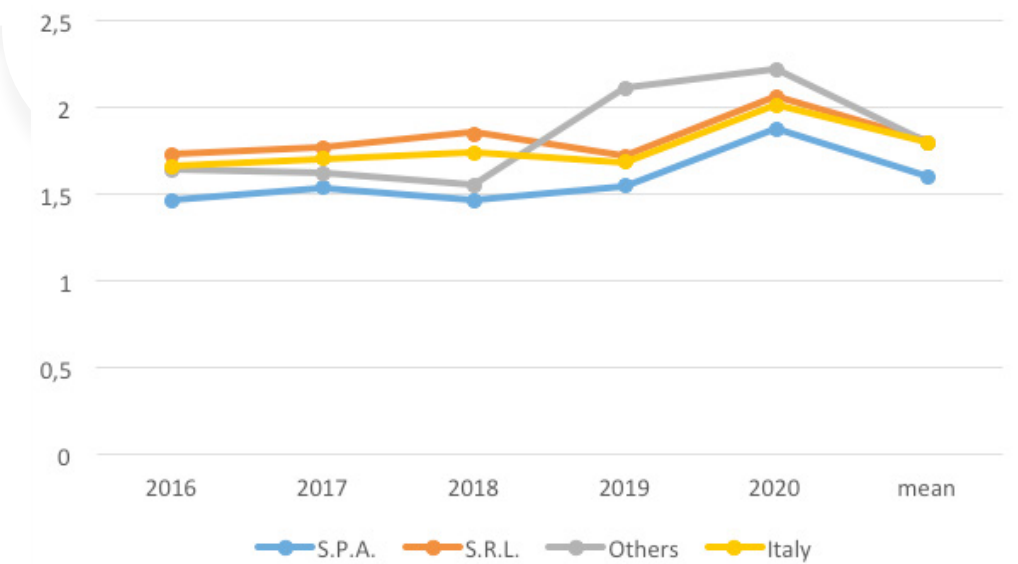


Figure 28. Coverage Ratios of Fixed Assets by legal form

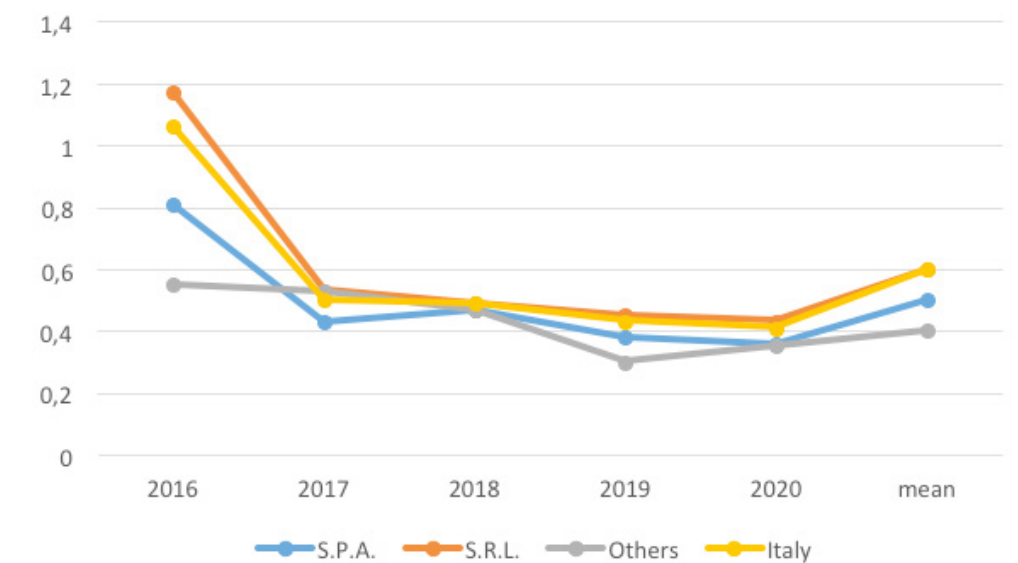
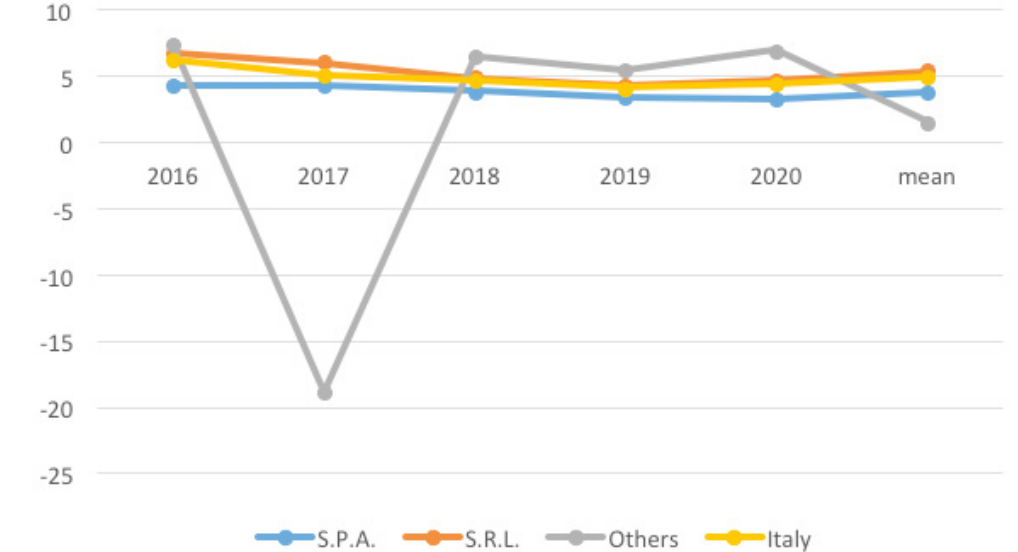


Figure 29. Debt equity ratio by legal form



6. Results

Figure 30. Financial independence index by legal form

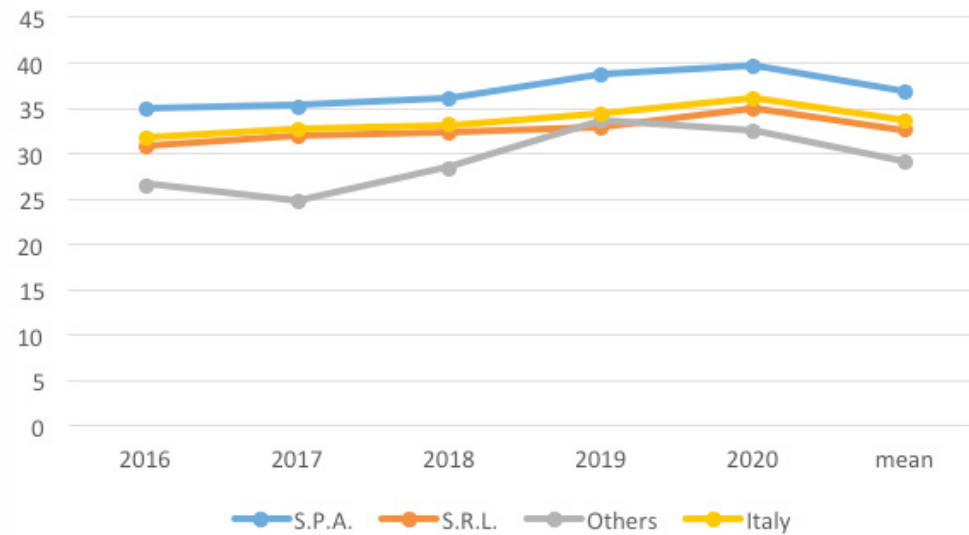


Figure 31. Debt/EBIDTA ratio by legal form

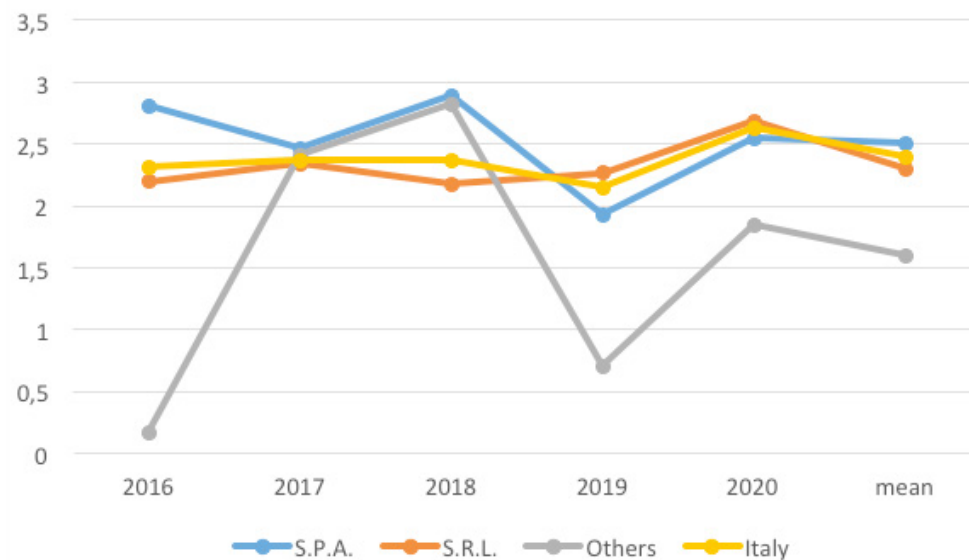
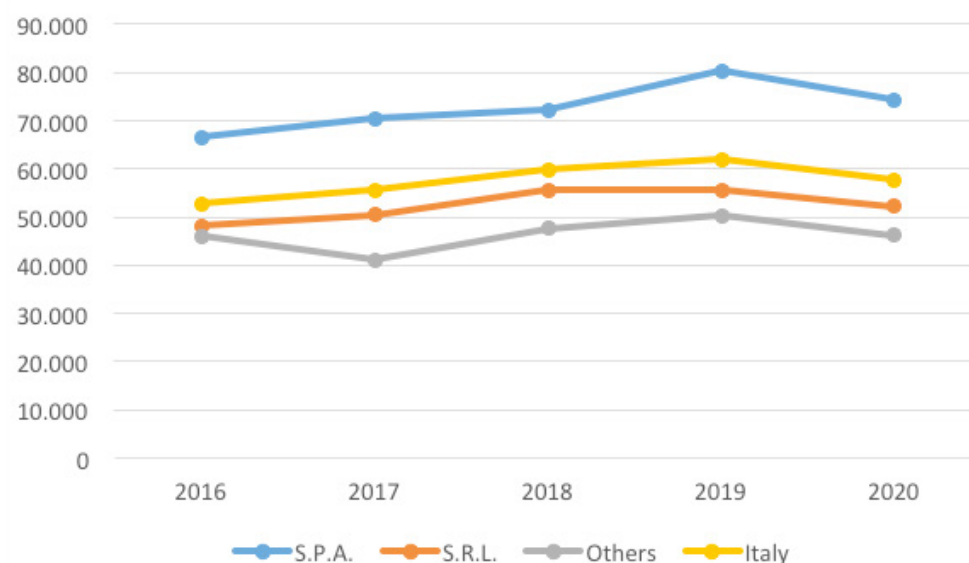


Figure 32. Value added per capita by legal form



7. Analysis of Variance ANOVA

7. Analysis of Variance – ANOVA

Taking into account the three main structural variables considered so far – company size (micro, small, medium), macro area (Northern, Central and Southern Italy), and activity sector (industry, tertiary, advanced tertiary) – the analysis of variance (ANOVA) was performed to assess whether the average performance of innovative SMEs is significantly different among the homogeneous groups of enterprises formed with respect to the above-mentioned characteristics. ANOVA evaluates the variability within and between groups, starting from the average values (μ_i) of each ratio. Univariate ANOVA models (only one dependent variable) can be classified according to the number of independent variables: *i*) one-way ANOVA if only one independent variable is involved; *ii*) factorial design when it involves two or more independent variables.

The one-way ANOVA is the simplest scheme for the simultaneous comparison of averages. In practice, it implicitly assumes that the variability of the groups to be compared is given solely by the levels of the one grouping factor. In such a case, for each observation y_{ij} , the model can be written as follows:

$$y_{ij} = \mu + \alpha_i + \varepsilon_{ij}$$

where μ is the overall average, α_i is the group effect (level i of the independent variable), which is constant within the group, ε_{ij} is the residual component, specific to each unit. The ANOVA procedure tests the null hypothesis (H_0) that the means of the groups are equal to each other. It can therefore be stated:

$$H_0 = \mu_1 = \mu_2 = \dots = \mu_i = \dots = \mu_{\text{overall}}$$

against the alternative hypothesis that the group averages are different. Statistically, if all averages are equal, then the distributions of the three groups are similar and, consequently, the performance indices within the groups have a similar distribution.

The ANOVA methodology is based on the decomposition of the total deviance of the dependent variable in deviance *between* groups (with $k-1$ degree of freedom, where k is the number of groups) and deviance *within* groups (with $n-k$ degree of freedom, where n is the total sample size). The respective variances (*between* and *within*) are obtained by dividing each deviance by the degrees of freedom (df). The ratio between the two variances (*between/within*) follows an F-distribution with $k-1$ and $n-k$

7. Analysis of Variance ANOVA

degrees of freedom and makes it possible to assess how much of the overall variability of the dependent variable is due to the classification factor.

It is often useful to consider more variability factors, both to analyse the effects of multiple causes simultaneously and to reduce the error variance by isolating the effects due to other causes. The two-way ANOVA procedure allows one to check, simultaneously and independently, the significance of the differences between the averages of the first factor (A) and between the averages of the second factor (B), as well as the effect due to the interaction of the two factors.

The aims and methods of the two-way ANOVA can easily be extended to three or more classification criteria. In general, with k factors, it is possible to test k null hypotheses, with as many two-sided alternative hypotheses. For this purpose, it is necessary to calculate the k variances, to perform k F-tests against the variance of the error.

In this study, we performed a three-way ANOVA ($k=3$) to assess the role of the three main structural characteristics of innovative SMEs (company size, macro area, activity sector) on the eight indicators considered (ROE, ROI, liquidity index, asset coverage ratio, debt equity ratio, financial independence ratio, Debt/EBITDA, added value per capita). The three-way ANOVA procedure allows analysing the contribution of the three main factors and the contribution of their two- and three-factor interactions. Therefore, the three-way ANOVA test allows testing three null hypotheses with respect to the three main effects (the group averages are equal) with as many alternative hypotheses (group averages are significantly different from each other).

For each observation y_{ijk} , the model can be written as follows:

$$y_{ijk} = \mu + \alpha_i + \beta_j + \gamma_k + R_{ijk}$$

where μ is the overall mean, α_i , β_j and γ_k represent the independent effects of the three factors, in their levels, R_{ijk} represents all other factors not considered, added to the random variation and measurement and sampling errors, as well as all possible interactions between the three factors.

Taking the size class of innovative SMEs based on the number of employees with three levels (micro, small, and medium) as the first classification factor, the null hypothesis (H_0) of equality of averages is as follows:

$$H_0 = \mu_{micro} = \mu_{small} = \mu_{medium} = \mu_{overall}$$

7. Analysis of Variance ANOVA

with alternative hypothesis (H_1) that not all μ of the three levels are equal to each other.

Considering the geographical macro area where innovative SMEs are located with three levels (Southern, Central, and Northern Italy) as the second classification factor, the null hypothesis of equality of averages is:

$$H_0 = \mu_{South} = \mu_{Centre} = \mu_{North} = \mu_{overall}$$

with alternative hypothesis (H_1) that not all μ of the three levels are equal to each other.

Taking into account the activity sector in which innovative SMEs operate with three levels (industry, tertiary, and advanced tertiary) as the third classification factor, the null hypothesis (H_0) of equality of averages is:

$$H_0 = \mu_{industry} = \mu_{tertiary} = \mu_{advanced\ tertiary} = \mu_{overall}$$

with alternative hypothesis (H_1) that not all μ of the three levels are equal to each other.

Therefore, the three-way ANOVA test allows the null hypotheses for each of the three main effects (group averages are equal) to be tested with as many alternative hypotheses (group averages are significantly different from each other). That is, whether the performance indicators are significantly different among the three subgroups of innovative SMEs and whether this difference can be attributed to a specific structural characteristic of the enterprises (i.e. size class, geographical location or activity sector) rather than to their interaction.

The three-way ANOVA methodology requires:

- The total deviance with $n - 1$ degrees of freedom
- The deviance *between* the levels of the first factor with $p - 1$ degrees of freedom
- The deviance *between* the levels of the second factor with $k - 1$ degrees of freedom
- The deviance *between* the levels of the third factor with $g - 1$ degrees of freedom
- The deviance *within* with $(p - 1) \cdot (k - 1) \cdot (g - 1)$ degrees of freedom

The respective variances are obtained by dividing each deviance by the degrees of freedom. The F-test consists of comparing, by means of the ratio of each variance between and variance within, the variance of the three factors separately with the error variance.

7. Analysis of Variance ANOVA

interaction effects. The main effect represents the average effect of an independent variable on the dependent variable, regardless of the values of the other independent variables. The interaction represents the effect of an independent variable on the dependent variable that is not the same for all levels of the other independent variables. In practice, the three-way ANOVA allows testing three more null hypotheses, namely, that the groups formed by the two-factor interactions show the same average, and a fourth null hypothesis that the groups formed by the three-factor interaction show the same average, against the alternative hypotheses that the averages are significantly different from each other.

7.1 Pairwise comparison

The ANOVA procedure cannot detect the exact source of variability. In other words, the significance of the ANOVA test allows one to establish that at least one mean is different from the others, but does not allow one to identify which one(s). therefore, once the null hypothesis has been rejected, more alternative hypotheses can be considered, i.e. made up of combinations of averages. In such cases, a pairwise comparison of all averages (Kramer, 1956; Tukey, 1949) is required to determine which averages are significantly different from each other.

In this study, we use Bonferroni method to identify which averages are significantly different from each other. In so doing, it involves a pairwise comparison of all averages. In other words, for each factor, Bonferroni method involves $m = \frac{k \cdot (k-1)}{2}$ possible pairs, where k is the number of factor levels. In our case, each factor (company size, macro area, activity sector) has three levels ($k=3$), so there are 3 pairwise differences to consider for each factor.

Once the values of alpha (α) has been selected, the idea is to divide this family wise error rate (α) among the k tests. Therefore, each test is done at the $\frac{\alpha}{k}$ level.

The t distribution helps determine the pairwise confidence interval. To start, we need to calculate the pooled variance, which is an estimate of the variance based on the k factor means, as follows:

$$s_p^2 = \frac{\sum(n_i - 1)s_i^2}{\sum(n_i - 1)}$$

7. Analysis of Variance ANOVA

The Bonferroni method says a pairwise difference between two factor levels (i and j) is significant if:

$$\frac{|\bar{y}_i - \bar{y}_j|}{s_p \sqrt{\frac{1}{n_i} + \frac{1}{n_j}}} > t_{df; \frac{\alpha}{2k}}$$

where t is the value from the t distribution with given degrees of freedom (df) and $\alpha/2k$ confidence, s_p is the pooled standard deviation, \bar{y} is the mean and n is the sample size. The confidence interval can be written as:

$$|\bar{y}_i - \bar{y}_j| > t_{df; \frac{\alpha}{2k}} \cdot s_p \sqrt{\frac{1}{n_i} + \frac{1}{n_j}}$$

The right-hand side of this equation is the critical value. Any difference in pair of means that is larger than this will be significant.



8. Analysis of Variance and pairwise comparisons: results

8. Analysis of Variance and pairwise comparisons: results

In this section, we discuss the main results of the three-way ANOVA test performed with regard to the three structural characteristics of innovative SMES (company size, macro area, activity sector) on the eight indicators considered. The ANOVA table is given for each indicator. The table is structured in six columns. The first column shows the different source of variability due to the first (company size), second (macro area) and third (activity sector) factor, respectively. The first column also shows the source of variability due to two- and three-way interaction effects. The second column (sum of squares) shows the deviance for each source, while the third column reports the degrees of freedom associated with each deviance. The fourth column shows the variance (mean of squares) obtained from the ratio of each deviance to the relative degrees of freedom. The last two columns show the F-statistics and the relative *p*-value.

For indicators on which ANOVA test was significant, pairwise comparison tables are provided to show which averages are significantly different from each other and, consequently, which factor level is more relevant in defining the performance of innovative SMEs in Italy.

8.1 Profitability ratios: Return on Equity (ROE) and Return on Investment (ROI)

Regarding Return on Equity (ROE), the three-way ANOVA confirms a significant difference with respect to one of the three main effects (Table 7). Therefore, the average performance in returns on equity was found to be significantly different at the 5% level among innovative enterprises of different size. No significant differences in the average performance in returns on equity were found among innovative SMEs classified by geographical macro area and activity sector. Similarly, no interaction effect was found to be statistically significant, neither two-way nor three-way.

Table 7. Three-way ANOVA – Return on Equity (ROE)

Source	Sum of squares	Df	Mean of squares	F	p-value
Company size	1884.35	2	942.17	3.993	0.019
Geographical macro area	319.43	2	159.72	0.677	0.509
Activity sector	103.10	2	51.55	0.218	0.804
Company size * Geographical macro area	1724.32	4	431.08	1.827	0.122
Company size * Activity sector	412.01	4	103.00	0.437	0.782
Geographical macro area * Activity sector	1026.23	4	256.56	1.087	0.362
Company size * Geographical macro area * Activity sector	1936.52	8	242.07	1.026	0.415
Error	139218.03	590	235.96		
Total	175035.36	617			

8. Analysis of Variance and pairwise comparisons: results

Therefore, it is inferred that the average level of return on equity is significantly different between small, medium and large-sized innovative SMEs. In particular, pairwise comparisons using Bonferroni's correction (Table 8) show that the average level of return on equity of innovative micro enterprise is significantly lower than the average level of ROE of innovative small and medium-sized SMEs. In contrast, the difference in the average level of return on equity between small and medium-sized enterprises is not significant.

Table 8. Pairwise comparisons – Return on Equity (ROE) vs. company size

Company size	Levels	Differences	St err	p-value	Lower bound (95%)	Upper bound (95%)
Micro	Small	-4.248***	1.384	.007	-7.570	-0.926
	Medium	-5.674***	1.764	.004	-9.909	-1.439
Small	Micro	4.248***	1.384	.007	0.926	7.570
	Medium	-1.425	1.694	1.000	-5.494	2.642
Medium	Micro	5.674***	1.764	.004	1.439	9.909
	Small	1.426	1.694	1.000	-2.642	5.494

Similar to the ROE, the three-way ANOVA shows only one significant difference in the averages of return on investment (ROI), which relates to the main effect of company size (Table 9). However, it is worth noting the significant two-way interaction effect at the 10% level between company size and geographical macro area.

Table 9. Three-way ANOVA – Return on Investment (ROI)

Source	Sum of squares	Df	Mean of squares	F	p-value
Size class	700.17	2	350.09	5.478	0.004
Geographical macro area	246.95	2	123.47	1.932	0.146
Activity sector	82.24	2	41.12	0.643	0.526
Size class * Geographical macro area	572.13	4	143.03	2.238	0.064
Size class * Activity sector	145.79	4	36.45	0.570	0.684
Geographical macro area * Activity sector	445.10	4	111.28	1.741	0.139
Size class * Geographical macro area * Activity sector	718.82	8	89.85	1.406	0.191
Error	37703.24	590	63.90		
Total	61083.83	617			

Pairwise comparisons show that the average level of return on investment (ROI) is significantly higher for small- and medium-sized innovative enterprises than for micro ones, while there are no significant differences between small- and medium-sized innovative SMEs (Table 10). These results are perfectly in line with those obtained for ROE.

8. Analysis of Variance and pairwise comparisons: results

Table 10. Pairwise comparisons – Return on Investment (ROI) vs. company size class

Company size	Levels	Differences	St err	p-value	Lower bound (95%)	Upper bound (95%)
Micro	Small	-2.241***	0.720	0.006	-3.970	-0.513
	Medium	-3.602***	0.918	0.000	-5.806	-1.398
Small	Micro	2.241***	0.720	0.006	0.513	3.970
	Medium	-1.361	0.882	0.370	-3.478	0.0756
Medium	Micro	3.602***	0.918	0.000	1.398	5.806
	Small	1.361	0.888	0.370	-0.756	3.478

As shown in Table 11, the significant two-way interaction effect between company size and geographical macro area also entails some significant differences in average levels of return on investment due to the different geographical location of innovative SMEs (not captured in the main effects of the ANOVA). In particular, ROI is significantly lower for innovative SMEs in Northern Italy than for those in the South and Centre. There are no significant differences in average ROI levels between innovative SMEs in Central and Southern Italy.

Table 11. Pairwise comparisons – Return on Investment (ROI) vs. geographical macro area

Macro area	Levels	Differences	St err	p-value	Lower bound (95%)	Upper bound (95%)
South	Centre	-0.958	0.965	0.964	-3.275	1.359
	North	2.195**	0.765	0.013	0.359	4.031
Centre	South	0.958	0.965	0.964	-1.359	3.275
	North	3.153***	0.853	0.001	1.106	5.201
North	South	-2.195	0.765	0.013	-4.031	-0.359
	Centre	-3.153***	0.853	0.001	-5.201	-1.106

8. Analysis of Variance and pairwise comparisons: results

8.2 Performance analysis: Liquidity ratio, asset coverage ratio, debt equity ratio, Financial independence index, Debt/EBIDTA

With regard to the liquidity ratio, the three-way ANOVA (Table 12) shows only one significant difference between the averages; this difference relates to economic activity. There are no significant differences in the average performance of the liquidity ratio with respect to the other main effects, i.e., size class and geographical macro area. No interaction effect was found to be statistically significant, neither two-way nor three-way.

Table 12. Three-way ANOVA – Liquidity ratio

Source	Sum of squares	Df	Mean of squares	F	p-value
Company size	0.93	2	0.465	0.369	0.691
Geographical macro area	2.35	2	1.173	0.931	0.395
Activity sector	22.87	2	11.436	9.076	0.000
Company size * Geographical macro area	1.92	4	0.479	0.380	0.823
Company size * Activity sector	2.83	4	0.707	0.561	0.691
Geographical macro area * Activity sector	3.50	4	0.875	0.694	0.596
Company size * Geographical macro area * Activity sector	7.43	8	0.929	0.737	0.659
Error	743.46	590	1.260		
Total	2731.88	617			

It can be inferred that the average level of the liquidity ratio depends significantly on the activity sector in which innovative SMEs operate. In particular, pairwise comparisons (Table 13) show that the average level of the liquidity ratio was consistently higher for innovative SMEs operating in the advanced tertiary sector than for innovative SMEs in both the industrial and tertiary sectors. In contrast, the difference in the average level of the liquidity ratio between innovative SMEs in the industrial sector is not significantly different from innovative SMEs operating in the tertiary sector.



8. Analysis of Variance and pairwise comparisons: results

Table 13. Pairwise comparisons – Liquidity ratio vs. activity sector

Activity sector	Levels	Differences	St err	p-value	Lower bound (95%)	Upper bound (95%)
Industry	Tertiary	0.219	0.205	0.855	-0.273	0.712
	Advanced tertiary	-0.451***	0.097	0.000	-0.684	-0.218
Tertiary	Industry	-0.219	0.205	0.855	-0.712	0.273
	Advanced tertiary	-0.670***	0.198	0.002	-1.147	-0.194
Advanced tertiary	Industry	0.451***	0.097	0.000	0.218	0.684
	Tertiary	0.670***	0.198	0.002	0.194	1.147

The three-way ANOVA shows only a significant difference between activity sector in the average levels of the **asset coverage ratio** (Table 14). On the other hand, there were no statistically significant differences between the averages of the asset coverage ratio with respect to company size and geographical macro area, just as there were no significant differences in the interaction effects, neither two- nor three-way.

Table 14. Three-way ANOVA – Asset coverage ratio

Source	Sum of squares	Df	Mean of squares	F	p-value
Company size	1.97	2	0.98	1.672	0.189
Geographical macro area	0.68	2	0.34	0.574	0.564
Activity sector	22.50	2	11.25	19.146	0.000
Company size * Geographical macro area	1.02	4	0.26	0.435	0.783
Company size * Activity sector	2.33	4	0.58	0.994	0.410
Geographical macro area * Activity sector	0.70	4	0.17	0.296	0.880
Company size * Geographical macro area * Activity sector	2.97	8	0.37	0.633	0.750
Error	346.64	590	0.59		
Total	603.73	617			

The averages of the asset coverage ratio depend significantly on the activity sector. Pairwise comparisons (Table 15) show that the average level of the asset coverage ratio was significantly higher for innovative SMEs in the industry sector than for those operating in both the tertiary and advanced tertiary sectors. In contrast, there is no significant difference in the asset coverage ratio between innovative SMEs in the tertiary sector and those in the advanced tertiary sector.

8. Analysis of Variance and pairwise comparisons: results

Table 15. Pairwise comparisons – Asset coverage ratio vs. activity sector

Activity sector	Levels	Differences	St err	p-value	Lower bound (95%)	Upper bound (95%)
Industry	Tertiary	0.546***	0.140	0.000	0.210	0.882
	Advanced tertiary	0.501***	0.066	0.000	0.342	0.660
Tertiary	Industry	-0.546***	0.140	0.000	-0.882	-0.210
	Advanced tertiary	-0.045	0.135	1.000	-0.370	0.280
Advanced tertiary	Industry	-0.501***	0.066	0.000	-0.660	-0.342
	Tertiary	0.045	0.135	1.000	-0.280	0.370

The three-way ANOVA shows no significant differences between the average levels of the **debt equity ratio** (Table 16). In other words, it can be stated that the debt equity ratio does not depend on company size, geographical macro area or activity sector. Just as there are no significant differences in the main factor, there were no differences in the interaction effects.

Table 16. Three-way ANOVA – Debt equity ratio

Source	Sum of squares	Df	Mean of squares	F	p-value
Company size	51.32	2	25.66	0.836	0.434
Geographical macro area	32.92	2	16.46	0.536	0.585
Activity sector	8.43	2	4.21	0.137	0.872
Company size * Geographical macro area	212.04	4	53.01	1.727	0.142
Company size * Activity sector	115.91	4	28.98	0.944	0.438
Geographical macro area * Activity sector	37.92	4	9.48	0.309	0.872
Company size * Geographical macro area * Activity sector	234.19	8	29.27	0.954	0.472
Error	18110.97	590	30.70		
Total	33334.19	617			

The three-way ANOVA shows only one significant difference in the averages of the **financial independence index** in the main effects, and this relates to company size at the 10% level (Table 17). However, it is interesting to note that while there were no significant differences with respect to the other two main factors (geographical macro area and activity sector) taken individually, there were significant differences in the average levels of the financial independence index when these factors interact with company size. In fact, the interaction effect between the three factors considered simultaneously was also statistically significant.

8. Analysis of Variance and pairwise comparisons: results

Table 17. Three-way ANOVA – Financial independence index

Source	Sum of squares	Df	Mean of squares	F	p-value
Company size	3497.28	2	1748.64	5.167	0.006
Geographical macro area	58.13	2	29.07	0.086	0.918
Activity sector	182.89	2	91.45	0.270	0.763
Company size * Geographical macro area	4035.92	4	1008.98	2.982	0.019
Company size * Activity sector	4532.61	4	1133.15	3.348	0.010
Geographical macro area * Activity sector	393.00	4	98.25	0.290	0.884
Company size * Geographical macro area * Activity sector	5087.43	8	635.93	1.879	0.061
Error	199661.88	590	338.41		
Total	906772.31	617			

The **financial independence index** depends on the size of innovative SMEs as well as its interaction with the geographical macro area and activity sector, both two- and three-ways. Pairwise comparisons (Table 18) show that the average level of the financial independence index was significantly higher for micro innovative enterprise than for small and medium-sized ones. Furthermore, there is also an advantage in the average levels of financial independence for small innovative enterprises compared to medium-sized ones.

Table 18. Pairwise comparisons

– **Financial independence index vs. company size**

Company size	Levels	Differences	St err	p-value	Lower bound (95%)	Upper bound (95%)
Micro	Small	0.973**	.489	0.023	0.883	1.063
	Medium	2.707**	1.340	0.021	2.405	3.009
Small	Micro	-0.973**	.489	0.023	-1.063	-0.883
	Medium	1.734**	0.818	0.017	1.557	1.911
Medium	Micro	-2.707**	1.340	0.021	-3.009	-2.405
	Small	-1.734**	0.818	0.017	-1.911	-1.557

The three-way ANOVA shows no significant differences between the average levels of the **debt/EBITDA** (Table 19). In other words, it can be stated that the debt/EBITDA does not depend on company size, geographical macro area or activity sector. Just as there are no significant differences in the main factor, there were no differences in the interaction effects.

8. Analysis of Variance and pairwise comparisons: results

Table 19. Three-way ANOVA – Debt/EBITDA

Source	Sum of squares	Df	Mean of squares	F	p-value
Company size	55.84	2	27.92	2.262	0.105
Geographical macro area	4.45	2	2.23	0.180	0.835
Activity sector	53.26	2	26.63	2.157	0.117
Company size * Geographical macro area	22.33	4	5.58	0.452	0.771
Company size class * Activity sector	51.07	4	12.77	1.034	0.389
Geographical macro area * Activity sector	15.45	4	3.86	0.313	0.869
Company size * Geographical macro area * Activity sector	44.21	8	5.53	0.448	0.892
Error	7283.39	590	12.35		
Total	10998.39	617			

8.3 Value added per capita

The variable 'valued added per capita' was first log-transformed before applying the ANOVA procedure. As shown in Table 20, the three-way ANOVA shows only one significant difference in the averages of valued added per capita that concerns the main effect of company size. There are no significant two- and three-way interaction effects.

Table 20. Three-way ANOVA – Value added per capita

Source	Sum of squares	Df	Mean of squares	F	p-value
Company size	8,22	2	4.11	11.380	.000
Geographical macro area	.60	2	.30	.835	.434
Activity sector	1.24	2	.62	1.712	.182
Company size * Geographical macro area	.35	4	.09	.243	.914
Company size * Activity sector	1.66	4	.42	1.152	.331
Geographical macro area * Activity sector	.82	4	.21	.569	.685
Company size * Geographical macro area * Activity sector	.99	7	.14	.391	.908
Error	208.82	578	.36		
Total	71108.89	604			

Pairwise comparisons (Table 21) show that the average level of added value per capita was significantly higher for small- and medium-sized innovative enterprises than for micro ones, while there are no significant differences between small- and medium-sized innovative enterprises.

Table 21. Pairwise comparisons – Value added per capita vs. company size

Company size	Levels	Differences	St err	p-value	Lower bound (95%)	Upper bound (95%)
Micro	Small	-.2762***	.05485	.000	-.4079	-.1445
	Medium	-.3983***	.06961	.000	-.5655	-.2312
Small	Micro	.2762***	.05485	.000	.1445	.4079
	Medium	-.1221	.06668	.203	-.2822	.0380
Medium	Micro	.3983***	.06961	.000	.2312	.5655
	Small	.1221	.06668	.203	-.0380	.2822

8. Analysis of Variance and pairwise comparisons: results

8.4 Insights on the legal form of innovative SMEs

In this section, we discuss the main results of the one-way ANOVA test performed with regard to the legal form chosen by innovative SMEs, i.e. joint stock companies, limited liability companies, other forms (cooperatives, consortium) on the eight indicators considered.

Results are reported for each indicator for which the ANOVA provides significant differences. Where appropriate, pairwise comparisons are also provided.

The average values of the liquidity ratio (Table 22), debt ratio (Table 24), financial independence ratio (Table 26) and value added per capita (Table 28) are significantly different among innovative SMEs with different legal forms. That is, it can be inferred that the average level of the liquidity ratio, debt ratio, financial independence ratio and value added per capita depend significantly on the legal form chosen by innovative SMEs.

Table 22. One-way ANOVA (legal form) – Liquidity ratio

Source	Sum of squares	Df	Mean of squares	F	p-value
Legal form	1909.043	3	636.348	481.385	.000
Error	805.042	609	1.322		
Total	2714.085	612			

In particular, as shown in Table 23, pairwise comparisons show that the average level of the liquidity ratio was consistently higher for innovative SMEs with limited liability than for joint stock companies. In contrast, the difference in the average level of the liquidity ratio between innovative SMEs as joint stock companies and limited liability companies is not significantly different from that of innovative SMEs in any other legal form.

Table 23. Pairwise comparisons – Liquidity ratio vs. legal form

Legal form	Levels	Differences	St err	p-value	Lower bound (95%)	Upper bound (95%)
Joint stock companies	Limited liability companies	-.247*	.107	.063	-.504	.009
	Other forms	-.286	.417	1.000	-1.286	.715
Limited liability companies	Joint stock companies	.247*	.107	.063	-.009	.504
	Other forms	-.038	.410	1.000	-1.023	.946
Other forms	Joint stock companies	.286	.417	1.000	-.715	1.286
	Limited liability companies	.038	.410	1.000	-.946	1.023

In contrast to the three-way ANOVA – which showed no significant differences between the average levels of the debt-equity ratio with respect to any of the three structural variables (company size, geographic macro-area, business sector) – the one-way ANOVA shows that the debt-equity ratio

8. Analysis of Variance and pairwise comparisons: results

depends on the legal form chosen. In particular, as shown in Table 25, limited liability companies consistently have a higher average debt equity ratio than joint stock companies.

Table 24. One-way ANOVA (legal form) – Debt equity ratio

Source	Sum of squares	Df	Mean of squares	F	p-value
Legal form	15254.991	3	5084.997	216.646	.000
Error	14294.110	609	23.471		
Total	29549.101	612			

Table 25. Pairwise comparisons – Debt equity ratio vs. legal form

Legal form	Levels	Differences	St err	p-value	Lower bound (95%)	Upper bound (95%)
Joint stock companies	Limited liability companies	-1.561***	.450	.002	-2.642	-.479
	Other forms	-1.071	1.756	1.000	-5.287	3.145
Limited liability companies	Joint stock companies	1.561***	.450	.002	.479	2.642
	Other forms	.489	1.728	1.000	-3.659	4.638
Other forms	Joint stock companies	1.071	1.756	1.000	-3.145	5.287
	Limited liability companies	-.489	1.728	1.000	-4.638	3.659

The **financial independence index** depends on the legal form chosen by innovative SMEs. In particular, as shown in Table 27, pairwise comparisons show that the average level of the financial independence index is significantly higher for joint stock companies than for limited liability companies, while there are no significant differences in the average level of the financial independence index between joint stock and limited liability companies compared to the other legal forms.

Table 26. One-way ANOVA (legal form) – Financial independence index

Source	Sum of squares	Df	Mean of squares	F	p-value
Legal form	699478.147	3	233159.382	689.111	.000
Error	206054.043	609	338.348		
Total	905532.190	612			

Table 27. Pairwise comparisons – Financial independence index vs. legal form

Legal form	Levels	Differences	St err	p-value	Lower bound (95%)	Upper bound (95%)
Joint stock companies	Limited liability companies	4.313**	1.710	.036	.208	8.418
	Other forms	-1.579	6.668	1.000	-17.586	14.428
Limited liability companies	Joint stock companies	-4.313**	1.710	.036	-8.418	-.208
	Other forms	-5.892	6.561	1.000	-21.643	9.859
Other forms	Joint stock companies	1.579	6.668	1.000	-14.428	17.586
	Limited liability companies	5.892	6.561	1.000	-9.859	21.643

8. Analysis of Variance and pairwise comparisons: results

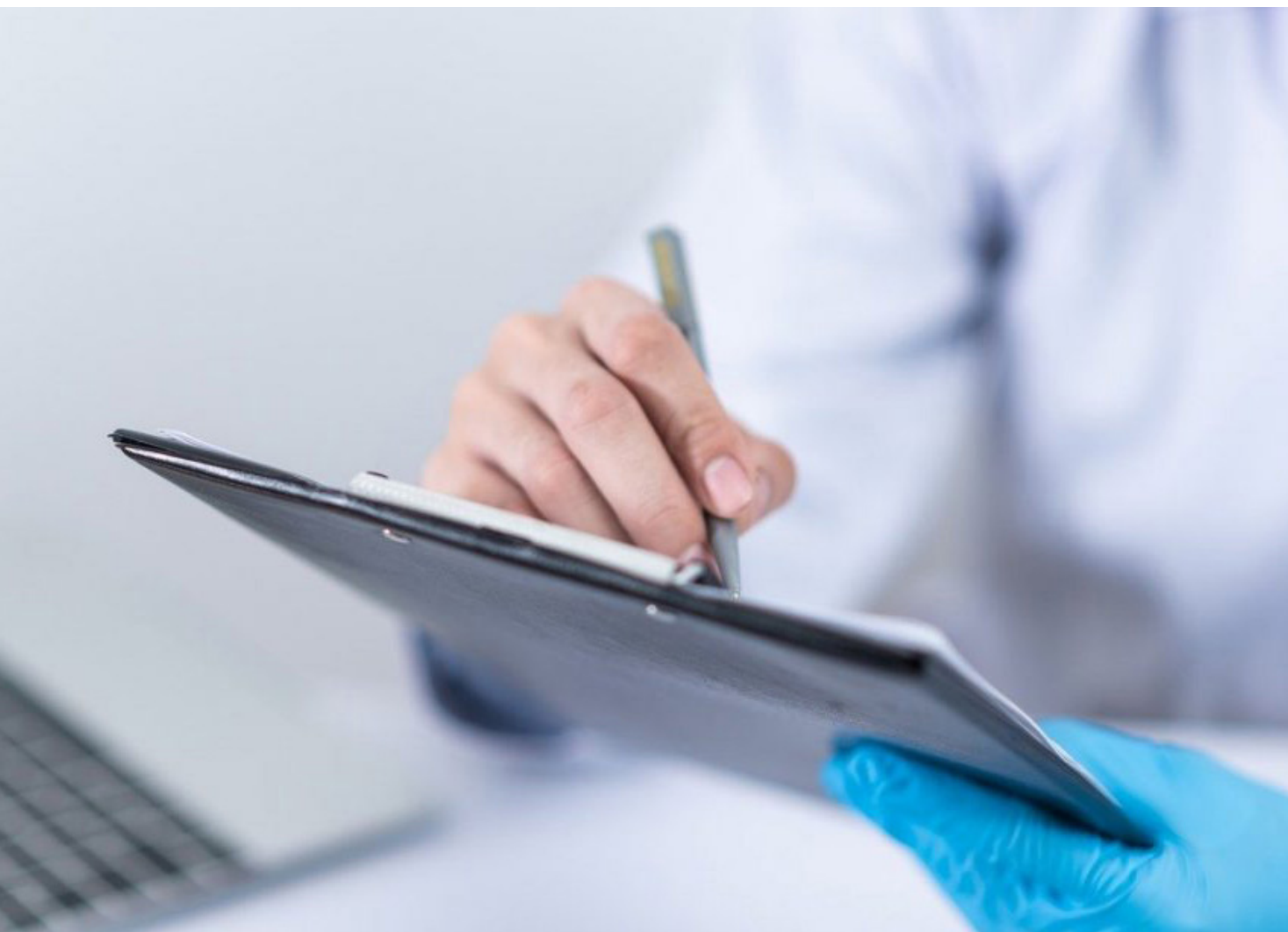
Table 28. One-way ANOVA (legal form) – Value added per capita

Source	Sum of squares	Df	Mean of squares	F	p-value
Legal form	70297.845	3	23432.615	65435.915	.000
Error	213.428	596	.358		
Total	70511.273	599			

Pairwise comparisons (Table 29) show that the average level of added value per capita was significantly higher for innovative SMEs taking the legal form of joint stock companies than for limited liability companies and other legal forms.

Table 29. Pairwise comparisons – Value added per capita vs. legal form

Legal form	Levels	Differences	St err	p-value	Lower bound (95%)	Upper bound (95%)
Joint stock companies	Limited liability companies	.3469***	.05644	.000	.2114	.4824
	Other forms	.8276***	.21710	.000	.3064	1.3488
Limited liability companies	Joint stock companies	-.3469***	.05644	.000	-.4824	-.2114
	Other forms	.4807	.21349	.074	-.0319	.9932
Other forms	Joint stock companies	-.8276***	.21710	.000	-1.3488	-.3064
	Limited liability companies	-.4807	.21349	.074	-.9932	.0319



9. Discussion

9. Discussion

From the five-year trend of the economic-financial dynamics of the Innovative SMEs it is possible to draw some important findings. First of all, it should be noted that the constant orientation towards innovation makes some indicators of these SMEs interpretable in a double direction, in the sense that their apparent worsening (for example the debtor situation) could be the consequence of the acceleration of the innovative processes. Conversely, an apparent improvement could be an effect of lower investments in innovations.

In general, with average values of 6.6 and 5.7% respectively of return on equity (ROE) and return on investment (ROI) we can believe that for the current historical moment the Innovative SMEs achieve a decent profitability, favored by existence of a positive financial leverage presumably related to the specific methods of accessing sources of funding. Anyway, the average level of both ROE and ROI of innovative micro enterprises is significantly lower than the average level of ROE of innovative small and medium-sized SMEs, while the difference in the average level of return on equity between small and medium-sized enterprises is not significant. The reduced size, therefore, refers to income performance. This is a not particularly positive aspect, by considering the small average size of the investigated SMEs. Furthermore, the financial structure tout court, at least in terms of solvency, asset coverage ratio and net debt / EBITDA ratio, does not seem particularly delicate or precarious. Regarding solvency, considered in terms of liquidity ratio, it is better for micro-enterprises and small enterprises as well as located in the South. Additionally, the liquidity ratio significantly is consistently higher for innovative SMEs operating in the so-called advanced tertiary sector than for innovative SMEs in both the industrial and tertiary sectors. These observations suggest that solvency is more a consequence of the better profitability of companies or investments made in border sectors, rather than the reflection of a delay in investment decisions that allows companies to maintain greater liquidity. The greater propensity to invest of these SMEs, therefore, would seem confirmed. Even coverage ratio of fixed assets appears to be somewhat linked to the sector, in this case with better values for industrial companies. The companies that presumably have the greatest exposure in fixed assets, therefore, also have the greatest capitalization. In general, however, this value appears unbalanced; although improving. Since the level of debt is also somewhat unbalanced, albeit homogeneously with respect to the three structural variables, also considering the growing trend in productivity, the negative values of the two aforementioned indicators seem to reflect first of all the consequences of SMEs that have exposed themselves financially by increasing the debt

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precisely in order to be able to make investments, the benefits of which are beginning to be seen.

The financial independence index was significantly higher for micro innovative enterprise than for small and medium-sized ones. Furthermore, there is also an advantage in the average levels of financial independence for small innovative enterprises compared to medium-sized ones. It is, presumably, reflecting a lower predisposition to invest or to resort less to external financing.

By considering this described background, we can consider the hypotheses H1 and H2 verified: the Innovative SMEs have a positive and high profitability and have a fair financial-equity balance. In particular, the income performance and capital balances of Innovative SMEs with over 50 employees are better than those of micro-enterprises, also because with more evident improvements in productivity. Thus the hypothesis H4 is verified. The size, therefore, retains advantages related to the greater skills available, more thoughtful decision-making processes, greater ease of access to sources of funding and so on.

It also emerges that companies in a territorial area, Central Italy, have overall better indicators than the other two macro-areas. Therefore, also the H3 hypothesis is verified, although one would have expected, as per economic history teaching, a better result from companies located in the North that normally use better quality services and infrastructures, as well as more effective networking due to a more widespread presence of organizations and support bodies. At present, however, it is confirmed that the Italian territorial context is not to be considered as a homogenous area for business development.

On the other hand, hypothesis H5 is not verified; that is to say that the Innovative SMEs operating in the advanced tertiary sector obtain better performances than the industrial ones. Of the latter two, the industrial sector has slightly better profitability and productivity values than the advanced service sector; with this presumably discounting a lower risk from innovation despite the presence of the concessions. Both the two aforementioned sectors, in any case, have income performances and a financial and equity situation that is clearly better than the (few) innovative SMEs belonging to the traditional service sector, which, presumably, could be associated with a lower expected profitability / risk ratio.

Finally, evaluating the performance according to the legal form chosen by Innovative SMEs, we cannot consider the H6 hypothesis to be verified as a whole. Certainly the hypothesis is not proven from the profitability side, while it is only partially proven from the financial-asset side. The legal status of a capital company, therefore, does not ensure advantages compared to

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the more streamlined form of the limited liability company. This is at least for this type of innovative SMEs.

Overall, therefore, the overall picture (Table x) can be considered better than that of comparable non-innovative companies, the so-called stable (par. 3.2); thereby revealing the positive effects of the incentive and support system. Support, it should be remembered, not only and not necessarily of an economic nature when it is also foreseen the possibility of benefiting from the advantages connected to networking with institutional and non-institutional actors.

Table 30. The Hypotheses.

N.	Hypotesis	Result
1	Innovative SMEs achieve a positive but also high profitability	verified
2	The Innovative SMEs have a fair financial-equity balance	verified
3	The localization context of SMEs affects financial and economic results	verified
4	As the size class increases, the performance of the Innovative SMEs improves	verified
5	The Innovative SMEs operating in the advanced tertiary sector experience higher economic-financial performances than their manufacturing equivalents	Not verified
6	Innovative SMEs with the legal form of joint stock companies have better income performance and balance sheets than those with the legal form of partnerships	Not verified

On the other hand, the high number of companies that are enrolling in the special register of the MISE, although perhaps still low in absolute terms, also attests a clear interest on the part of the economic world, in particular of young entrepreneurs or aspiring entrepreneurs, in the paths innovative. Regardless of the sector of activity, that is to say, the cultural change that emerges is appreciable; by virtue of which economic subjects with a high cultural level and skills recognize the importance of innovation in order to compete on global markets. A sign of great interest in the light of the Italian industrial fabric typically considered crystallised on so-called traditional labor-intensive production activities and a low rate of innovation. The widespread adoption of innovations can, thus, represent an alternative way to maintain competitive capacity even in consolidated sectors and activities compared to those newly conceived with foreseeable future development; without jumps or discontinuities with the technological level and the prevailing traditions in the territorial context. Failure to verify hypotheses H5 and H6 seems to support this position.

Moreover, we must not forget that when these companies adopt innovations, they increase the level of risk, as well as potential profitability, with which they are confronted. The sectoral geography (Calenda, 2017) seems to confirm that rather than entering new sectors, the companies that enroll in the register of Innovative SMEs are looking for new ways

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to compete while operating in sectors already with a strong and dated presence of national SMEs.

Nevertheless, since 58% of founders already carried out an independent professional activity, for 56% have a degree or even a doctorate (11%) (Calenda, 2017), the stimulus of the law to enhance the value of intellectual capital, freeing itself from the polarization on material resources that are usually considered inadequate in the national reality with respect to the needs of a modern entrepreneurial system. This assumption, however confirmed by other surveys relating to the founders of high-potential and in any case innovative companies (Thomas et al., 2011; Passaro et al., 2018), constitutes an important implication for the national reality, as already said lacking in resources materials but very well projected on high quality, if not excellent, training courses.

Overall, therefore, this Decree is an experience that in the light of the findings obtained in this study can be judged positively, not only at a conceptual level but also at an operational level. This is although it is not possible to easily calculate the effects of tangible benefits associated with the dissemination of knowledge and territorial fertilization related to the implementation of innovations and the relationships between those who participate in the processes of conception and implementation at the local and national level. In any case, similarly the majority of all other national and international companies, SMEs have been markedly affected by the crisis generated by the pandemic, presumably slowing down their innovative activity (Bartolacci et al., 2016). Not surprisingly, the MISE decided to intervene by introducing new measures to strengthen and support the ecosystem of Innovative SMEs (Legislative Decree 34/2020 - the so-called "Relaunch" Decree) (MISE, 2020), the effect of which clearly it will be valid for the next few years.

10. Conclusions

10. Conclusions

In the last few decades, the logics leading to innovation have undergone major changes, particularly with regard to smaller enterprises. The increase in consumer purchasing power, the parcelling out of market demand into ever more limited niches, the acceleration of the process of technological change have reduced the structural disadvantages of SMEs resulting from their more limited economies of scale. Moreover, the proceeding of the knowledge economy, more open and distributed innovation, the proceeding of globalisation, the diffusion of non-technological innovations have given rise to a new model of the entrepreneurial economy where SMEs play a number of critical roles in supporting innovation itself (Thurik et al., 2013; Audretsch et al., 2022). In addition, in-company Research & Development has given way to models of continuous interchange with upstream and downstream business partners, enhancing the importance of networking (Del Baldo and Aureli, 2012; Sgrò et al., 2020), as of the learning capacity linked to intellectual capital (Paoloni et al., 2020; Giampaoli et al., 2021). As OECD (2010; 2018) points out, these dynamics have increased the importance of the role of SMEs in the innovation process.

In this context, it becomes imperative for policy makers both to distinguish the different ways in which SMEs innovate and to identify the ways in which they can stimulate innovation processes, thereby favouring a change in the technical and technological paradigm of the system-environment, as well as spreading knowledge and creating net employment. It is on this basis that Decree-Law 3/2015 was created, aimed at the birth of SMEs systematically projected towards technological innovation in the broadest sense. It is a law that is highly selective towards its recipients, a clear example of entrepreneurship policies (Hart, 2003; Lundstrom and Stevenson, 2005), but at the same time has several new elements.

The first element is not targeting investment financing tout court, with the well-known tendency to oversize facilities with reverberations on running costs, but directly targeting highly qualified individuals interested in starting an SME or leading an existing SME towards the regular adoption of technological innovations. The second aspect is the endorsement of consistency with nationally consolidated sectors of operation without necessarily focusing on cutting-edge or high-tech sectors that are often detached from the local economic reality in terms of experience, level of know-how and traditions. The third new element is to break free from the polarisation on the availability of tangible resources and instead make the most of the intellectual resources generated by the nation's high-level training system, as well as the relational thrust with public and private consulting, research and training entities in order to identify and develop

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synergies. This is also a way of bypassing the notorious structural and organisational limitations linked to the small size and greater fragility of these smaller units with respect to the exogenous context or economic changes (Storey and Greene, 2010; Rosenbusch et al., 2011; Sciascia et al., 2015).

Based on the above, the present contribution aimed to verify, through an analysis of the balance sheets for the 2016-2020 period of the so-called innovative SMEs registered in the special register established by the legislation in question, whether these economic organisations actually show benefits associated with the introduction of innovations; in this, they are stimulated by the pervasive facilitations of various types made available by the aforementioned decree law and which somewhat minimise the risk associated with such innovations (Thomas et al., 2020; Carfora et al., 2021). An overall satisfactory picture emerged, in which these companies display sound profitability and a fair financial and asset balance. That is to say, it is to be assumed that the law is positively manifesting its effects, effectively incentivising many SMEs to systematically engage in innovative processes. It would be desirable at this point, given also the growing number of companies registering in this register, to verify whether they, by reaching higher levels of competitiveness, manage to expand and actually prove to be net creators of employment and agents of territorial fertilisation. To date, in fact, the majority of Innovative SMEs do not exceed 20 employees, do not reach €1 million in turnover (Calenda, 2017) and are family-owned (Sciascia et al., 2015). A second implicit objective is linked to verifying whether the decree law is succeeding in stimulating a change in the entrepreneurial mindset among many of the national SMEs whose competitiveness is tied to position rents at a local level but rather sensitive to economic trends, in order to favour a transition towards broader choices based on the search for strategic levers centred on the innovative content of the business proposal, to be proposed from an international perspective.

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Within the limits of a survey that covers a rather limited period of time and does not delve into many other factors necessary for a full understanding of the dynamics of such Innovative SMEs, it is, however, possible to draw some insights into the implications of such a study for the benefit of public decision-makers, practitioners and corporate management itself. The discourse proposed so far, in fact, clearly shows how the main focus of innovation strategies proposed by policy makers should aim at the dissemination of policies to strengthen the level of endogenous entrepreneurship (Shane, 2009) and increase relations and synergies with partners outside the SME (Del Baldo and Aureli, 2012; Passaro et al., 2018). This, in particular, should it be confirmed that Innovative SMEs are among those high-growth firms capable of offering the greatest contribution to employment absorption and a boost to recovery from the current recessionary face.

In light of the hypotheses tested in the contribution, in order to better support innovative economic units, it seems advisable, in line with the recommendations of the OECD (2018), not only to promote the culture of entrepreneurship, but also to intervene to improve the business climate in which SMEs operate by freeing them from practical problems - from the availability of trained personnel to the absence of infrastructure - to which these units are more sensitive than large enterprises. Another direction of intervention should aim at proposing instruments that increase SME participation in knowledge flows and the strengthening of human capital; the latter, as seen, makes companies more receptive to innovation. The emphasis on knowledge flows is linked to the fact that innovation in SMEs is not an isolated process, but is made possible by connections with external actors. This knowledge is nowadays created and exchanged within open and locally or globally distributed innovation systems involving interactions between customers, suppliers, competitors and market and technology collaborators. It follows that for this type of Innovative SMEs, the need for tangible resources, starting with financial ones, takes second place to the availability of intangible assets (Massaro et al., 2016; Paoloni et al., 2020). From a more strategic perspective, therefore, in line with what characterises companies of excellence, some lines of *soft* actions can be defined (Richini, 2012)

- The push towards opening up to national or international markets, where SMEs often entrench themselves in the strenuous defence of markets on a purely local basis;
- the push towards high quality production in line with national or international standards, also with reference to sustainability issues,

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- enhancing any niches of specialisation and guaranteeing their defensibility;
- support for innovation and related investments in technology;
- the improvement of the internal organisational structure and decision-making processes that often tend to focus on the entrepreneurial figure with plausible skill limitations;
- the strengthening of relations with training and research structures, primarily universities, for the transfer of knowledge, the experimentation of innovative ideas, and the procurement of qualified personnel;
- the simplification of relations with institutional structures offering support services of various kinds (from accelerators to internationalisation services to dedicated consultancy);
- the introduction of mechanisms facilitating the opening to investors (business angels, venture capitalists) able to support and finance expansion processes by investing in risk capital, rather than resorting to debt financing tout court;
- support for the initiation of procedures for the constant updating and improvement of staff skills, or even for the acquisition of specific skills dedicated to overcoming certain problems (e.g. temporary managers);
- incentives for the creation of business networks and the exploitation of networking abilities resulting from structured and loyal links between economic units that are no longer competing with each other at local level but are consortia in order to be able to present themselves in a more structured manner in international markets.

In this perspective, it is desirable to offer real consulting, training and mentoring services to fill possible gaps of entrepreneurs whose skills are often production-centred to the detriment of commercial ones, to encourage joint ventures with research institutions to promote company and university spin-offs to test the technical and commercial viability of innovative ideas (proof-of-concept), to endorse partnerships within innovation systems involving large and small companies, research institutes, government bodies and development agencies (e.g. science and technology parks, incubators...), to adopt management accounting practices as well as knowledge transfer. science and technology parks, incubators, etc.), the adoption of management accounting practices, and knowledge transfer. Obviously, in keeping with *entrepreneurial policies*, there is also the need to aim for an improvement in the aforementioned *business climate* in which companies operate, acting both on the *hard* side of infrastructures, with certainty of time and cost in the construction and access of the infrastructures themselves, and on that of the functioning of the

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administrative machine; starting with the times of justice and bureaucracy in general for the granting of authorisations and the processing of paperwork. It is clear that from this point of view, small units are more sensitive to contextual conditions than larger units.

We hope, therefore, that this contribution would be a first step towards improving the effectiveness of Decree-Law 3/2015, with the twofold aim of thus increasing the number of companies that register in the special register, as well as enhancing their performance. On the first side, there would be a tangible sign of a change, first of all cultural, in the orientation of SMEs to adopt technological innovations that would improve their competitiveness and presumably favour entry into new cutting-edge sectors with foreseeable future development. On the second hand, there would be the almost automatic certainty that these companies are on the path to expansion, not only qualitatively but also quantitatively, with obvious reverberations in the area of employment, per capita GDP, and the dissemination of best practices and knowledge.

Further investigations on the topic of innovative SMEs or future developments of this same contribution may try to enrich this investigation by answering the above-mentioned questions.



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Endnotes

- 1 In our hypothesis, reference is made to the size parameter. However, it should be pointed out that by using other size parameters such as turnover or capital value the results could vary, even significantly (Baussola, 1994). This is a not insignificant difference. As Zappa (1957) notes, "the notion of enterprise size is in itself indeterminate; it does not correspond to a concept endowed with absolute scientific and practical meaning; it is a character of the production of enterprises and, as such, it is bound by ties of mutual correlation to the structure of production in different sectors and generally to any changes undergone in management." Therefore, defining an enterprise by size is not a simple task, precisely because of the "inherent vagueness of the notion of enterprise size itself" (Ciambotti, 1984: 96).
- 2 For the distinction between tertiary and advanced tertiary (KIBS), reference is made to the taxonomy proposed by Passaro and Thomas (1999).
- 3 Net invested capital is the difference between total invested capital and non-interest-bearing liabilities (i.e. without interest expenses) such as trade payables, tax or social security debts, severance tax provisions and risks, accrued liabilities and deferred income (Silvi, 2012: 63).
- 4 Some authors use operating income or EBIT instead of EBITDA. EBITDA is, however, a more prudent potential cash flow than the former where it does not use, for the purpose of repayment of financial debt, the cash resources set aside to meet (i) the payment of severance pay, (ii) the payment of risks and charges, (iii) the impairment of certain assets.
- 5 Ebitda reflects the company's profits before any deductions such as interest, taxes, depreciation, amortisation.





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