



Inside out: cutting-edge methods to decode external opportunities for startup growth

Leonardo Mazzoni^a, Niccolò Innocenti^{b,*}, Stefania Oliva^b

^a European University Institute, Robert Schuman Centre for Advanced Studies, Centre for a Digital Society, Italy

^b University of Florence, Department of Economics and Management, Italy

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ABSTRACT

We examine how both internal resources and the external environment influence startup growth, addressing the challenge of measuring the knowledge structure in which the startup operates. We introduce, in relation to firm growth, two indicators belonging to the economic complexity paradigm, complexity and relatedness, to respectively assess the economic sophisticatedness and connectedness of the local area. Using a longitudinal analysis over three-, four-, and five-year growth windows, as well as sustained growth patterns, we investigate the early growth of 902 innovative startups in Italy. Our results confirm previous findings, identifying a positive association between effective organizations, managers' external relationships, and initial R&D investments and startup growth. Among the external factors, we find a supportive role for relatedness, but not complexity. All variables remain stable and consistent over the period examined.

1. Introduction

The growth of new ventures is of central importance to strategic entrepreneurship, given its effect on employment creation, industrial renewal, and economic dynamism (Davidsson et al., 2023; Gilbert et al., 2006). There is a lively, ongoing debate as to why some startups grow while others do not. The resource-based view (RBV) of the firm, rooted in Penrose's (1959) theory of firm growth, has emerged as the dominant theoretical framework for understanding how firms leverage resources to expand (Nason & Wiklund, 2018). The RBV is particularly relevant in the startup context because it explains uneven growth as a consequence of how entrepreneurs assemble and leverage idiosyncratic resource bundles under conditions of scarcity and uncertainty (Zahra, 2021).

The literature on the determinants of startup growth has primarily focused on the entrepreneurs' characteristics and internal organizational features (Protogerou et al., 2017; Symeonidou et al., 2022; West & Noel, 2009), with considerably little attention devoted to the external conditions in which startups operate (Pe'er & Keil, 2013; Pindado et al., 2023; Van Oort & Stam, 2009). Although some studies have combined these two perspectives (Baum et al., 2001; Capozza et al., 2020; Clarysse et al., 2011; Cooper, 1993; Davidsson, 1991; Innocenti & Zampi, 2019; Misangyi et al., 2006), the effect of the external environment on startup growth remains under-theorized.

This imbalance reflects a broader tendency in the entrepreneurship literature to treat the external environment as spatially homogeneous, rather than a dynamic, heterogeneous strategic resource that both shapes and is shaped by entrepreneurial strategies (Combs et al., 2023; Davidsson et al., 2023). It also mirrors a deeper theoretical gap within the RBV itself, which recent reassessments have called for an explicit integration: the value of resources embedded in the external environment where the startup operates (Barney et al., 2021; Zahra, 2021). Quantifying these external conditions poses significant challenges because, while traditional models conceptualized knowledge as sticky and non-fungible, the knowledge inputs available in the external environment can be shared among firms and are potentially non-rivalrous (Hidalgo, 2021, 2023). Without cutting-edge methods that account for the specific, combinatorial aspects of external knowledge, measuring and interpreting the influence of the operational context on startup growth remains difficult.

This paper addresses this gap by investigating the following questions: *Which internal resource configurations and external territorial conditions drive the growth of innovative startups? What role does the industrial structure of the local environment play in shaping this growth?*

To answer these questions, we introduce the economic complexity paradigm as a novel lens for assessing the dynamic influences of the external environment on startup growth. Initially developed in

* Corresponding author at: University of Florence, Department of Economics and Management, Via delle Pandette 9, 50127 Florence, Italy.

E-mail address: niccolo.innocenti@unifi.it (N. Innocenti).

economic geography and innovation studies to measure and predict path dependency and sophistication of economic systems (Balland et al., 2022; Hidalgo, 2021, 2023), the economic complexity paradigm has been extended to the entrepreneurship literature, primarily in relation to firm entry (Ejdemo & Örtqvist, 2020; Mazzoni & Innocenti, 2024; Nguyen et al., 2021).

We extend its application to startup growth, arguing that the economic complexity paradigm provides a theoretically grounded solution to the RBV's long-standing problem of exogenous resource value determination (Barney, 2001). The paradigm offers a way to empirically operationalize the external productive opportunity set (Nason & Wiklund, 2018) in terms of both quality, i.e., economic complexity and recombability, i.e., relatedness; (Hidalgo, (2021)). Consistent with the RBV, we identify a set of variables related to internal resources, including founders' experience, an organized management team, external relational networks, and intangible assets. Then, we estimate the determinants of growth performance three, four, and five years after the startup's founding. These multiple time windows allow us to account for the irregular and discontinuous nature of new venture growth and identify consistent patterns over time (Delmar et al., 2003; Gilbert et al., 2006; Göttel et al., 2024).

To conduct our analysis, we use a sample of 902 Italian innovative startups, which are new firms holding a special status granted by the government, tied to the possession of a set of characteristics considered relevant preconditions for innovation (Audretsch et al., 2020). These new ventures have strong connections with universities and R&D infrastructures, making them an interesting test bed for assessing the impact of external factors on startup growth (Modina et al., 2024). Moreover, their specific mission, focused on introducing new services/products to the market, and the presence of highly qualified entrepreneurs and workers make them ideal for examining the critical internal determinants in terms of resources and competencies (Giraudo et al., 2019).

In addition to offering this unique firm classification, Italy offers a particularly informative context for our study because of its distinctive local hubs of competencies concentrated in industrial districts and significant interregional differences in productivity and innovation. The existence of the Italian Register of Innovative Startups since 2012 enables longitudinal tracing of venture development within the country (Colombelli et al., 2020; Giraudo et al., 2019).

Our results confirm that, among internal resource factors, the presence of an organized management team, broader external networks, investment in intangible assets, and younger founding teams are positively associated with startup growth. Regarding the external environment, we find that relatedness, which captures the density and connectedness of the local productive structure, exerts a significant positive effect on growth.

Our paper presents two main contributions. First, it provides a theoretical integration of the internal and external determinants of startup growth within the RBV framework. Drawing on the economic complexity paradigm, we address the question of exogenous resource value determination, identifying how resources embedded in the local productive environment generate competitive advantage, thereby shaping entrepreneurial choices and startup growth. This question has long remained unresolved in RBV research, despite growing recognition of its importance (Barney et al., 2021; Zahra, 2021).

Second, we develop a novel methodological approach, applying the paradigm of economic complexity at the firm level to explore startup growth. The two measures of the economic complexity paradigm—complexity and relatedness—build upon the intuitions of dimensionality reduction and recommendation systems, with the advantage of agnostically learning external environment dynamism and properties from data without any fixed assumptions (Hidalgo et al., 2007; Hidalgo, 2021). These measures offer insightful properties relating to entrepreneurship in comparison to traditional measures, characterizing the external environment in terms of opportunity space,

competition, and the density of productive networks (Mazzoni et al., 2022a; Mazzoni & Innocenti, 2024). The remainder of the paper is organized as follows. The second section presents the theoretical background and the development of hypotheses. The third and fourth sections describe the sample selection, measurement of variables, and econometric strategy. Section five illustrates the results, and section six concludes by discussing the theoretical and managerial implications as well as the limitations of the study.

2. Theoretical background

Penrose's (1959) seminal work, *The Theory of the Growth of the Firm*, emphasized that firms are more than simple administrative organizations; they can be conceptualized as bundles of resources. The theoretical argument about the value of resources has been further extended by the RBV, which has served as the main rationale for explaining the root of firms' competitive advantage beyond product positioning (Barney, 1991; Wernerfelt, 1984). While the RBV was originally developed to explain sustained competitive advantage, it has become one of the dominant theoretical approaches also for explaining firms' differential growth (McKelvie et al., 2006; Nason & Wiklund, 2018).

Although the RBV was not theorized for a particular stage of the firm lifecycle, its effects on firm growth have primarily been analyzed in established companies, with little application to new ventures (Zahra, 2021). Established firms can count on an accumulated stock of resources, which Wernerfelt (1984) defined as "tangible and intangible assets tied semipermanently to the firm" (p. 172). By contrast, for new ventures, resources are typically not yet stabilized, deeply embedded, or fully owned. Instead, new ventures depend on the entrepreneurial ability to recognize and exploit opportunities under conditions of uncertainty, a perspective largely absent from the traditional RBV paradigm (Alvarez & Busenitz, 2001). As Alvarez and Busenitz argued, entrepreneurship theory and the RBV share resources as their common unit of analysis but differ in emphasis; while the RBV focuses on heterogeneity of resources across firms, entrepreneurship theory foregrounds the entrepreneur's ability to recognize and exploit the productive potential of those resources under uncertainty. Along this line of reasoning, Zahra (2021) introduces the concept of resourcefulness to describe the process of creatively managing resources in the face of the well-known constraints of the liability of newness and smallness (see Freeman et al., 1983).

Few works using the RBV to explore firm growth consider both internal and external factors as key determinants of startup growth (Baum et al., 2001; Capozza et al., 2020; Cooper, 1993; Clarysse et al., 2011; Davidsson, 1991; Gilbert et al., 2006; Innocenti & Zampi, 2019; Paoloni et al., 2022). Simultaneously studying both the internal and external factors that lead to new venture growth may be more effective than studying them in isolation (Baum et al., 2001).

On the one hand, empirical applications of the RBV to new venture growth identify entrepreneurial know-how, networking, managerial capabilities, and intangible assets as predictors of early-stage performance, though without consensus as to their relative importance (Cassar, 2014; Chandler & Hanks, 1994; Eesley & Roberts, 2012; Paoloni & Modaffari, 2022; Protogerou et al., 2017; Weemaes et al., 2022; West & Noel, 2009; Wu, 2007). This lack of agreement is not surprising, given the wide heterogeneity of antecedents that can consistently influence firm growth over time (Coad et al., 2013).

On the other hand, the relationship between firm growth and the external environment remains more complex to disentangle and is often overlooked (Castrogiovanni, 1991; Davidsson et al., 2023; Garnsey et al., 2006; Wood et al., 2023), despite growing evidence of its importance (Auerswald & Dani, 2022; Mazzoni & Innocenti, 2024; Misangyi et al., 2006). This discussion is particularly relevant in light of the recent RBV theoretical debate. Originally developed as a firm-level explanation alternative to the Porterian theory of industry-level competitive advantage (Barney, 1991), recent reassessments of RBV

have called for a careful re-evaluation of the value of resources that are embedded in the external environment (Barney et al., 2021; Zahra, 2021).

Jointly considering internal resource configurations and external environmental conditions is therefore an interesting extension of the RBV rooted in the Penrosean tradition. It acknowledges growing awareness that the subjective evaluation of external market conditions remains largely unexplored in the startup context (Davidsson et al., 2023; Kimjeon & Davidsson, 2022; McKelvie et al., 2006; Zahra, 2021).

2.1. Internal factors

The entrepreneurship literature has converged on a relatively stable set of internal factors known to be the principal resource-level predictors of firm growth, typically organized around the founding team, the founder's prior knowledge and experience, technology investment, and networks (Protogerou et al., 2017; Weemaes et al., 2022; West & Noel, 2009). These attributes are particularly relevant in the entrepreneurial context, as they cover the human, organizational, relational, and knowledge dimensions of the resource bundle that innovative startups must assemble in their earliest stages of development (Zahra, 2021). Although the literature recognizes other relevant resource categories, such as initial financial endowments and physical capital (McKelvie et al., 2006; Wu, 2007), these are more difficult to assess for the majority of new ventures in the early phases of their life and less distinctive of the innovative startup context, which relies primarily on knowledge-intensive and intangible assets.

2.1.1. Founders' experiences

Founders are often the most visible part of a startup. Their experience and vision drive the startup and may explain differences in growth across new ventures (Oe & Mitsuhashi, 2013; Protogerou et al., 2017). The previous literature has emphasized the importance of founders' characteristics as key strategic assets of the startup (Short et al., 2009).

The relationship between founders' experience and startup performance yields mixed findings (Eesley & Roberts, 2012; Gruber et al., 2024; Hashai & Zahra, 2022; Zhao et al., 2021). More experienced founders may manage uncertainty more effectively, reduce cognitive bias, and be better judges of opportunities and sources of failure (Cassar, 2014; Delmar & Shane, 2006; Dencker & Gruber, 2015). Conversely, younger founders may bring greater energy, critical voices, and stronger growth incentives (Davidsson, 1991; Savarese et al., 2016; Weemaes et al., 2022).

Considering that in our analysis we are interested in understanding the role of founders' experience in innovative startups, a new typology of firm dedicated to innovative activities with a marked digital propulsion, we hypothesize the following:

H1.1: Younger entrepreneurial teams positively influence the early growth stages of a startup.

2.1.2. Organized management teams

Startups often begin their journeys by investing time and resources in niche markets. When growth is the objective, a more structured management team is often preferable to a solo startup, as it allows for task specialization and the internal distribution of responsibilities (Amason et al., 2006; Clarysse et al., 2011; Ensley et al., 2006). Such management teams may consist of the founders or of professionals strongly committed to the startup project. The presence of a dedicated management team may facilitate the creation of well-functioning routines, internal and external coordination mechanisms, and trust among employees (Ensley et al., 2006; Hashai & Zahra, 2022).

The existence of a structured management team may come at a cost, as such teams can disagree on crucial decisions, limiting the speed of startup growth or restricting organizational inertia (Gilbert et al., 2006; Weemaes et al., 2022). However, structured teams can add value to the startup by increasing the overall level of efficiency and leading new

ventures during transitional phases. Organizational skills are crucial in innovative startups to ensure that creative ideas are developed into successful go-to-market approaches. Based on these arguments, we hypothesize the following:

H1.2: The existence of a structured management team positively influences the early growth stages of a startup.

2.1.3. External networks

Initially, new ventures often lack the necessary resources to conduct their activities, particularly financial capital (Short et al., 2009). Relying on external networks is a common strategy to legitimize the startup in the eyes of customers, suppliers, and specialized funds (Modaffari et al., 2023; Symeonidou et al., 2022). Networks allow startups to reach resources that otherwise would not be available for "going solo" strategies. Pre-established relationships between founders and managers, for example, represent important sources of ready-to-use intangible capital, and may expand stakeholders' interests in a new venture (Ahmad & Krishna, 2025; Stuart & Sorenson, 2003). Former relationships from previous experiences and roles in other companies may provide channels for acquiring capital, knowledge, productive partnerships, and market power, overcoming the initial lack of resources for new ventures (Clarysse et al., 2011; Dencker & Gruber, 2015; Field et al., 2013). Based on these arguments, we hypothesize the following:

H1.3: A larger external network positively influences the early growth stages of a startup.

2.1.4. Intangible resources

Understanding initial endowments of both tangible and intangible resources is critical to predicting how a startup is likely to perform. The literature dedicated to startup growth has specifically underlined the role of R&D expenses in influencing the propensity of a new firm to engage in the highly technical and remunerative activities that lead to growth (Stam & Wennberg, 2009; Yuan & Nishant, 2021).

Although public incentives such as tax breaks and other public incentives may push a startup to invest its own resources in R&D, it may hesitate to do so due to the irreducible uncertainty of the influence of research practices on final outcomes. Larger investments in proprietary resources may signal to stakeholders that management has confidence in such investment's ability to confer a substantial competitive advantage (Innocenti & Zampi, 2019). Because our study takes place in a knowledge economy paradigm with a sample of innovative startups, which are highly reliant on intellectual property and R&D (Modina et al., 2024), we emphasize the strategic role of intangible resources in startup growth. Based on this, we hypothesize the following:

H1.4: Greater investment in intangible resources positively influences the early growth stages of a startup.

2.2. External factors

One of the main tenets of the RBV is that Porter's concept of industrial competitiveness, which primarily attributed performance differences to industry-level structural characteristics such as entry barriers, concentration, and buyer/supplier power, is not an adequate framework for explaining differences in sustained competitive advantage among firms, as it neglects the heterogeneous distribution of resources across firms (Barney, 1991). As an additional motivation for the development of the RBV, Barney (2001) argued that defining the concept of "industry" is itself challenging: its boundaries are difficult to identify, and its inherent assumption of technological stability can be a significant limitation in explaining differences in competitive advantage among firms.

However, the literature that has analyzed the determinants of startup growth has pointed out the relevance of the external environment (Gilbert et al., 2006; Innocenti & Zampi, 2019; Naldi et al., 2020; Protogerou et al., 2017). In particular, studies combining entrepreneurship and regional economics have highlighted the economic value of location and the knowledge spillovers arising from the cognitive and physical

spatial concentration of those industries surrounding the new venture (Audretsch & Dohse, 2007; Gilbert et al., 2008; Pindado et al., 2023). Relatively few studies have analyzed the relationship between startup performance and the external environment (e.g., Audretsch & Dohse, 2007; Belitski et al., 2023), as most have focused on the effect of the external environment on incumbents (e.g., Folta et al., 2006; Mathias et al., 2021) and new firm entry (e.g., Ejdemo & Örtqvist, 2020; Mazzoni et al., 2022a).

Recent reinterpretations of the RBV framework have created new theoretical space for addressing the tension between the growing empirical evidence on the role of the external context in explaining new venture performance and its underdevelopment within the RBV literature (Barney et al., 2021). As noted by Zahra (2021), resource value is not defined solely by supply–demand characteristics but also by the availability of knowledge opportunities external to the firm that are embedded in the industry structure in which the startup operates. Extending the line of reasoning by Nason and Wiklund (2018), the industrial context—often seen as beyond the control of new ventures—may instead be conceptualized as an external resource space whose knowledge versatility increases the firm's set of productive opportunities.

Following the literature discussed above, two key external elements appear particularly relevant to startup growth: economic complexity, meaning the sophistication of economic activities in the area (Hidalgo, 2021; Hidalgo & Hausmann, 2009; Tacchella et al., 2012), and the relatedness of the economic activities, or how the industrial structure is connected in the area (Hidalgo et al., 2007; Naldi et al., 2020; Neffke & Henning, 2013).

These two constructs characterize the firm's external environment, consistent with the RBV's requirement for the exogenous determination of resource value (Barney et al., 2021). Both constructs emphasize the importance of distributed, non-owned resources (Nason & Wiklund, 2018) and connect the RBV with the principles of evolutionary economics that Barney (2001) identified as a promising but underexplored foundation for resource-based theorizing. The two concepts operate in a complementary manner, describing the quality (i.e., economic complexity) and recombining ability (i.e., relatedness) of the productive opportunity set available to new firms.

2.2.1. Economic complexity

The concept of economic complexity has emerged as a new theoretical and empirical framework for characterizing the economic sophistication level of countries, regions, and cities (Hidalgo, 2021). Unlike previous approaches that use fixed characterizations of industrial structure (e.g., high-tech, low-tech), economic complexity adopts an agnostic view of the relationships occurring within an economic system. Instead, it provides a propensity score of economic sophistication computed on the “rarity” and “diversity” of productive inputs such as products, technologies, sectors, and skills (Hausmann et al., 2021; Hidalgo, 2021, 2023).

While originally conceptualized to infer growth or innovation at the country, region, or city level (Balland et al., 2022), economic complexity has recently been used to investigate firm-level effects (Burlina et al., 2023; Guerzoni et al., 2024). Territories with higher economic complexity are home to a richer array of specialized knowledge, differentiated demand, and complementary capabilities, which—from an RBV perspective—expands the set of opportunities that firms can identify and exploit. The impact of economic complexity on startups is of relatively recent interest (Iftikhar et al., 2022; Nguyen et al., 2021), with only a few studies examining its effect on innovative entrepreneurship (Mazzoni & Innocenti, 2024). Empirical evidence remains ambiguous, with non-significant results (Iftikhar et al., 2022), mixed effects (Mazzoni & Innocenti, 2024), or country–income-differentiated results (Nguyen et al., 2021). This heterogeneity likely reflects the dual nature of complex environments: creating more opportunities but also fostering more intense competition (Pe'er & Keil, 2013).

Given that our focus is innovative entrepreneurship, we expect the influence of economic complexity on the growth of innovative startups to differ from the effects observed in studies on new firm entry. A complex economic environment influences innovative startups through at least two growth-enabling channels. First, it provides access to a richer pool of specialized suppliers, skilled workers, and advanced knowledge that startups require to scale but typically cannot develop internally due to resource constraints (Balland et al., 2022; Zahra, 2021). Second, it generates a demand-side pull; incumbents in complex economies are continuously seeking novel solutions, creating acquisition opportunities, and entering into business partnerships that specifically benefit innovation-oriented startups. While intense competition may challenge startups in general (Pe'er & Keil, 2013), it simultaneously selects for and accelerates the growth of those startups with the strongest innovative capacity.

We therefore hypothesize the following:

H2.1: Higher levels of complexity in the area where the startup is located positively influence the early growth stages of the startup.

2.2.2. Relatedness

Within the literature on the industrial structure of the area and entrepreneurship, management scholars first analyzed the similarity of capabilities by observing the incidence of co-occurrence of products at the plant level (Teece et al., 1994). Later, innovation studies developed empirical approaches to investigate industrial activities of the area, such as related variety (Frenken et al., 2007) and relatedness (Hidalgo et al., 2007). These new methods improved the capacity of research to explain connectedness among local knowledge bases and how such connections may increase the flow of knowledge between technologically related industries, considering productive inputs such as employment, technologies, and skills (Neffke & Henning, 2013).

Originally developed to explain territorial growth and innovation, these methodologies have also been applied to investigate the effects of local knowledge bases on firms (Cainelli & Ganau, 2019; Sabel & Sasson, 2023) and specifically on the creation or growth of new ventures (Cheng et al., 2023; Colombelli, 2016; Ejdemo & Örtqvist, 2020; Naldi et al., 2020).

From the RBV perspective, relatedness can be understood as an operationalization of the path-dependent branching structure of the local environment within which new capabilities are selected and developed from existing ones (Barney, 2001). A territory with a dense, interconnected network of related activities provides firms with cognitively accessible complementary knowledge, improving the process of capability building.

For innovative startups, the literature suggests that the presence of a highly interconnected technological or industrial network may facilitate the birth and growth of high-quality entrepreneurship (Capozza et al., 2020; Mazzoni & Innocenti, 2024). In terms of startup growth specifically, relatedness operates through two channels. First, integrating new skills or new technologies is easier when the skills or technologies are cognitively proximate to those already possessed by the startup (Neffke & Henning, 2013; Zahra, 2021). Second, relatedness facilitates collaborations with other companies; this is particularly important for startups whose limited resources make it difficult to cooperate with cognitively distant firms or to integrate highly diverse technologies (Colombo et al., 2006; Grillitsch & Schubert, 2021). In summary, the presence of a highly related industrial structure expands the range of productive options that can be integrated into the venture. Based on the presented literature, we propose the following hypothesis:

H2.2: A higher level of relatedness in the area where the startup is located positively influences the early growth stages of the startup.

3. Data

3.1. Sample

We extract our sample from the list of Italian innovative startups delineated by the Italy Start Up Act (Decree Law 179/2012). This act by the Italian Ministry of Economic Development has guaranteed favorable development conditions for more innovative startups (Audretsch et al., 2020; Colombelli et al., 2020). To earn the label of an innovative startup, companies must meet the following criteria: (1) be a new company incorporated for less than five years; (2) be headquartered in Italy; (3) have annual revenue less than €5 billion; (4) not distribute profits to shareholders; (5) have a mission clearly oriented to innovation; (6) not be the result of a split-up or a company merger; and (7) be able to satisfy at least one of the following innovation indicators:

- a) R&D and innovation expenses of at least 15% of the yearly costs;
- b) 1/3 of employees hold a Ph.D. or 2/3 hold a master's degree;
- c) Be the holder, depositary, or licensee of a registered patent or software.

To build our sample, we follow Colombelli (2016) and identify startups founded in 2013, 2014, and 2015 from the list of startups provided by the Italian Chamber of Commerce. We cross-reference this information with the ORBIS database, identifying startups with available information on their balance sheets from 2016 to 2020 (i.e., 3–5 years after founding).¹

Our final sample includes 902 firms with complete information on our variables of interest. Approximately 24.3% are located in northwest Italy, 23.3% in the northeast, 22.9% in the center, and 29.5% in the south. At the city level, 22% are located in the two largest Italian cities, Milan and Rome. Approximately 19% of startups in our sample operate in manufacturing; the greatest proportion is in Information and Communication Technologies (ICT) (approximately 43% of startups), and 25% operate in consultancy.

3.2. Dependent variable

Startups exhibit a variety of signals that can be interpreted as growth antecedents (Gilbert et al., 2006). While sales and employment are the most frequently adopted proxies for growth due to data availability (Garnsey et al., 2006; Grillitsch & Schubert, 2021; Symeonidou et al., 2022), there are a diverse range of other modalities that can be used to measure new firm growth, such as market share or customer acquisition. Sales growth represents customers' progressive appreciation of the products and services offered by a firm, but it can be volatile across years and is subject to inflation and currency exchange rates, making comparisons across countries difficult (Chandler et al., 2009; Delmar et al., 2003; Gilbert et al., 2006). Conversely, many researchers find employment a more stable and standard measure of growth, with a higher degree of comparability across economic systems (Garnsey et al., 2006; Stam & Wennberg, 2009). It can serve as a measure of organizational change and the accumulation of new competencies, which rarely occur without sustained financial and economic performance (Chandler et al., 2009). In addition, hiring new employees increases organizational costs, which are generally only taken on if the startup is expected to grow (Götzel et al., 2024). Other researchers have indicated that employment is a more stable and standard measure with a higher degree of comparison across economic systems (Garnsey et al., 2006; Stam and

Wennberg, 2009). Moreover, it indicates a direct contribution to the community in which the startup is based (absorption of capabilities).

For these reasons, we rely on the change in the number of employees to compute our growth indicator (Santoleri, 2020; Weemaes et al., 2022). We calculate the relative difference in employment between the last year of performance (in our case, 3, 4, or 5 years) and the year of founding as follows:

$$StartupGrowth_y = \log(emp_y) - \log(emp_{y-x})$$

where *emp* represents the total number of employees in a given year (plus one), *y* denotes the year in which growth is observed (three, four, or five years after founding), and *x* represents the years since founding. When calculating the total number of startup employees, it is important to consider that many startups may not have any employees at their founding. To keep all these observations when taking logarithms, we add one to the original number of employees (Santoleri, 2020; Weemaes et al., 2022).

3.3. Independent variables

In this study, we focus on four internal variables of interest and two variables external to the startup. Our first internal variable measures founders' experience, using the average age of the founding team at the year of the startup's founding (Savarese et al., 2016; Weemaes et al., 2022). The second internal variable identifies the presence of an organized management team using a dummy variable that takes a value of 1 if the team managing the startup has at least three members, and 0 otherwise (Protogerou et al., 2017). This variable aligns with the literature investigating the influence of management team members on startup performance (Amason et al., 2006).

The third internal variable measures the startup's external network by considering the number of positions previously held by the startup manager(s) in other companies. We set the value of the dummy variable for a well-connected startup as equal to 1 if managers have held at least three positions at other companies, and 0 otherwise, consistent with the literature on the effect of the number of board positions on startup performance (Field et al., 2013). The fourth internal variable adopts the value of intangible resources as a proxy for a startup's R&D capabilities, as this information is not covered by ORBIS for many new firms (for a similar approach, see Innocenti & Zampi, 2019).

The two external variables of interest are economic complexity and relatedness, both measured at the local level (NUTS-3 regions²). Both are based on employment data (Innocenti et al., 2021) drawn from the firm-level database (ORBIS), following the Nomenclature of Economic Activities (NACE) 4-digit industrial classification for all the Italian NUTS-3 regions for the year 2014.

The construction of the economic complexity index followed the method of Balland and Rigby (2017), which refined the original proposal by Hidalgo and Hausmann (2009). Specifically, we computed the second eigenvector of the squared matrix of 103 dimensions (the number of Italian NUTS-3 regions), where the elements capture the similarity in the industrial structure of NUTS-3 region pairs (Mazzoni & Innocenti, 2024).

Many measures for relatedness have been proposed over the last two decades (e.g., Frenken et al., 2007; Hidalgo et al., 2007). In our case, we follow the methodology first proposed by Hidalgo et al. (2007). This method does not rely on the number of digits shared to define the relatedness between sectors, but uses a co-occurrence calculation between sectors to infer their proximity. This method has been widely used to define relatedness using a variety of data sources, including patents, exports, scientific publications, and employment. Since we are

¹ We exclude the first year after establishment of the startup from the growth evaluation, as startups can be founded in different months, which could create a potential discrepancy affecting our results, especially for the three-year window. Our analysis is limited to five years, since under Italian Decree Law 179/2012, innovative startups lose their special status after 5 years.

² NUTS-3 regions represent the Nomenclature of Territorial Units for Statistics for small regions of the European Union.

interested in the industrial sectors where startups operate, we used employment data (Innocenti & Lazzeretti, 2019; Mazzoni et al., 2022a).³ A summary of the variables is reported in Table 1.

As controls, we include two variables for the internal characteristics of the firm and three for external environmental characteristics. We use the startup's year of founding to control for the general business climate in a given year (Weemaes et al., 2022). We also use the number of employees in the year of founding (the base year) to control for its impact on startup growth (Jeewandara & Cox, 2020; Protogerou et al., 2017).

For external environment controls, we use the population of the NUTS-3 region to control for urbanization levels and as a possible indicator of access to the market. We also control for the innovativeness of the region, using the annual patent production per thousand workers, frequently used in firm growth studies as a proxy for the innovation

Table 1

Summary with all variables used in the analysis.

Variable	Definition	Typology ¹	Source
Growth3, 4 and 5y	Natural logarithm of the startup growth in terms of employment after respectively 3, 4 and 5 years from the foundation	Dependent	Orbis
Sustained growth	A dummy variable that identifies the status of a startup that grows both after 3 and 5 years	Dependent	Orbis
Founders' experience	The average age of founders	Independent internal	Orbis
Management Team	A dummy variable that indicates the presence of a team composed of at least 3 members	Independent internal	Orbis
External Networks	A dummy variable that indicates if startup managers overall cover at least 3 positions in other firms	Independent internal	Orbis
Intangibles	The value of intangible Assets at the year of foundation	Independent internal	Orbis
Complexity	Second eigenvector of the squared matrix M^*M_T	Independent external	Orbis
Relatedness	$R_{pt} = \sum_{s=1}^S R_{sk} \left(\frac{n_{kp} + n_{kp}}{N_p} \right)$	Independent external	Orbis
Year Birth	Categorical variable that indicates the year of foundation of the firm	Control	Orbis
Dimension	Natural Logarithm of the startup employees at the year of foundation	Control	Orbis
Population	The number of inhabitants of the NUTS-3 region, divided by 100.000	Control	Eurostat
Patwork	Patent production per thousand workers	Control	Eurostat
IQI	Composite index that measures institutional quality (Corruption, government effectiveness, regulatory quality, rule of law, voice and accountability)	Control	Nifo & Vecchione (2014)

¹External variables refer to the NUTS3 region where the startup is located.

³ For a more detailed discussion of the construction of the two variables, see the Supplementary Material.

capacity (Bae & Koo, 2009). Finally, we control for institutional quality.⁴ This indicator is widely used in firm growth studies and is of particular interest in entrepreneurship studies (Audretsch et al., 2020). All independent and control variables refer to the year of the startup's founding, creating a temporal lag of 3, 4, and 5 years with respect to the dependent variables, mitigating potential endogeneity issues. Table 2 shows descriptive statistics.

4. Econometric strategy

Multilevel models are often ideal for modeling nested relationships (Van Oort et al., 2012), such as the firm-level internal attributes and regional-level environmental characteristics in our study. To test for the appropriateness of the multilevel model, we rely on the intra-class correlation coefficient (ICC), which measures the ratio between cluster variance and total variance. If an ICC value approximates zero, we can conclude that there is no substantial difference from ordinary least squares (OLS) estimation (Amara & Thabet, 2019). As suggested by the literature (Amara & Thabet, 2019; Van Oort et al., 2012), we tested the random-intercept empty model using both maximum likelihood estimation and residual maximum likelihood estimation. The ICC values were very close to 0 across the three growth windows, thus suggesting no difference from OLS estimation. The likelihood ratio test, which was only and marginally significant in the three-year growth window (see Table A2 in the Supplementary Material), points in the same direction. This preference for OLS over a multilevel model may be due to the few observations across groups in our sample. For 902 observations distributed across 95 NUTS-3 groups, only 11% have more than 20 observations. As reported by Peterson et al. (2012), for a two-level model, it is recommended to have "at least 20 observations for 50 groups to test cross-level interactions, and at least 10 observations for 100 groups to test random effects" (p. 453). Based on these results, we decided to rely on OLS modeling with standard errors clustered at the NUTS-3 region level.

The correlation matrix (Table A1 in the Supplementary Material) did not show worrisome correlation levels among variables. Additionally, the highest variance inflation factor (VIF) identified was 2, which falls substantially below the typical threshold of 10 (Hair et al., 1995). Thus, these results suggest that there was no issue of multicollinearity in the model.

Table 2

Descriptive Statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
Growth3y	902	0.872	0.826	−2.302	3.611
Growth4y	902	0.977	0.901	−2.302	3.932
Growth5y	902	1.051	0.972	−2.302	4.234
Sustained growth	902	0.562	0.496	0	1
Dimension	902	1.305	0.594	1	4.526
Founders' experience	902	41.884	11.095	18	81.5
Management Team	902	0.385	0.487	0	1
External Networks	902	0.349	0.477	0	1
Intangibles	902	26.047	98.068	0	2021.132
Complexity	902	0.107	1.017	−1.716	2.043
Relatedness	902	2.538	0.284	1.902	3.014
Population	902	9.838	8.3413	0.572	26.253
Patwork	902	0.192	0.160	0	1.302
IQI	902	0.559	0.3	0	1

⁴ The index used here is composed of five dimensions of institutional quality: government effectiveness, corruption, rule of law, regulatory quality, and voice and accountability. It was originally introduced by Nifo and Vecchione (2014) and is frequently used in the Italian context due to its construction accuracy and the small unit of analysis (NUTS-3 regions).

In the elaboration of our models, we followed a stepwise approach for all dependent variables. Models labeled *a* (i.e., 1a, 2a, 3a, 4a) pertain to startup growth three years after founding. Those models labeled *b* and *c* refer to the 4- and 5-year growth windows, respectively. The complete model (4a, 4b, 4c) includes all internal and external variables.

In addition, we performed two main robustness tests. The first test concerned possible curvilinear effects of the variables of interest. For this reason, Table A3, in the Supplementary Material, reports the results for the complete models, including the squared terms.⁵ A second robustness test explored sustained growth, aimed at investigating the persistence of growth over time. In this case, the dependent variable was a binary variable taking a value of 1 if the startup showed growth both in the 3-year and 5-year window, and 0 otherwise. The models estimated for this robustness test differ in specification, as we apply a logistic regression model with standard errors clustered at the NUTS-3 region level, to estimate the probability of a startup experiencing sustained growth (Eklund & Van Criekingen, 2022).

5. Results

The key findings are reported in Table 3. Models 1a, 1b, and 1c included two variables: founding year and number of initial employees. Only the number of initial employees had a significant (negative) impact on startup growth. This finding aligns with the existing literature, which suggests that startups with larger initial sizes tend to experience slower growth (Jeewandara & Cox, 2020; Weemaes et al., 2022).

Models 2a, 2b, and 2c included all internal variables that could impact the early growth of startups. Founder age was inversely associated with growth during the early phase of a startup, with older founders leading to lower growth (3-year window: $\beta = -0.0038$, $p < 0.1$; 4-year window: $\beta = -0.0039$, $p < 0.1$; 5-year window: $\beta = -0.0059$, $p < 0.05$). This finding supports H1.1, indicating that for the growth of innovative startups, the dynamism of younger individuals may be particularly important (Savarese et al., 2016). Startups established by older entrepreneurs also tend to be larger at founding and consequently exhibit lower growth (Zhao et al., 2021). The results align with recent research showing that new firm's performance is negatively associated with the founder's age (Gruber et al., 2024).

We also found that larger management teams support startup growth (3-year window: $\beta = 0.260$, $p < 0.001$; 4-year window: $\beta = 0.287$, $p < 0.001$; 5-year window: $\beta = 0.314$, $p < 0.001$), confirming H1.2. with one-standard-deviation increase in external network associated with employment growth about 15% higher on average across the three windows. A robust external network also increased startup growth (3-year window: $\beta = 0.195$, $p < 0.001$; 4-year window: $\beta = 0.231$, $p < 0.001$; 5-year window: $\beta = 0.310$, $p < 0.001$), confirming hypothesis H1.3 with one-standard-deviation increase in external network associated with employment growth about 13% higher on average across the three windows. Both results align with previous results from the literature, suggesting that a more structured management team and a larger external network are key factors for startup growth (Hashai & Zahra, 2022). These characteristics increase access to key players, competencies, and additional resources that a smaller, unconnected team may struggle to access.

Intangible resources had a significant positive effect on startup growth (even if with a lower effect in comparison to other internal determinants), supporting hypothesis H1.4 on the importance of early R&D investments for innovative startup growth (3-year window: $\beta = 0.0003$, $p < 0.1$; 4-year window: $\beta = 0.0004$, $p < 0.05$; 5-year window:

$\beta = 0.0005$, $p < 0.05$): with a one-standard-deviation increase in intangible assets associated with employment growth about 4% higher on average across the three windows (Innocenti and Zampi, 2019).

All in all, the results for internal firm characteristics align with the related literature (Gilbert et al., 2006; Protoerou et al., 2017; Symeonidou et al., 2022) and generally confirm that the quality of firm organization, external relationships, and the capacity to attract external investors are fundamental to the initial growth of startups. Notably, all variables investigated maintained their significance and direction over the three windows analyzed, with their effects showing increasing positive and negative trends, respectively.

Models 3a, 3b, and 3c aimed to investigate the effect of external factors on the growth of innovative new ventures. The effects of each variable were consistent throughout all three windows. Economic complexity was not significant, providing no evidence that a more advanced industrial structure influences the growth of innovative startups. Thus, H2.1 was not confirmed. We may speculate on the reason for this result, considering the relatively modest economic burden of innovative startups. These results are similar to previous studies finding mixed effects of economic complexity considering different outcomes, such as the founding of startups (Mazzoni & Innocenti, 2024), context, such as the development level of the country (Nguyen et al., 2021), and typology of sectors and incumbents (Burlina et al., 2023).

Conversely, the relatedness of the industrial structure proves to be significant and positive across all time frames, with a peak in the growth coefficient after four years (3-year window: $\beta = 0.273$, $p < 0.05$; 4-year window: $\beta = 0.320$, $p < 0.001$; 5-year window: $\beta = 0.285$, $p < 0.05$), with a one-standard-deviation increase in relatedness associated with employment growth about 9% higher on average across the three windows. This may suggest that when the industrial specializations in an area are closely related, innovative startups tend to show higher growth early on. This finding supports H2.2 and aligns with previous studies that emphasize the significance of relatedness in promoting innovation. The effect of relatedness is attributed to spillover effects among firms within comparable industries, as well as the enhanced accessibility for new skills and technologies akin to those already held by the firm (Grillitsch & Schubert, 2021).

Models 4a, 4b, and 4c include all variables of interest. However, there are no substantial differences with previous specifications; all variables of interest maintain the same sign and significance as in the previous three models, with some minor differences in magnitude of the specification.

To assess whether external environmental conditions moderate the effect of internal firm characteristics on growth for innovative startups, we estimated additional model specifications that included interaction terms between complexity, relatedness, and our main firm-level variables. Among the estimated interactions, only the interaction term combining relatedness and founders' experience reached significance, and only in the 3-year growth window. This implies that younger founders are likely more dynamic and keener to interact with related industries; conversely older founders are probably less likely to explore new yet related fields in the very early phases of the startup.

These results suggest that the most internal and external drivers of startup growth operate additively rather than multiplicatively. Marginal-effects analysis nonetheless revealed some descriptive heterogeneity, which may suggest a moderation between relatedness and two internal variables: startup size and founder age. The positive association between larger teams at founding and startup growth appears stronger in environments characterized by higher relatedness (exceeding the 10th percentile). Conversely, the negative effect of older founders on startup growth is exacerbated for values of relatedness above the median.

In terms of robustness tests, the first aimed to assess the curvilinear effect of our variables of interest. We identified two significant curvilinear effects (Table A3 of the Supplementary Material). First, we observed a U-shaped curvilinear effect for relatedness in the 3-year and

⁵ Due to the binary nature of these variables, we did not test the squared terms for Organized Management Teams or External Networks. In addition, due to space constraints, Table A3 reports the values and standard errors for the variable and squared term of interest only, as the aim of these models was to test for the eventual presence of a curvilinear relationship and its directionality.

Table 3
Estimation results, OLS.

	Model 1a	Model 1b	Model 1c	Model 2a	Model 2b	Model 2c	Model 3a	Model 3b	Model 3c	Model 4a	Model 4b	Model 4c
	Growth3y	Growth4y	Growth5y	Growth3y	Growth4y	Growth5y	Growth3y	Growth4y	Growth5y	Growth3y	Growth4y	Growth5y
Year birth	−0.0539 (0.0355)	−0.0209 (0.0307)	−0.0134 (0.0326)	−0.0490 (0.0347)	−0.0155 (0.0296)	−0.0066 (0.0327)	−0.0688 ⁺ (0.0365)	−0.0344 (0.0320)	−0.0225 (0.0361)	−0.0616 ⁺ (0.0356)	−0.0265 (0.0308)	−0.0136 (0.0359)
Dimension	−0.404 ^{***} (0.0525)	−0.502 ^{***} (0.0570)	−0.529 ^{***} (0.0631)	−0.409 ^{***} (0.0553)	−0.511 ^{***} (0.0607)	−0.540 ^{***} (0.0661)	−0.411 ^{***} (0.0516)	−0.508 ^{***} (0.0556)	−0.538 ^{***} (0.0602)	−0.414 ^{***} (0.0550)	−0.515 ^{***} (0.0598)	−0.545 ^{***} (0.0635)
Founders' exp.				−0.0038 ⁺ (0.0022)	−0.0039 ⁺ (0.0022)	−0.0059 [*] (0.0024)				−0.0043 ⁺ (0.0022)	−0.0043 ⁺ (0.0023)	−0.0066 ^{**} (0.0025)
Management Team				0.260 ^{***} (0.0539)	0.287 ^{***} (0.0669)	0.314 ^{***} (0.0599)				0.269 ^{***} (0.0544)	0.291 ^{***} (0.0679)	0.291 ^{***} (0.0605)
External Networks				0.195 ^{***} (0.0509)	0.231 ^{***} (0.0517)	0.310 ^{***} (0.0536)				0.203 ^{***} (0.0506)	0.249 ^{***} (0.0505)	0.325 ^{***} (0.0511)
Intangibles				0.0003 ⁺ (0.0002)	0.0004 [*] (0.0002)	0.0005 [*] (0.0002)				0.0003 ⁺ (0.0002)	0.0004 [*] (0.0002)	0.0005 [*] (0.0002)
Complexity							−0.00781 (0.0334)	0.00927 (0.0386)	−0.0328 (0.0371)	0.00823 (0.0339)	0.0285 (0.0403)	−0.0100 (0.0394)
Relatedness							0.273 [*] (0.118)	0.320 ^{**} (0.115)	0.285 [*] (0.125)	0.261 [*] (0.116)	0.310 ^{**} (0.115)	0.285 [*] (0.125)
Population Den							0.075 [*] (0.032)	0.034 ⁺ (0.036)	0.113 ^{**} (0.039)	0.062 ⁺ (0.034)	0.046 (0.038)	0.094 [*] (0.041)
Patwork							0.177 (0.201)	0.0773 (0.197)	−0.0730 (0.267)	0.248 (0.203)	0.158 (0.196)	0.0046 (0.268)
IQI							0.0927 (0.117)	−0.0728 (0.144)	0.00882 (0.145)	0.0143 (0.111)	−0.167 (0.140)	−0.103 (0.141)
_cons	109.8 (71.44)	16.05 (61.57)	12.64 (73.97)	99.95 (69.96)	32.54 (59.68)	13.74 (65.91)	139.0 ⁺ (73.49)	69.81 (64.31)	45.18 (72.58)	124.7 ⁺ (71.66)	54.00 (61.90)	27.44 (72.29)
Sector FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Macro regions FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	902	902	902	902	902	902	902	902	902	902	902	902
R ²	0.123	0.135	0.139	0.168	0.185	0.200	0.142	0.153	0.160	0.185	0.201	0.219
MAX VIF	1.04	1.04	1.04	1.10	1.10	1.10	1.99	1.99	1.99	2.00	2.00	2.00
AIC	2132.6	2276.1	2413.3	2095.0	2232.8	2354.9	2125.5	2269.6	2399.3	2087.0	2224.4	2341.6
BIC	2219.1	2362.6	2509.4	2205.5	2343.3	2470.2	2240.8	2384.9	2514.6	2221.5	2358.9	2476.1

Clustered standard errors in parentheses; ⁺ $p < 0.1$, ^{*} $p < 0.05$, ^{**} $p < 0.01$, ^{***} $p < 0.001$.

4-year windows. This indicates that the effect of relatedness on startup growth is negative for lower values and becomes positive once relatedness the value of 2.3, below the sample mean of 2.54: the marginal effect of relatedness is therefore negative only for startups located in the least related environments, and positive for the majority of provinces in our sample. Second, we found significant results for the quadratic term of intangible resources, but only for the 3-year growth window. In this case, the effect follows an inverted U-shaped curve, with lower values of early R&D investments having a positive effect on startup growth. Once R&D investment reaches a certain threshold, its effect on startup growth becomes negative.

The second robustness test was intended to control for so-called sustained growth. The results of the logistic regression model are presented in Table 4; a large number of the variables of interest do not show changes in comparison to models presented in Table 3. Among the internal variables, the presence of an organized management team ($\beta = 0.373$, $p < 0.05$) and an external network ($\beta = 0.472$, $p < 0.001$) maintain their significant positive effect. The influence of relatedness ($\beta = 0.959$, $p < 0.001$) does not show any change with respect to the previous specification, remaining significantly positive. Conversely, founder age and early investments in R&D become non-significant.

6. Discussion and Conclusions

6.1. Research contribution

Our paper contributes to the RBV literature by focusing on the understudied stream analyzing new ventures (Alvarez & Busenitz, 2001; Zahra, 2021). We concentrate on the early stage of new venture development, when startups are particularly vulnerable and subject to great uncertainty. We contribute to the debate by jointly analyzing the internal and external productive resources that startups leverage to overcome the liabilities of newness and smallness.

Our analysis of internal factors confirms that the effective

deployment of an early-stage resource bundle, an organized management team, external relational networks, intangible assets, and younger founding teams are associated with higher growth, consistent with empirical work within the RBV tradition (Chandler & Hanks, 1994; Paoloni & Modaffari, 2022; Protogerou et al., 2017; Weemaes et al., 2022; Wu, 2007). Notably, the positive effect of structured management teams and broader managerial networks on startup growth is consistent with Zahra's (2021) notion of resourcefulness, the creative management of scarce resources. Structured teams enable task specialization and the emergence of internal routines (Ensley et al., 2006), while external networks compensate for an initial lack of proprietary resources by providing access to knowledge, partnerships, and legitimation channels (Field et al., 2013; Stuart & Sorenson, 2003). The positive role of intangible resources reinforces the interpretation of innovation as a strategic lever through which startups address the liabilities of newness, consistent with the knowledge-intensive nature of the innovative-startup context (Modina et al., 2024).

The literature is more divided as to the effect of founder age on startup growth (Delmar & Shane, 2006; Gruber et al., 2024). Our evidence suggests that a younger founding team may positively affect startup growth. Younger entrepreneurs tend to adopt more agile, lean management practices and may introduce more creative, fresh ideas compared to older founders.

By exploring the external factors that influence startup growth through the economic complexity paradigm, we address a specific gap in the RBV literature: the value of resources embedded in the external environment (Barney, 2001; Barney et al., 2021; Zahra, 2021). Interestingly, we identify a more pronounced effect of relatedness (i.e., highly specialized areas with a dense network of competencies) on startup growth, but not for economic complexity.

Industrial relatedness can be interpreted as the strategic redeployment of local resources available to the startup (Sabel & Sasson, 2023; Sakhartov, 2017). Relatedness functions as an enabler of growth not because it provides generic agglomeration benefits, but because it expands the range of cognitively accessible productive options that startups can integrate into their resource bundle without exceeding their limited absorptive capacity (Colombo et al., 2006; Grillitsch & Schubert, 2021).

Previous research suggests that economic complexity can have opposing effects, supplying valuable resources that facilitate the emergence of startups while simultaneously crowding the playing field with sophisticated rivals, thus favoring scaling strategies or reducing the effectiveness of the local knowledge search process (Mazzoni & Innocenti, 2024; Yayavaram & Chen, 2015). Another concurrent explanation, not yet explored by the literature, could be that regions with higher economic complexity may attract entrepreneurs oriented to exit strategies, given the dense presence of potential acquirers, rather than toward sustained organic growth.

Finally, we contribute to the necessary methodological expansion of the RBV (Helfat et al., 2023), by introducing the economic complexity paradigm in relation to the growth of startups at the firm level. In the fields of economic geography and innovation studies, the economic complexity paradigm has been shown to be a better predictor, with respect to previously adopted metrics, for identifying future growth potential, innovativeness, inequalities, and development of the area analyzed (Hidalgo, 2021; Hidalgo & Hausmann, 2009). We consider it an effective framework for addressing the need for specific, concrete methods to assess the impact of external factors on firm performance (Castrogiovanni, 1991; Chowdhury & Endres, 2021), in line with emerging approaches on the importance of external enablers on entrepreneurship (Davidsson et al., 2020; Davidsson et al., 2023).

In comparison to previous approaches used to measure external environment effects on firms (e.g., Baum et al. 2001; Misangyi et al. 2006), the economic complexity paradigm extends beyond the quantity (munificent), volatility (dynamism), or heterogeneity of local resources, offering a fresh view of how the modern economy can offer a capability-

Table 4
Robustness test – sustained growth.

	Model 5	Model 6	Model 7	Model 8
	Logit	Logit	Logit	Logit
Year birth	−0.156 ⁺ (0.0922)	−0.149 (0.092)	−0.227* (0.096)	−0.219* (0.097)
Dimension	−0.109 (0.143)	−0.133 (0.159)	−0.126 (0.146)	−0.149 (0.162)
Founders' exp.		−0.005 (0.006)		−0.006 (0.006)
Management Team		0.373* (0.175)		0.331⁺ (0.183)
External Networks		0.472*** (0.128)		0.515*** (0.132)
Intangibles		0.001 (0.001)		0.001 (0.001)
Complexity			0.005 (0.079)	0.038 (0.080)
Relatedness			0.959*** (0.288)	0.996*** (0.291)
Population			−0.034 (0.088)	−0.066 (0.089)
Patwork			0.306 (0.518)	0.406 (0.519)
IQI			0.102 (0.353)	−0.071 (0.346)
_cons	314.8 ⁺ (185.7)	300.3 (186.1)	456.1* (193.2)	440.3* (195.1)
Sector FE	YES	YES	YES	YES
Macro regions FE	YES	YES	YES	YES
N	897	897	897	897
AIC	1242.1	1230.5	1241.9	1226.2
BIC	1323.7	1336.0	1352.3	1351.0

Clustered standard errors in parentheses; ⁺ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

combinatorial view of production: hard-to-copy capabilities and the distance to the “adjacent possible”. Furthermore, its independent explanatory power (without relying on factor-based scales constructed on non-replicable firm-level data) and inherent comparability across countries make economic complexity a compelling choice for developing a common background for modeling the knowledge space in which entrepreneurs strategize.

6.2. Managerial and policy implications

Our findings suggest that internal factors, such as the presence of a well-organized management team, external relationships, investment in intangible resources, and relatively younger teams, lead to growth for innovative startups. The management team and external networks play a particularly important role in the sustained growth process over time. Founders and aspiring entrepreneurs should therefore consider prioritizing the creation of structured management teams, which can help develop an adequate level of specialization, as well as create and maintain a portfolio of external relationships and professional affiliations, which serve as channels for acquiring complementary knowledge, capital, and legitimization.

With respect to external factors, founders should not simply target the most advanced areas in terms of knowledge, but should carefully evaluate the relatedness of the local productive structure, which may create economies of scope. A dense, interconnected local environment of cognitively proximate industries lowers the cost of accessing adjacent capabilities, suppliers, and talent pools for a resource-constrained startup to exploit. However, our results reveal that the positive effect of relatedness on startup growth exists only above a certain threshold. In other words, these channels generate growth opportunities only in territories where the density of related activities is sufficiently high.

Interestingly, all examined variables consistently maintain—and often increase—their effect on startup growth over each of the windows considered, indicating how decisions and strategic choices made in the founding years shape a firm's subsequent growth trajectory by triggering virtuous circles of growth.

Our results also offer guidance to policymakers. The finding that relatedness, but not economic complexity, drives startup growth has direct implications for innovation policy. Policies that concentrate resources on the most sophisticated regions may miss the importance of the connectedness of the surrounding industrial structure. Policymakers should therefore design programs that strengthen regional relational infrastructure, such as technology-transfer hubs, matchmaking platforms between startups and adjacent incumbents, or skill mobility schemes within related industries. This is particularly consequential for countries like Italy, with significant interregional heterogeneity in productivity and innovation capacity.

The persistence of the estimated effects across three-, four-, and five-year horizons indicates that the configuration of the startup at founding continues to shape its growth trajectory. While our design does not evaluate policy interventions, this persistence suggests that support directed at the pre-incorporation and early-stage support (e.g., team-formation programs, location-advisory services, early-stage intellectual-property support), may have durable effects.

6.3. Limitations and future Directions

Studying new venture growth presents significant challenges due to the unique structure of startups, the rapid pace of technological evolution, and the scarcity of historical data, which complicates the adoption of a cohesive analytical framework (Baum et al., 2001; Cooper, 1993). While our investigation yields valuable insights, it is not without limitations that merit further exploration in future research.

First, the limited focus of our study on startups within a single country necessitates additional investigations to evaluate potential limits to the generalizability of our findings to other contexts,

particularly concerning the economic complexity paradigm. The Italian industrial structure, dominated by small- and medium-sized enterprises with strong local embeddedness and with large heterogeneity across regions, is informative for other countries that share a similar structure (e.g., Spain), but determining the generalizability of our results to more globalized and venture capital-based ecosystems requires future study.

Second, although we identified the internal startup characteristics of interest from the existing literature, data collection for some such characteristics (such as external networks) was constrained and some features were missing (e.g., innovation and education) due to the data availability on ORBIS. This issue might be addressed in future studies through the exploration of countries with higher-quality data, which could facilitate a more precise construction of these variables.

Similarly, our choice of employment growth as our dependent variable is grounded in the empirical literature on startup growth (Garnsey et al., 2006; Santoleri, 2020; Stam & Wennberg, 2009; Weemaes et al., 2022), and is consistent with the RBV interpretation of employment as an indicator of organizational commitment and human-capital accumulation. Nonetheless, alternative indicators such as turnover, market share, assets, or intellectual-property output capture different facets of the growth process and are often only weakly correlated with one another. Future studies using richer databases could test whether the relationships we identify hold when growth is measured through these alternative dimensions.

Third, with a more extensive dataset, multilevel models could more effectively identify the associations between nested data. Such an approach offers the opportunity to examine entrepreneurs as creative agents embedded within enabling structures, thereby empirically augmenting existing theoretical perspectives on this subject (Combs et al., 2023; Kimjeon & Davidsson, 2022; Mazzoni et al., 2022b). In this respect, we therefore cannot exclude that some of the interaction patterns suggested by the marginal-effects analysis, currently undetected, could reveal other interesting patterns. Fourth, our indicators of relatedness and complexity are both constructed from employment data. Future research should consider alternative data sources beyond employment metrics (e.g., patents, export data) to develop indicators of relatedness and complexity, thereby testing whether different forms of knowledge distinctly influence growth processes.

CRedit authorship contribution statement

Leonardo Mazzoni: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Niccolò Innocenti:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Stefania Oliva:** Writing – review & editing, Writing – original draft, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jbusres.2026.116571>.

Data availability

The authors do not have permission to share data.

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Leonardo Mazzoni is Research Associate at the Centre for a Digital Society – Robert Schuman Centre, European University Institute. He is member of the program committee of the PhD program in Development Economics and Local Systems at the University of Florence. His research spans entrepreneurship, innovation and digital transformation, focusing on startups' determinants of birth, performance and growth, entrepreneurial ecosystems and the development of new technologies.

Niccolò Innocenti is Senior Assistant Professor of management at the Department of Economics and Management, University of Florence where he is member of the program committee of the PhD program in Development Economics and Local Systems. He has been involved in several regional national and European projects, on themes connected to innovation, entrepreneurship, digital transition and local development. His main research interests include entrepreneurship, development of new technologies and innovation.

Stefania Oliva is Senior Assistant Professor in Economics and Management at the Department of Economics and Management, University of Florence. Her research interests include, among others, resilience and creative cities, business models and value creation in museums.