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Entrepreneurial innovativeness: When too little or too much agglomeration hurts

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ABSTRACT

This study sheds light on the relationship between agglomeration, entrepreneurs' internal resources and capabilities, and new ventures' innovativeness using a multilevel framework. We argue that the urban agglomeration of economic agents within a country has an inverted U-shaped relationship with new ventures' innovativeness, suggesting that both insufficient and excessive agglomeration might be detrimental to entrepreneurial innovativeness. Additionally, we perform interactions between individual level factors and urban agglomeration to examine the differential effects of entrepreneurs' internal resources and capabilities. Results confirm our hypothesising that the geographical concentration of economic agents within a country exerts an inverted U-shaped influence on new ventures' innovativeness. Furthermore, we find that entrepreneurs with higher levels of education or prior entrepreneurial experience are better equipped to benefit from agglomeration and to mitigate its negative effects; in contrast, at low levels of agglomeration, entrepreneurs with lower resources exhibit increasing marginal returns. Entrepreneurs in contact with other entrepreneurs are better positioned to deal with agglomeration externalities although their benefits and drawbacks are intensified. Our research contributes to the understanding of agglomeration externalities and entrepreneurial innovativeness, its non-linear dynamics and differential effects.

1. Introduction

It is widely accepted in the entrepreneurship literature that high levels of entrepreneurial activity per se do not guarantee economic prosperity but the type of new firm created, with innovative new ventures being key actors of economic development and change (Colombelli et al., 2016; Szerb et al., 2019). In practice, however, entrepreneurship is largely replicative in nature and the levels of innovative entrepreneurship vary significantly across countries (Kelley et al., 2010). Entrepreneurs operate within a national ecosystem, involving a variety of interdependent actors and contexts, and it is precisely this interplay what determines the development and growth of innovative start-ups (Wright, 2014; Spigel, 2015). Thus, understanding both the macro and micro-level factors driving the creation of innovative new ventures, and factor dynamics, is crucial to entrepreneurial development and economic growth (Stam, 2015; Cantner et al., 2020).

From an entrepreneurial ecosystem perspective, the spatial dimension plays a significant role in innovative entrepreneurship (Autio et al., 2014). In particular, the agglomeration of economic agents in urban areas within countries is considered key to the creation of, and access to, new knowledge required for the development of innovative new ventures (Acs and Varga, 2005). Urban agglomeration, defined as the concentration of heterogeneous economic actors and activities within cities, generates knowledge spillovers and externalities that drive creativity and innovation and increase the availability of inputs for the creation and survival of innovative new ventures (Audretsch and Keilbach, 2007; Beaudry and Schiffauerova, 2009; Tran and Santarelli, 2017; Frick and Rodríguez-Pose, 2018). However, extant research reports divergent results suggesting both a positive (e.g., Cavallo et al., 2018) and a negative (e.g., Qian et al., 2012) impact of urban agglomeration on entrepreneurial innovativeness. This corresponds to the so-called 'proximity paradox' (Boschma and Frenken, 2010), suggesting that agglomeration may have a two-fold effect on innovative entrepreneurship due to congestion effects. Agglomeration leads to an increase in

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input prices and makes new knowledge and ideas less common within the system, implying a non-linear effect of urban agglomeration on entrepreneurial innovation (Sedgley and Elmslie, 2004; Plummer and Acs, 2014).

However, entrepreneurship research has tended to overemphasise the direct link between agglomeration and entrepreneurial innovation and overlook how proximity may generate congestion effects (Ejdemo and Örtqvist, 2020). The agglomeration economics and strategic management literature posits that entrepreneurs' internal resources and capabilities enabling new knowledge exploitation might moderate these non-linear effects (Molina-Morales and Expósito-Langa, 2012). However, theoretical and empirical work on moderating factors has largely focused on firm-level resources, obviating entrepreneur-level factors (Shaver and Flyer, 2000; Pe'er and Keil, 2013; Knoben et al., 2016). Consequently, extant research only provides a partial picture with ambiguous results regarding the non-linear effect of agglomeration on entrepreneurial innovativeness and the moderating effect of individual level factors (Audretsch et al., 2018; Audretsch et al., 2021).

This paper, therefore, examines the existence of a curvilinear relationship of countries' urban agglomeration with innovative entrepreneurship, hypothesising that both insufficient and excessive urban concentration might be detrimental to new ventures' innovativeness. In other words, this form of agglomeration has a marginal value, beyond which further agglomeration begins to hinder the flow of new knowledge within the system and hamper the expected benefits of starting innovative firms due to competitive pressures, complexity and congestion effects (Plummer and Pe'er, 2010; Sedgley and Elmslie, 2011; Plummer and Acs, 2014). Furthermore, as the effects of agglomeration externalities on new ventures' innovativeness are contingent on firm-level factors (Shaver and Flyer, 2000; McCann and Folta, 2011), we examine how the impact of urban agglomeration on innovative entrepreneurship differs depending on entrepreneurs' internal resources and capabilities. To address both research questions, this study draws on the National Systems of Entrepreneurship (NSE) theory's premise that entrepreneurial behaviour is driven by the individual pursuit of opportunity and its outcomes are determined by the interaction between internal factors and the national context where the entrepreneur operates (Acs et al., 2014; Acs et al., 2016; Schillo et al., 2016).

This paper contributes to entrepreneurship and agglomeration research in several ways. We respond to recent calls to investigate entrepreneurial innovation in terms of the type of new venture pursued and operating context (e.g., Autio et al., 2014; Agarwal and Shah, 2014). Prior research on the external drivers of entrepreneurial innovation has largely focused on the institutional context (e.g., Laplume et al., 2014; Hoogendoorn et al., 2020) while the influence of the spatial dimension remains largely under-researched (Plummer and Acs, 2014; Zahra et al., 2014). Hence, we expand current understanding by examining the impact of countries' urban agglomeration on innovative entrepreneurship (Acs et al., 2014). We hypothesize and confirm the non-linearity of these agglomeration externalities shaping entrepreneurial innovation outcomes. In doing so, we contribute to the development of NSE theory by providing a more nuanced view of its non-linear dynamics. This research also contributes to the strategic management and agglomeration literature by proposing and testing the moderating role of entrepreneurs' internal resources and capabilities to examine how entrepreneurs might benefit differently from their context (Shaver and Flyer, 2000; McCann and Folta, 2008; Van Oort et al., 2012). By considering entrepreneurs' human and social capital, we explore individual level agency which is under-researched in agglomeration studies and propose a comprehensive approach of how individuals – in addition to firms – benefit from agglomeration (Rutten, 2014).

2. Theoretical background and hypotheses development

NSE theory argues that new venture's feasibility and desirability are driven by the individual-level opportunity pursuit and regulated by country-level factors, mainly the institutional setting, and contextual factors, such as market conditions, culture and resource availability (Acs et al., 2014). The NSE framework posits that entrepreneurs' actions are important for the entrepreneurial process but emphasizes that the interaction between contextual factors and entrepreneurs is critical in this process (Cowling, 2016). Therefore, it is important to consider both individual and country level factors and their interactions when examining differences in new venture creation and innovativeness across countries (Schillo et al., 2016).

Among the factors that determine a country's entrepreneurial dynamics, the spatial concentration of people and economic activities within urban areas shapes the availability of resources, entrepreneurial activity and its variety, as well as the increased demand and market imperfections, which determine entrepreneurial pursuit and behaviour (Plummer and Pe'er, 2010). The agglomeration of diverse economic agents in urban areas influences the sharing, matching, learning, and knowledge spillovers mechanisms identified in the literature as the main drivers of innovation (Rosenthal and Strange, 2004; McCann and Folta, 2008; Feldman and Kogler, 2010; Carlino and Kerr, 2015). Consequently, the lens of agglomeration theory can be adopted to extend existing knowledge on new ventures' innovativeness (Audretsch and Feldman, 2004; Carlino and Kerr, 2015). Agglomeration theories provide a strong basis to understand the external drivers of innovative entrepreneurship as well as the hindering forces (e.g., pecuniary externalities of competition and congestion diseconomies) that underlie the contradictory results obtained in entrepreneurship research (Delgado et al., 2010). Moreover, this strand of literature shows an increasing interest in the role exerted by firms' internal resources and capabilities as a focal point to understand the relationship between agglomeration and innovation, in line with NSE theory (Crescenzi and Gagliardi, 2018; Speldekamp et al., 2020).

In this regard, at the individual level, the resource-based view has been extensively applied to understand entrepreneurial processes and entrepreneurs' innovative behaviour (e.g., Lockett and Wright, 2005; Paradkar et al., 2015). Innovative entrepreneurs require specific resources and capabilities, such as knowledge, managerial and organizational skills as well as social networks, in order to pursue and exploit market opportunities and extract rents through new products, processes or services (Alvarez and Busenitz, 2001). However, entrepreneurial outcomes are generated following different paths and the effects of agglomeration externalities are contingent on firm-level factors (Knoben et al., 2016). This implies that new ventures are heterogeneous in nature and differ in terms of the benefits they harness from agglomeration depending on their internal resources and capabilities (Shaver and Flyer, 2000; Pe'er and Keil, 2013).

Thus, the literature suggests how innovative entrepreneurship is influenced by context-specific conditions at national level, such as urban agglomeration, which can generate both positive and negative effects on new ventures' innovativeness. In turn, entrepreneurs' internal resources and capabilities to access and effectively commercialize new knowledge also affect the agglomeration-innovative entrepreneurship relationship. This is in line with the systemic view of the entrepreneurial process where the type of new venture created depends on the interplay between individuals' internal resources and capabilities and their operating context (Autio et al., 2014). Therefore, the theoretical framework proposed in this study (Fig. 1) integrates multi-dimensional factors influencing entrepreneurial innovativeness and focuses on cross-level interactions.

2.1. Urban agglomeration and new ventures' innovativeness

At a contextual level, geography of innovation theories argues that entrepreneurs' innovative behaviours emerge from the agglomeration of economic activities (Crescenzi et al., 2012). The literature posits a series of mechanisms or factors that enhance entrepreneurial innovativeness due to agglomeration externalities, such as sharing infrastructures, input

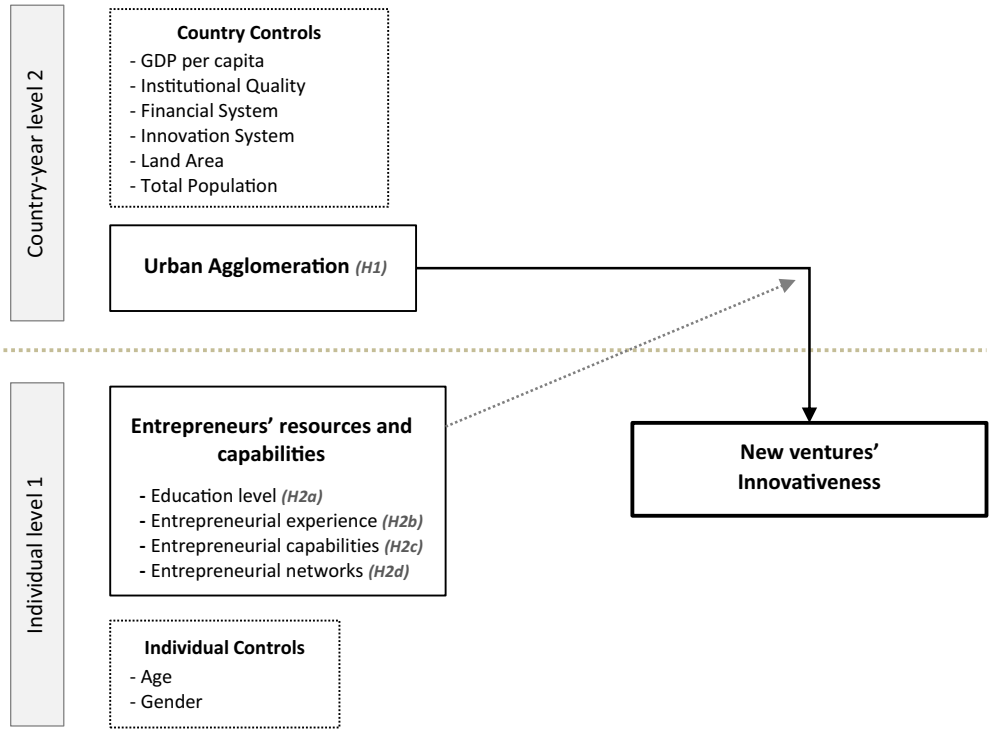

Fig. 1. Theoretical framework.

and specialized labour pooling, supply and demand matching, legitimacy and diversity (Rosenthal and Strange, 2004; Tran and Santarelli, 2017). In terms of diversity, it is argued that the geographical concentration of diverse economic actors in urban areas increases information flows between agents, which fosters the "cross-fertilization of ideas", and creates new knowledge and therefore innovation through the so-called 'Jacob's externalities' (Carlino et al., 2007; Bosma and Sternberg, 2014).[1]

These externalities are influenced by the spatial dimension where they occur, implying that knowledge spillovers fostering innovation tend to be local and decrease with distance (Feldman and Kogler, 2010). However, several studies have noted how they occur across and within national boundaries (Maurseth and Verspagen, 2002; Thompson and Fox-Kean, 2005).[2] Consequently, the analysis of the country-specific context (e.g., urban agglomeration degree) that shapes intra-national knowledge spillovers driving productive entrepreneurship has gained increased attention by scholars in order to explain cross-countries differences (e.g., Acs and Varga, 2005; Audretsch and Lehmann, 2017). In that respect, Tavassoli et al. (2017) extensively discussed the concept of "*aspatial knowledge spillovers*" as inter-regional knowledge spillovers based mainly in scientific and entrepreneurial knowledge rather than technological knowledge that is more spatially bounded, its role on strategic entrepreneurship and how urbanization drives them within national boundaries. This study sides with this conceptualisation rather than localized and specialized knowledge spillovers which are more difficult to capture at a national scale.

The urban concentration of diverse economic agents encourages the accumulation of human capital and knowledge in specific areas, providing richer interactions and boosting the spread of information and new knowledge within a country, which trigger productive entrepreneurship (Acs and Varga, 2005; Tavassoli et al., 2017). These urban areas host more knowledge-generating institutions, supportive and collective services, as well as an easy access to financial resources and skilled labour, which foster innovation (Harrison et al., 1996). Further, as diversity and competition increase, innovative activities increase within these areas (Feldman and Audretsch, 1999; Plummer and Acs, 2014). Duranton and Puga (2004) argue that cities act as a "nursery" for new firms driving innovation and growth at micro and country level "*through the sharing and matching of inputs, people, and ideas*" (Frick and Rodríguez-Pose, 2018, p. 160). Urban agglomerates provide a fertile national ecosystem with an efficient spatial distribution of economic agents, which promotes growth and dynamism within the country (Ganau and Rodríguez-Pose, 2021).[3]

However, scholars have also noted how urban agglomerations can hinder innovation since highly agglomerated regions have higher operational costs (e.g., high input prices, increased wages and rent inflation) which erode the expected profits from innovative new ventures (Sedgley and Elmslie, 2011). At national level, it is argued that increasing economic and population density in urban areas generates the above-mentioned congestion effects, which may hamper the flow and diffusion of knowledge and halt innovation (Sedgley and Elmslie, 2011; Frick and Rodríguez-Pose, 2018). The benefits of concentration in countries' core urban areas may be outweighed by congestion effects, generating a re-dispersion of economic activities and a balanced urban system. However, cities' employment and benefits may generate a "*co-ordination failure*" mechanism, leading to high concentration in core

[1] For further details of agglomeration externalities (Marshall, Jacobs and Porter) and their interconnections see Beaudry and Schiffauerova (2009) and Frenken et al. (2007).

[2] Audretsch and Feldman (2004, p. 2718) indicate that "*knowledge externalities are so important and forceful that there is no reason that knowledge should stop spilling over just because of borders, such as a city limit, state line, or national boundary*".

[3] Several papers, within the economic geography field, have noted the importance of the national urban system regarding to countries' innovative capacity, highlighting how the main urban agglomerations within a country remain highly connected between them, having cities their own trajectories and characteristics to generate and diffuse innovations, which are determined and constrained by the national urban system (Polèse, 2005, 2006; Rozenblat, 2009; Rozenblat and Pumain, 2018).

urban structures, increasing the negative externalities of agglomeration within the country and inhibiting innovation and growth (Venables, 2005; Accetturo, 2010).[4] Within these urban systems, firms' have less resources available to support R&D activities due to the lower margins derived from increased competition (Beaudry and Breschi, 2003) as well as fewer knowledge links due to an under-search of potential collaborators in their context "*by becoming overselective*" (Berliant et al., 2006). Both macro- and micro-mechanisms reduce the accumulation, creation and spread of knowledge, both locally and nationally, and may hinder innovative responses by entrepreneurs (Antonelli, 2017).[5]

Therefore, the above arguments point to a two-fold effect of urban agglomeration on entrepreneurial innovation, the so-called 'proximity paradox' (Boschma and Frenken, 2010). It suggests that geographic proximity between economic agents can foster knowledge exchange but at the same time too much proximity could hurt innovativeness (Boschma, 2005). This paradox is based on the premise that geographical proximity within urban areas enables the exchange and creation of new knowledge boosting innovation. However, as urban agglomeration increases, congestion effects hinder knowledge spillovers within the national system, hampering innovation. This implies that a high concentration of diverse economic agents and population in cities can disrupt the exchange of new knowledge and information, which results in a nonlinear impact on new ventures' innovativeness (Sedgley and Elmslie, 2011). Therefore, we propose the following hypothesis:

H1. There is an inverted U-shaped relationship between urban agglomeration at the country level and new ventures' innovativeness.

2.2. Moderating effects of entrepreneurs' internal resources and capabilities

2.2.1. Education level

Entrepreneurs' formal education increases their stock of knowledge and reasoning skills, which increases cognitive and problem-solving performance and, therefore, innovation identification and exploitation (Marvel and Lumpkin, 2007). It is argued that entrepreneurs with high stocks of knowledge benefit more from agglomeration and suffer less from its negative effects due to their increased capacity to adapt to intense competition and greater absorptive capacity, which allows them to identify, integrate and effectively exploit relevant external information required to innovate (Escribano et al., 2009; McCann and Folta, 2011). Furthermore, in agglomerated markets, competition usually increases, and coupled with congestion effects, firms' profits decrease. Hence, entrepreneurs are required to have high levels of knowledge and capabilities to acquire resources outside the firm's boundaries, benefit from specialized suppliers, generate legitimacy with their purchasers, and learn from their customers (Pe'er and Keil, 2013).

The above responds to the "knowledge competition argument" where entrepreneurs with stronger knowledge are better placed to benefit from agglomeration-knowledge externalities and suffer less from congestion effects (Cohen and Levinthal, 1990; Kogut and Zander, 1992; Grillitsch and Nilsson, 2019). However, the literature also postulates that knowledge externalities may be less relevant for entrepreneurs with stronger knowledge, benefitting weaker entrepreneurs until differences between them disappear, responding to the "knowledge equilibrium argument" (Shaver and Flyer, 2000; Tallman et al., 2004; Alcácer and Chung, 2007). Both arguments rely on complex substitution and complementarity effects between firms' internal and external knowledge, where weak firms can substitute, and stronger firms can complement, their internal knowledge with external knowledge from urbanization economies (Speldekamp et al., 2020).

For the "knowledge equilibrium argument", it is argued that knowledge-rich firms are more likely to access redundant knowledge within urban agglomerations; therefore, they rely more on in-house R&D activities coupled with localized and specialized knowledge to innovate; in other words, they benefit less from being located in diversified urban areas and more from specialized clusters (Beaudry and Schiffauerova, 2009; Frenken et al., 2015). Furthermore, these firms are exposed to higher risks of knowledge leakage to competitors (Shaver and Flyer, 2000; Alcácer and Chung, 2007; Boschma and Frenken, 2011). Hence, the substitution effect that weaker firms may experience from urban agglomeration can be greater than the complementary effect for strong firms (Speldekamp et al., 2020). This implies that knowledge-poor firms might comparatively gain more from agglomeration-knowledge externalities compared to knowledge-rich ventures (Hervas-Oliver et al., 2018; Potter and Watts, 2010).

Recent studies have highlighted how the above arguments coexist and the net effect of agglomeration externalities depends on internal and contextual factors. As agglomeration increases, the "knowledge competition argument" seems to be the predominant effect while the "knowledge equilibrium argument" may emerge at low levels of agglomeration where new knowledge provided by urban agglomerations devaluates slowly and is easily accessible to weak firms and redundant to strong firms (Frenken et al., 2015; Grillitsch and Nilsson, 2017, 2019). Taking both arguments together, in general entrepreneurs with higher levels of education are better positioned to benefit from agglomerations and suffer less its negative impacts. However, at low levels of agglomeration, entrepreneurs with lower levels of education can experience increased marginal gains from agglomeration but, at high levels, suffer more its negative impacts as external knowledge erodes quickly and the substitution effect decreases (Pe'er and Keil, 2013; Frenken et al., 2015). We suggest, therefore, that the positive and negative effects of urban agglomeration at the country level on new ventures' innovativeness will be attenuated for entrepreneurs with higher levels of education and strengthened for entrepreneurs with lower levels of education.[6] Accordingly, we propose the following hypothesis:

H2a. The concavity of the inverted U-shaped relationship (H1) will be weakened for individuals with higher education levels compared to individuals with lower levels of education.

2.2.2. Entrepreneurial experience

Entrepreneurs' accumulated experience (e.g., work, management and entrepreneurial) increases innovation by providing relevant knowledge and skills which facilitate decision-making, exchange and combination of new information and better resource acquisition (Marvel and Lumpkin, 2007; Vaillant and Lafuente, 2019; Garcia Martinez et al., 2019). As urban agglomeration increases, entrepreneurs require start-up experience and organizational capabilities to mitigate congestion effects

[4] Over-concentration processes favouring specific cities (e.g., Mexico City, Seoul, or Bangkok) have negative impact on non-primate cities due to a disproportionate absorption of resources by primate cities to solve their increasing congestion effects, which hurts economic growth within the whole system (Henderson, 2002).

[5] According to Antonelli (2017) the introduction of innovations within highly agglomerated regions increases the complexity of the system to innovate, which may induce the decline and deterioration of the overall stock of knowledge due to an increase of the "*search, absorption, decodification costs*", as well as a decrease of the "*coherence, variety and rarity of the stock of knowledge*" and "*external connectivity*" between agents.

[6] Considering the predominance of the "competition argument", our hypotheses assume that the increase in marginal gains by weak entrepreneurs in terms of the resources addressed, if it occurs, is not enough to outstrip the total gains by strong entrepreneurs (i.e., the curve for strong entrepreneurs will be above). To test the hypothesized effects, we posit that the curve for strong entrepreneurs compared to weak entrepreneurs weakens or strengthens its concavity, revealing if the upsides and downsides of urban agglomeration are attenuated (weak concavity) or accentuated (strong concavity) for strong entrepreneurs.

and enhance innovation performance (Bahlmann, 2016). Specifically, entrepreneurs require a set of competencies (e.g., management of budgets, operations, personnel, financing or marketing) to effectively combine firm's inputs and manage the business, to become more productive than their rivals, and survive within highly competitive markets (Pe'er et al., 2008).

As previously stated, this responds to the "knowledge competition argument" where stronger entrepreneurs in terms of entrepreneurial knowledge benefit greater from agglomeration-knowledge externalities and suffer less from congestion effects. However, the "equilibrium argument" may also be present implying that weaker entrepreneurs in terms of entrepreneurial knowledge can experience increased marginal benefits from agglomeration externalities (Shaver and Flyer, 2000; Pe'er et al., 2008). The prevalence of both arguments depends on contextual and internal factors, determining different paths to innovation based on substitution and complementarity effects of business-related knowledge (Agarwal et al., 2010; Grillitsch and Nilsson, 2019; Speldekamp et al., 2020). For the equilibrium argument, Mathias et al. (2021) provide a review of the constraints that experienced entrepreneurs may face within agglomerations to complement their knowledge base and innovate, such as greater rigidity and inertia of past knowledge and practices, which can make them less capable to recognize and integrate new knowledge extracted from urban agglomerations. In contrast, less experienced entrepreneurs tend to have less structural inertia and are more likely to adopt new knowledge and routines, having greater learning advantages to innovate (Kotha et al., 2011; Diez-Vial and Fernández-Olmos, 2017). Given the resource limitations that novice entrepreneurs have to generate knowledge internally and their greater need to draw upon external sources of information, the substitution effect from urban agglomerations would become more relevant to innovate compared to the complementarities that experienced entrepreneurs can derive from these agglomerations (McDougall et al., 1994; Mathias et al., 2021).

Taken these arguments together, the "competition argument" posits that experienced entrepreneurs may benefit more from agglomeration externalities and suffer less its congestion effects. However, at low levels of urban agglomeration, experienced entrepreneurs may exhibit decreasing marginal gains compared to novice entrepreneurs, in line with the "equilibrium argument". When the value of the knowledge provided by urban agglomerations decreases slowly, experienced entrepreneurs may be more reluctant to integrate external knowledge (seen as superfluous) while novice entrepreneurs might be more prone to integrate it (Beaudry and Schiffauerova, 2009; Shearmur and Doloreux, 2016; Grillitsch and Nilsson, 2019). At high levels, as noted, novice entrepreneurs may suffer more from congestion effects due to the lack of business-related knowledge as well as a decrease in the potential substitution effect (Pe'er et al., 2008; Bahlmann, 2016). We suggest, therefore, that the positive and negative effects of urban agglomeration at the country level on new ventures' innovativeness will be more attenuated for experienced entrepreneurs and more exacerbated for novice entrepreneurs. Hence, we test the following hypothesis:

H2b. The concavity of the inverted U-shaped relationship (H1) will be weakened for experienced individuals compared to novice individuals.

2.2.3. Entrepreneurial capabilities

Entrepreneurial innovations, however, not only emerge from having knowledge but also require the appropriate capabilities to exploit it (Lockett and Wright, 2005). Within agglomerated locations, it is argued that firms with higher capabilities to access and integrate new knowledge achieve better innovation performance (McCann and Folta, 2011). Entrepreneurs require capabilities to optimize and reorganize business processes quickly to meet changing customer needs (Teece, 2014). Hence, entrepreneurial capabilities, understood as those needed to successfully start and run a business, are essential to properly exploit the opportunity through an appropriate architecture and strategic management (Eisenhardt and Martin, 2000; Paradkar et al., 2015). Additionally, the negative effects of agglomeration may be weaker for those entrepreneurs with the necessary capabilities to set up a business. Competitive pressures and congestion costs in highly agglomerated markets require efficient entrepreneurs (Pe'er et al., 2008). Entrepreneurs with the capabilities to set up a new business within these complex and dynamic contexts have capacity to overcome resource constraints, such as capital, which provides greater flexibility and agility to bring the resources required to enhance competitive positions (Delmar and Shane, 2004; Aramand and Valliere, 2012).

However, as stated above, new ventures' capabilities are "important contingencies" that will determine how a firm is affected by agglomeration forces (Pe'er and Keil, 2013). These contingencies may act as a "competition" mechanism —stronger firms deal better with positive and negative agglomeration externalities—, or as an "equilibrium" mechanism that allows weaker firms to experience greater marginal gains from agglomeration externalities until they converge with stronger firms (Grillitsch and Nilsson, 2019; Speldekamp et al., 2020). In this regard, Shaver and Flyer (2000) argue that strong firms, in terms of their capabilities, may have less to gain from agglomeration externalities compared to weaker firms based on the premise that strong firms face greater costs in terms of knowledge redundancy and its leakage to competitors within agglomerations (Frenken et al., 2015). Hence, external resources and new knowledge from urban agglomerations are more valuable for entrepreneurs with a low level of entrepreneurial capabilities compared to strong entrepreneurs who rely more on their internal capabilities and for whom access to external knowledge provided by urban agglomerations is less vital (Hervas-Oliver et al., 2018). Strong firms need to compensate the lack of complementary knowledge available in urban agglomerations through distanced pipelines (e.g., global linkages) and strong in-house capabilities (Grillitsch and Nilsson, 2017). Furthermore, the strong reliance on their internal capacities may generate behavioural rigidities and hamper learning from their local environment (Navis and Ozbek, 2016). Thus, the substitution effect experienced by entrepreneurs with weak entrepreneurial capabilities from urban agglomerations may become more relevant to innovate, compared to the complementary effect experienced by strong entrepreneurs (Grillitsch and Nilsson, 2017; Grashof, 2021).

The above arguments suggest that entrepreneurial capabilities may enable entrepreneurs to benefit from agglomeration and weaken its negative effects. However, at low levels of agglomeration, strong entrepreneurs in terms of entrepreneurial capabilities may experience comparatively lower marginal gains compared to weak entrepreneurs, as the complementary knowledge acquired may be less relevant for them (Grillitsch and Nilsson, 2019; Grashof, 2021). In contrast, at high levels of agglomeration, entrepreneurs without these capabilities may experience a decreasing substitution effect and suffer more the negative impacts of agglomeration (Delmar and Shane, 2004; Pe'er et al., 2008; Aramand and Valliere, 2012). Together, these mechanisms imply that the positive and negative effects of urban agglomeration will be weakened for entrepreneurs with high levels of entrepreneurial capabilities and strengthened for weak entrepreneurs in terms of these capabilities. This leads to the following hypothesis:

H2c. The concavity of the inverted U-shaped relationship (H1) will be weakened for individuals with entrepreneurial capabilities compared to individuals without these capabilities.

2.2.4. Entrepreneurial networks

Entrepreneurs require access to external resources, knowledge and new information to innovate, acquired mainly through their social relationships and interactions (Tsai and Ghoshal, 1998; Liao and Welsch, 2005). In terms of the different types of social networks that entrepreneurs can establish, social ties with other entrepreneurs (i.e., entrepreneurial networks) are particularly relevant to the development of innovative new ventures as these reduce the ambiguity of the

entrepreneurial process and the uncertainty related to the introduction of innovations (Koellinger, 2008). Entrepreneurial networks enhance entrepreneurs' ability to benefit from the knowledge spillovers available in agglomerations due to an increasing exposure to learning opportunities and the development of their skills from their peers (McCann and Folta, 2011). Thus, we expect that individuals with entrepreneurial networks will benefit more from the positive effects of spatial agglomeration of economic activities.

Nevertheless, it is important to stress that the most valuable knowledge for innovation is distributed unevenly, and the over-embeddedness in highly agglomerated areas (i.e., a large number of redundant ties hindering the flows of new knowledge and ideas) could negatively impact innovation (Uzzi, 1997; Boschma, 2005). In this regard, the need to become "over-selective" in knowledge exchanges due to congestion externalities can create a collective blindness, develop shared values and reinforce existing activities, and hinder the adoption of new ideas and innovation (Tura and Harmaakorpi, 2005; Berliant et al., 2006). This suggests that at high levels of urban agglomeration, entrepreneurs' social networks can increase the negative effects of agglomeration, such as over-embeddedness, given that they do not adopt novel ideas due to the collective blindness, and increase the flows of redundant information (Malecki, 2012; Ter Wal et al., 2016). Thus, this argument together with that for the benefits of urban agglomeration imply a strengthening of the inverted U-shaped relationship for these entrepreneurs. Hence, we propose the following hypothesis:

H2d. The concavity of the inverted U-shaped relationship (H1) will be strengthened for individuals in contact with other entrepreneurs compared to individuals without these social ties.

3. Methodology

3.1. Data and sample

The data for the quantitative analysis was drawn from various sources. Data on entrepreneurial innovativeness was taken from the (cross-sectional) database created by the Global Entrepreneurship Monitor (GEM). This dataset captures the skills, activity and aspirations of entrepreneurs and has been extensively used to study entrepreneurial behaviour.[7] GEM Adult Population Surveys (APS) apply different survey techniques to avoid common method bias (see Bosma and Levie, 2010). To test our research hypotheses and capture contextual influences affecting entrepreneurial innovativeness, we merged GEM data with indicators and control variables from the World Data Bank and World Economic Forum. In the current study, we used a sample of 97 countries and 190,046 individuals for the 2007–2017 period.[8] We focused on individuals involved in the early-stages of the entrepreneurial process, defined as individuals that manage/own a business venture created in the past 42 months.

3.2. Dependent variable

To capture entrepreneurial innovativeness, we use the product innovation measure proposed by Hoogendoorn et al. (2020). This measure is created by calculating a product innovation index as an average of two items of the GEM's APS that capture on a three-point scale: (i) the degree of novelty of the products or services offered by the entrepreneur to their customers, and (ii) the degree of competitors that offer the same products or services to these same customers (Table 1). Thus, this measure is subjective (i.e., entrepreneurs consider that their product/services are new for their customers, thus, new to the firm) which is in line with the Oslo Manual (Horbach et al., 2012) and the Community Innovation Surveys (CIS) since it also captures product/services new to the market (Hoogendoorn et al., 2020).[9] Both GEM's dimensions of product innovation have been used together in prior entrepreneurship research to measure entrepreneurial innovativeness and to differentiate from pure imitative behaviours (Koellinger, 2008; Koellinger and Thurik, 2012; González-Pernía et al., 2015). Further, the use of the three-point scale of these two items has also been applied in prior studies to analyse the different degree of new venture's product innovativeness launched by entrepreneurs (Schøtt and Sedaghat, 2014; Schøtt and Jensen, 2016).

3.3. Independent variable

This study integrates two levels of analysis: individual- and country-year level. To measure a country level of urban agglomeration of economic activities, we use the indicator proposed by Acs et al. (2017) in the Global Entrepreneurship Index (GEI) which captures national contextual factors featuring entrepreneurship across countries. Specifically, urban agglomeration of economic activities at the national level is determined by the product of a country's domestic market size and its level of urbanization (Acs et al., 2014; Lafuente et al., 2016). Country's domestic market size is measured as the normalized index (on a 1–7 scale) of the difference between the sum of gross domestic product plus the value of imports of goods and services and the value of exports of goods and services from the World Economic Forum Global Competitiveness Index (GCI). For level of urbanization, we use the percentage of population living in urban areas obtained from World Bank Indicators (WBI).

3.4. Moderating variables

To test our hypothesis related to entrepreneurs' general human capital measured through education level (H2a), we follow Aidis et al. (2008), Fuentelsaz et al. (2018) and Boudreaux et al. (2019), and create a dummy variable indicating if the entrepreneur has attained at least a secondary degree or higher. This approach is consistent with our theoretical argumentation, differentiating between lower and higher educational attainments, and facilitates the interpretation of the cross-level interactions (Lim et al., 2016). Furthermore, it allows to distinguish individuals who have graduated from secondary school —compulsory in most of the countries— from those who have not, which supposes a major break in the challenges that they face in their working lives as well as their entrepreneurial orientation and behaviours (Millan et al., 2014).[10]

To test our hypothesis regarding entrepreneurs' specific human capital (H2b), we use entrepreneurs' previous entrepreneurial experience as a dummy variable indicating if the entrepreneur has discontinued, quit or shut down a business in the 12 months preceding the survey. This indicator has been used in prior studies and captures experience in new venture's creation and management, independently of the success of the venture created (Estrin et al., 2016; Elston and

[7] For more details on the GEM project see Reynolds et al. (2005).

[8] A summary of countries sampled can be found in the Appendix - Table A1.

[9] Other innovation surveys are also subject to self-perception of the firm in their responses and objective measures tend to overlap with subjective, making these suitable to capture firms' innovation performance (De Beule and Van Beveren, 2012). Furthermore, the levels of self-perception of innovation activities reported by GEM surveys and CIS are similar. Farè (2021) reports that 34 % of European SMEs were involved in product innovations during 2014–2018, whereas our own calculation (same period) reports 36.15 % of early-stage entrepreneurs in Europe indicating that their product or service is new to their customers.

[10] This differentiation is relevant in cross-sectional studies since the countries' stage of development vary significantly and the effect of tertiary education and higher against lower levels on entrepreneurship and its outcomes within developing economies may be influenced by its higher returns in the wage sector (Dimova and Pela, 2018).

Table 1
Definition of the variables and descriptive statistics.

Variable	Description	Mean	Std. Dev	Min	Max
Dependent variable					
New ventures' innovativeness	Average of: Item 1: "*Do all, some, or none of your potential customers consider this product or service new and unfamiliar?*" (GEM) 0. None 1. Some 2. All Item 2: "*Right now, are there many, few, or no other businesses offering the same products or services to your potential customers?*" (GEM) 0. Many 1. Few 2. No	0.588	0.557	0	2
Individual level variables					
Age	Age of respondents measured in years. (GEM)	37.075	11.417	18	64
Gender	Gender of respondents. (GEM)	0.577	0.494	0	1
Education level	Dummy variable indicating whether individual has at least secondary education or higher. (GEM)	0.72	0.449	0	1
Entrepreneurial Experience	Dummy variable indicating whether individual has shut down a business, which he/she owned and managed, in the in the last 12 months. (GEM)	0.075	0.264	0	1
Entrepreneurial capabilities	Dummy variable indicating whether the respondent believes that he or she "Has the knowledge, skills and experience required to start a business." (GEM)	0.835	0.371	0	1
Entrepreneurial networks	Dummy variable indicating whether the respondent knows someone who has started a business in the last two years. (GEM)	0.641	0.48	0	1
Country level variables					
GDP per capita (t − 1)	Gross Domestic Product (GDP) per capita, constant at 2017 $USD. (WBI)	23,605.112	17,909.892	977.392	113,396.75
Institutional quality (t − 1)	1st Pillar GCI conformed by items covering the country's quality of the Public and Private Institutions, normalized on a 1–7 (best) scale.	4.113	0.789	2.505	6.182
Financial system (t − 1)	8th Pillar GCI conformed by items covering the country's financial market efficiency, trustworthiness and confidence, normalized on a 1–7 (best) scale.	4.318	0.661	2.393	6.4
Innovation system (t − 1)	12th Pillar (GCI) conformed by items covering the country's context that is conducive to innovative activity, normalized on a 1–7 (best) scale.	3.572	0.795	2.053	5.838
Land area (t − 1)	Country's total area sq. km. (WBI)	1,539,477	2,757,562.7	430	16,377,740
Total population (t − 1)	Total population, all residents regardless of legal status or citizenship. (WBI)	1.004e+08	2.532e+08	282,987	1.379e+09
Urban agglomeration (t − 1)	Urban Agglomeration = [Domestic market size] * [Urbanization] Domestic market size as the sum of gross domestic product plus value of imports of goods and services, minus value of exports of goods and services, normalized on a 1–7 (best) scale. (GCI) Urbanization is the percentage of people living in urban areas as defined by national statistical offices. (WBI)	307.032	121.109	34.961	572.612

Source: Authors based on GEM, WBI and World Economic Forum's GCI.

Weidinger, 2019).[11] This variable captures, therefore, a learning from either positive or negative experiences that allows entrepreneurs to increase their skills and knowledge about the entrepreneurial process through practice, leading to increased innovation (see for further discussion, Vaillant and Lafuente, 2019).

To test our hypothesis related to entrepreneurial capabilities (H2c), we use a binary variable indicating if the entrepreneur perceives that he/she has the skills required to start a business.[12] This variable has been used in recent studies addressing the effect of entrepreneurial capabilities on entrepreneurs' innovation since self-assessed capabilities tend to be strongly related with objective measures (Ucbasaran et al., 2008; González-Pernía et al., 2015; Darnihamedani et al., 2018). Hence, entrepreneurs' self-assessment of their capabilities to start new ventures corresponds with their "entrepreneurial capacity" to effectively assess and exploit business opportunities, acting as gap-fillers and input-completers (Levie and Autio, 2008).

Finally, regarding entrepreneurial networks (H2d), we use a binary variable indicating if the entrepreneur knows someone who has started a business in the last two years. This variable has been widely used in previous GEM research to address the effect of entrepreneurs' social capital on the decision to start a business and to analyse its impact on post-entry behaviours, such as innovation (Koellinger, 2008; González-Pernía et al., 2015; Darnihamedani et al., 2018). Both approaches correspond to the need to distinguish between "*selection effects and strategic choice effects*" (Autio et al., 2014), which are different and need to be addressed separately (Autio et al., 2013).

3.5. Control variables

Previous GEM-based research (Koellinger, 2008; González-Pernía et al., 2015) has shown that start-ups innovative behaviour depends on demographic factors, such as age and gender; hence, we controlled for these factors. At the national level, we control for the country level means of our individual level independent variables to ensure that the effects of entrepreneurs' resources and capabilities are obtained more finely, differentiating them from their contextual effects (Mickiewicz

[11] To capture this form of specific human capital, this measure is preferred than current enterprise ownership/management due to the "*confounds effects of skills with opportunity costs*" (Estrin et al., 2016, p. 457).

[12] This measure encompasses different dimensions regarding entrepreneurial skills. It may reflect its self-assessment, overconfidence, or the easiness or difficulty to start new ventures (Bosma et al., 2018). There is an important variation of this variable across countries and 82–85 % of entrepreneurs consider that they have entrepreneurial skills (Szerb and Vörös, 2021). In this sense, it is argued that entrepreneurial practice (i.e., entrepreneurial learning) decreases overconfidence bias and self-assessment becomes more related to the real skills level, which make this variable a good proxy of entrepreneurial skills level of active entrepreneurs (Ucbasaran et al., 2008; Hechavarria et al., 2012; Koellinger et al., 2013).

et al., 2021).[13] Additionally, prior studies report that a country's level of development influences entrepreneurial innovation (Koellinger, 2008); thus, we control for the GDP per capita taken from WBI, which also serves as proxy for the stock of existing knowledge within the country (Rodríguez-Pose and Crescenzi, 2008). We also control for the quality of the institutional environment measured by the 1st Pillar from the Global Competitiveness Index (GCI), due to its importance in shaping entrepreneurial behaviours as suggested by NSE theory (Acs et al., 2014; Bosma et al., 2018). Additionally, we consider the country's degree of the financial system development, 8th Pillar, capturing the availability and stability of financial resources (Lafuente et al., 2020). Furthermore, we control for the quality of the national innovation system through the 12th Pillar which captures the level of R&D investment, the quality of research institutions, technological collaboration between industries and universities, as well as the protection of intellectual property (Amorós et al., 2019). These controls from the GCI's Pillars are measured on a 1–7 scale.[14] Finally, we control the countries' size, measured by their physical size and total population, due to its influence on country's level of agglomeration and its externalities (Frick and Rodríguez-Pose, 2018). Our specifications include industry controls to capture sectoral differences that may affect firm innovativeness (Audretsch et al., 2021).[15] Details and descriptive statistics of variables used in this study are shown in Table 1.

3.6. Estimation models

We used multilevel modeling, which takes into account the hierarchical structure of the dataset, where individuals represent level one and country-year represents level two. This hierarchical structure violates the OLS assumption of independence of all observations (Faraway, 2004). Observations from entrepreneurs within the same country and year are usually more similar to each other compared to those from a different country-year. Thus, the use of statistical methods that assume independence of observations can lead to biased and inefficient results due to an underestimation of standard errors given their non-normal distribution (Hofmann et al., 2000). A multilevel approach, therefore, addresses the unobserved heterogeneity of the database (Rabe-Hesketh et al., 2005). We used a multilevel random intercept model that includes random intercepts and fixed slopes at the specified levels (Gelman and Hill, 2006).

A five-step testing strategy was used to test the research hypotheses. First, we tested the significance of the country-year groups' variance for the dependent variable by excluding individual and country-year level independent and moderating variables and controls (i.e., the null random model) to justify the use of multilevel models (Bliese, 2000). Second, we added individual predictors and individual and country-year controls to test the effect of entrepreneurs' internal resources and capabilities on new ventures' innovativeness. Third, we include country-year level means of individual level independent variables to test the improvement on the goodness of fit (Estrin et al., 2013). Next, we added the country's level of urban agglomeration together with its quadratic term to establish our baseline specification and to test H1. Finally, we added cross-level interaction effects both in the linear and quadratic terms to test the moderating role of the individual level variables on the proposed inverted U-shaped relationship between urban agglomeration and new ventures' innovativeness (H2a–H2d) (Haans et al., 2016).

For the above steps, we carried out the likelihood ratio test to examine whether the inclusion of the predictors improves the goodness of fit and therefore justified the use of the proposed multilevel specification. In addition, we established a lag structure in our data by measuring the contextual variable in year $t-1$ to avoid simultaneity and reverse causality problems (Bradley et al., 2010). Variables were standardized before running the models to reduce potential problems of multicollinearity (Aiken and West, 1991). Moreover, the variance inflation factor (VIF) values indicate that multicollinearity is not a problem in the database (all variables are below 10).[16] Table 2 reports pairwise correlations for the variables used in the empirical study.

4. Results

As noted above, a necessary condition for running a multilevel model is a significant between-group variance for the dependent variable (Bliese, 2000). Hence, in order to test the significance of the country-year group membership effect on new ventures' innovativeness, we carried out a likelihood ratio test (LRT) comparing the null multilevel model to a null single-level model. We found a statistically significant effect with an LRT of 22,213.84 ($p < 0.01$), which supports the use of multilevel models. Furthermore, the intraclass correlation (ICC) values indicate that 7.72 % of the total variance in new ventures' innovativeness can be attributed to country-year characteristics.

Table 3 presents the results of the multilevel random intercept models. The goodness-of-fit measures indicate that the models have an acceptable fit. Overall, results show that both the individual and country-year level variables are significantly associated to new ventures' innovativeness, which provides support for the multidimensional nature of entrepreneurial innovation (Acs et al., 2014).

At the individual level, Model 1 (Table 3) shows that entrepreneurs' education level, previous entrepreneurial experience, entrepreneurial capabilities and entrepreneurial networks have a significant and positive effect on new ventures' innovativeness. Regarding the effect of contextual factors, it shows that the national level of urban agglomeration of economic activity is statistically significant and positively related to new ventures' innovativeness ($b = 0.0291$; $p < 0.01$). However, the effect of its squared term is negative and significant ($b = -0.0203$; $p < 0.01$). Therefore, we find support for H1.

Model 2 includes the interactions of entrepreneurs' education level with urban agglomeration terms (linear and quadratic). The coefficient of the interaction with the squared term is positive and significant ($b = 0.00960$; $p < 0.01$). This implies that in the case of entrepreneurs with higher levels of education, the positive effects of urban agglomeration before the turning point of the inverted U-curve and the negative effects of higher levels of agglomeration on innovation after the turning point are weakened. In other words, the concavity of the inverted U-shaped relationship is weakened with entrepreneurs' level of education. Thus, this provides support for H2a. To better understand the moderation role of entrepreneurs' level of education, we plotted Fig. 2, which shows that the curve of the urban agglomeration effect has a less pronounced inverted U-shape for entrepreneurs with a higher level of education compared to entrepreneurs without a higher education degree.

With respect to the moderating role of entrepreneurs' entrepreneurial experience, Model 3 (Table 3) shows that the interaction of this variable with the quadratic term of urban agglomeration is positive and

[13] This specification corresponds to the Mundlak approach, which allows to reduce group-level heterogeneity bias (Bell and Jones, 2015).

[14] See Valliere and Peterson (2009) for a brief description of GCI indicators and data collection and Sala-i-Martin et al. (2008) for further details.

[15] Agriculture, forestry and fishing as reference category, based on ISIC Rev.4 Sections.

[16] To control for self-selection bias, we followed Estrin et al. (2013) and performed a two-step Heckman test. We use a selection probit equation to predict individuals' self-selection into entrepreneurship, employing a variable that is correlated with entrepreneurial entry and uncorrelated with new ventures' innovativeness (number of days to complete legal procedures to operate a business (WBI), which suppose sunk costs not relevant to innovation). Using equation's residuals, we calculate the inverse Mills' Ratio (IMR) and it was inserted in our baseline regression of new ventures' innovativeness. The coefficient of the IMR was not significant, suggesting that selection bias is not a major concern in our analysis.

Table 2
Correlation matrix.

Variables	1	2	3	4	5	6	7	8	9
1. New ventures' innovativeness	1.000								
2. Age	0.012***	1.000							
3. Gender	0.014***	−0.002	1.000						
4. Education level	0.083***	−0.051***	0.056***	1.000					
5. Entrepreneurial experience	0.008***	−0.005**	−0.004*	−0.050***	1.000				
6. Entrepreneurial capabilities	0.045***	0.026***	0.052***	0.048***	0.035***	1.000			
7. Entrepreneurial networks	0.028***	−0.066***	0.059***	0.079***	0.030***	0.136***	1.000		
8. GDP per capita (t − 1)	0.066***	0.151***	0.069***	0.255***	−0.065***	0.017***	0.001	1.000	
9. Institutional quality (t − 1)	0.097***	0.124***	0.051***	0.197***	−0.037***	0.008***	0.032***	0.741***	1.000
10. Financial system (t − 1)	0.096***	0.112***	0.011***	0.135***	−0.033***	0.011***	−0.004*	0.513***	0.700***
11. Innovation system (t − 1)	0.041***	0.142***	0.041***	0.201***	−0.064***	−0.011***	0.028***	0.750***	0.796***
12. Land area (t − 1)	−0.057***	−0.001	−0.030***	0.000	−0.021***	−0.080***	0.007***	−0.025***	−0.050***
13. Total population (t − 1)	−0.015***	−0.016***	−0.006***	−0.021***	−0.017***	−0.101***	0.039***	−0.171***	−0.010***
14. Education level, country-year mean	0.118***	0.138***	0.069***	0.430***	−0.091***	−0.006***	−0.016***	0.592***	0.466***
15. Entrepreneurial experience, country-year mean	−0.008***	−0.127***	−0.040***	−0.238***	0.165***	0.044***	0.026***	−0.384***	−0.221***
16. Entrepreneurial capabilities, country-year mean	−0.012***	−0.034***	0.002	−0.035***	0.023***	0.024***	0.189***	0.006***	0.166***
17. Entrepreneurial networks	0.051***	0.013***	−0.015***	−0.014***	0.037***	0.193***	0.023***	0.087***	0.045***
18. Urban agglomeration (t − 1)	0.065***	0.127***	0.028***	0.195***	−0.079***	−0.034***	−0.044***	0.504***	0.328***

Variables	10	11	12	13	14	15	16	17	18
10. Financial system (t − 1)	1.000								
11. Innovation system (t − 1)	0.630***	1.000							
12. Land area (t − 1)	0.007***	0.136***	1.000						
13. Total population (t − 1)	−0.016***	0.111***	0.580***	1.000					
14. Education level, country-year mean	0.332***	0.463***	0.000	−0.050***	1.000				
15. Entrepreneurial experience, country-year mean	−0.212***	−0.361***	−0.127***	−0.094***	−0.553***	1.000			
16. Entrepreneurial capabilities, country-year mean	0.015***	0.134***	0.036***	0.208***	−0.082***	0.139***	1.000		
17. Entrepreneurial networks	0.051***	−0.051***	−0.416***	−0.524***	−0.033***	0.227***	0.123***	1.000	
18. Urban agglomeration (t − 1)	0.331***	0.492***	0.429***	0.105***	0.451***	−0.460***	−0.236***	−0.183***	1.000

Level of significance: *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.
Source: GEM 2007–2017 APS surveys, WBI, GCI.

significant ($b = 0.00906$; $p < 0.05$). This indicates that the concavity of the inverted U-curve is weakened for entrepreneurs with prior entrepreneurial experience (see Fig. 3), which supports H2b.

With regard to the hypothesized moderating effect of entrepreneurial capabilities, Model 4 (Table 3) shows that the coefficient of the interaction with the linear term of urban agglomeration is positive and significant ($b = 0.0152$; $p < 0.01$). However, the interaction with the squared term is positive and non-significant ($b = 0.00018$; n.s.). Thus, we do not find support for H2c.

Model 5 (Table 3) reports the results of testing the moderating effect of entrepreneurial networks. The interaction of this variable with the linear term of urban agglomeration has a positive and significant effect ($b = 0.00606$; $p < 0.05$), and its interaction with the squared term is negative and significant ($b = -0.00472$; $p < 0.05$). Hence, H2d is supported. As Fig. 4 shows, the inverted U-shaped relationship between urban agglomeration and new ventures' product innovation increases more rapidly for entrepreneurs in contact with other entrepreneurs until the turning point; after that, it decreases more rapidly. Therefore, the concavity of the inverted U-shaped relationship is strengthened for entrepreneurs with entrepreneurial networks.

To analyse the size of the effects by these factors and their confidence intervals, we follow the procedure for examining nonlinear interaction effects proposed by Mize (2019), which examines "*whether an interaction effect exists or not on average*" by evaluating the equality of the average marginal effects through second differences tests. Further, we explore how these effects vary across different levels of urban agglomeration. We present the results of these analyses and its graphical representation in the Online Supplementary Materials accompanying this paper. These analyses confirm the above results and provide further information on our findings.

4.1. Robustness checks

We performed several analyses to test the robustness of the inverted U-shaped relationship and to provide additional insights.[17] Following Haans et al. (2016) and Brieger et al. (2020), we performed a Wald test to prove the joint effect of the urban agglomeration and its squared term (Wald chi-square = 26.48; $p < 0.01$). Additionally, we included the cubed values of urban agglomeration which were statistically insignificant, suggesting that the inverted U-curve fits better than other specifications (Li et al., 2009). In this sense, we conducted a Sasabuchi test (Sasabuchi, 1980) to address if the relationship between agglomeration and entrepreneurs' innovativeness increases at low levels of agglomeration and decreases at high levels. The slope at the lower bound is positive and significant (slope = 0.120; t-value = 4.410; $p < 0.01$), negative and significant at the upper bound (slope = −0.060; t-value = −2.011; $p < 0.01$), and the overall test shows a significant inversed U-shape (t-value = 2.01; $p < 0.05$). We estimate the turning point of the standardized urban agglomeration as 0.718 (−0.0291/[2 × −0.0203]), which corresponds with the non-standardized point of 394.02.[18] This value is within the data range of the agglomeration variable (34.96; 572.61) and within the confidence interval estimated using the Delta (314.36; 473.67) and Fieller (336.11; 562.19) methods (Lind and Mehlum, 2010). Additionally, we introduce categorical dummies indicating different segments of our agglomeration variable following Haans et al. (2016); the estimated coefficients are consistent with the proposed relationship (Bothner et al., 2012).

[17] These analyses can be found in the Online Supplementary Materials.
[18] Non-standardized turning point = mean + (standardized turning point × standard deviation) = 307.032 + (0.718 × 121.109) = 394.02.

Table 3
Multilevel random intercept models for new ventures' innovativeness.

	Model 1	Model 2	Model 3	Model 4	Model 5
Individual-level control variables					
Age	−0.00161	−0.00170	−0.00162	−0.00169	−0.00154
	(0.0012)	(0.0012)	(0.0012)	(0.0012)	(0.0012)
Gender (male)	0.00753***	0.00742***	0.00749***	0.00743***	0.00762***
	(0.0025)	(0.0025)	(0.0025)	(0.0025)	(0.0025)
Individual-level variables					
Education level	0.0336***	0.0242***	0.0336***	0.0335***	0.0336***
	(0.0031)	(0.0042)	(0.0031)	(0.0031)	(0.0031)
Entrepreneurial experience	0.0189***	0.0190***	0.0104*	0.0189***	0.0190***
	(0.0046)	(0.0046)	(0.0062)	(0.0046)	(0.0046)
Entrepreneurial capabilities	0.0437***	0.0438***	0.0437***	0.0425***	0.0435***
	(0.0033)	(0.0033)	(0.0033)	(0.0045)	(0.0033)
Entrepreneurial networks	0.0284***	0.0284***	0.0284***	0.0283***	0.0329***
	(0.0026)	(0.0026)	(0.0026)	(0.0026)	(0.0035)
Country-year level control variables					
GDP per capita (t − 1)	0.0234**	0.0239**	0.0233**	0.0232**	0.0235**
	(0.0098)	(0.0098)	(0.0098)	(0.0098)	(0.0098)
Institutional quality (t − 1)	0.0197*	0.0194	0.0198*	0.0197*	0.0196*
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Financial system (t − 1)	0.0200**	0.0199**	0.0199**	0.0198**	0.0199**
	(0.0079)	(0.0079)	(0.0079)	(0.0079)	(0.0079)
Innovation system (t − 1)	−0.0324***	−0.0315***	−0.0325***	−0.0323***	−0.0324***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Land area (t − 1)	−0.0240***	−0.0239***	−0.0240***	−0.0241***	−0.0241***
	(0.0078)	(0.0078)	(0.0078)	(0.0078)	(0.0078)
Total population (t − 1)	0.0436***	0.0428***	0.0436***	0.0436***	0.0435***
	(0.0083)	(0.0083)	(0.0083)	(0.0083)	(0.0083)
Country-year level means					
Education level	0.0669	0.0562	0.0673	0.0678	0.0659
	(0.044)	(0.044)	(0.044)	(0.044)	(0.044)
Entrepreneurial experience	0.549***	0.573***	0.549***	0.553***	0.551***
	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)
Entrepreneurial capabilities	−0.148*	−0.140*	−0.149*	−0.148*	−0.147*
	(0.076)	(0.076)	(0.076)	(0.076)	(0.076)
Entrepreneurial networks	0.368***	0.362***	0.367***	0.371***	0.368***
	(0.094)	(0.094)	(0.094)	(0.094)	(0.094)
Country-year level variables					
Urban agglomeration (t − 1)	0.0291***	0.0318***	0.0288***	0.0165*	0.0252***
	(0.0089)	(0.0093)	(0.0089)	(0.0094)	(0.0091)
Squared urban agglomeration (t − 1)	−0.0203***	−0.0272***	−0.0209***	−0.0201***	−0.0170***
	(0.0061)	(0.0065)	(0.0061)	(0.0067)	(0.0063)
Interactions					
Urban agglomeration (t − 1) × education level		−0.00474			
		(0.0031)			
Squared urban agglomeration (t − 1) × education level		0.00960***			
		(0.0030)			
Urban agglomeration (t − 1) × entrepreneurial experience			0.00799		
			(0.0049)		
Squared urban agglomeration (t − 1) × entrepreneurial experience			0.00906**		
			(0.0039)		
Urban agglomeration (t − 1) × entrepreneurial capabilities				0.0152***	
				(0.0035)	
Squared urban agglomeration (t − 1) × entrepreneurial capabilities				0.000180	
				(0.0032)	
Urban agglomeration (t − 1) × entrepreneurial networks					0.00606**
					(0.0026)
Squared urban agglomeration (t − 1) × entrepreneurial networks					−0.00472**
					(0.0024)
Constant	0.155*	0.168*	0.157*	0.152*	0.152*
	(0.090)	(0.090)	(0.090)	(0.090)	(0.090)
Model fit statistics					
Variance of random intercept country-year	0.0180	0.0180	0.0180	0.0180	0.0180
Num. of groups country-year	579	579	579	579	579
$ICC_{country\text{-}year}$	0.062	0.063	0.062	0.062	0.063
Observations	190,046	190,046	190,046	190,046	190,046

(*continued on next page*)

Table 3 (*continued*)

	Model 1	Model 2	Model 3	Model 4	Model 5
Log likelihood	−146,093.35	−146,086.18	−146,090.39	−146,083.69	−146,088.07
Chi-square	14,898.34	14,788.13	14,876.45	14,853.41	14,887.05
Probability > chi-square	***	***	***	***	***
AIC	292,270.7	292,260.4	292,268.8	292,255.4	292,264.1
LR test of model fit[a]	_	***	*	***	***
Industry controls	Yes	Yes	Yes	Yes	Yes

Note: Standard errors in parentheses. Level of significance: *$p < 0.10$, **p < 0.05, ***$p < 0.01$. Continuous variables are standardized.

[a] Likelihood ratio test (LRT) was conducted comparing Model 1 with each of the interactions considered (Models 2 to 5) to test the significance of the interaction effect.

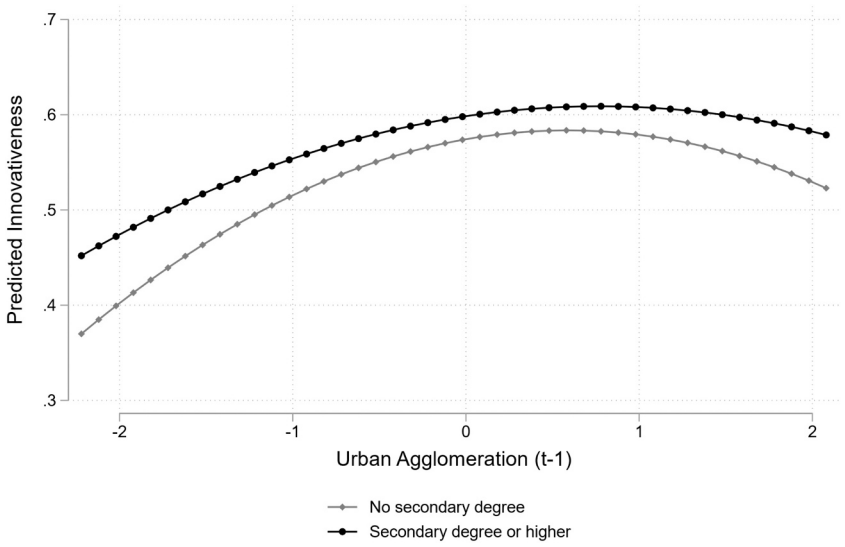

Fig. 2. Moderating effect of entrepreneurs' education level on the inverted U-shaped relationship between urban agglomeration and new ventures' innovativeness (predictive margins).

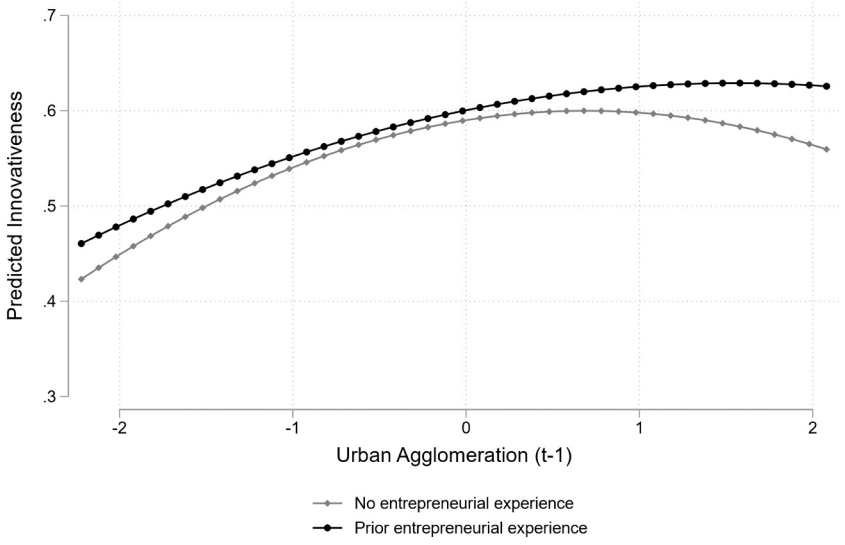

Fig. 3. Moderating effect of entrepreneurial experience for the inverted U-shaped relationship between urban agglomeration and new ventures' innovativeness (predictive margins).

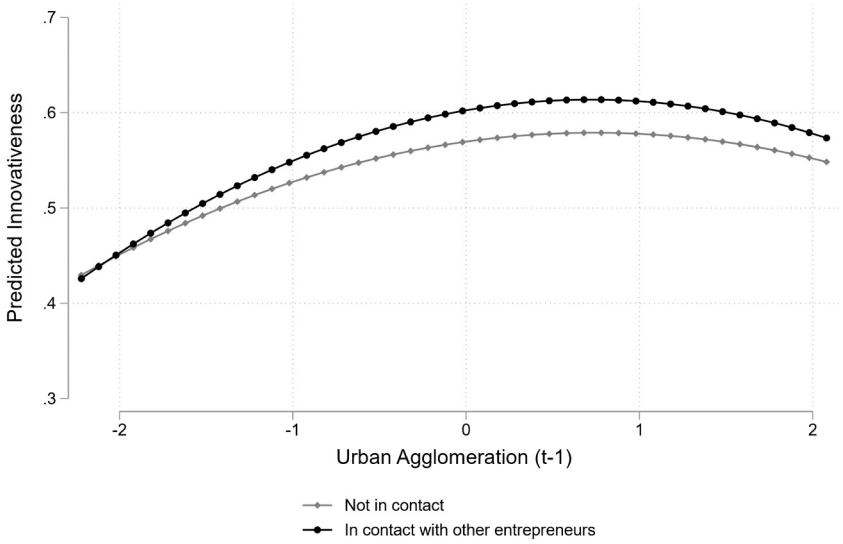

Fig. 4. Moderating effect of entrepreneurial networks for the inverted U-shaped relationship between urban agglomeration and new ventures' innovativeness (predictive margins).

We also explore if there is a shift in the turning point which is a moderation effect that needs to be treated differently empirically and theoretically (Haans et al., 2016). We found that our moderators slightly move the turning points to the right, but the overall effect is non-significant for H2a, H2b and H2d; the effect is however significant for H2c ($p < 0.05$).[19] This significant moderating effect implies that entrepreneurial skills strengthen the benefits of urban agglomeration (see Fig. 5).

As robustness check, we introduce as controls the quality of the higher education and training system (5th Pillar) and the degree of business sophistication (11th Pillar) from CGI, as well as, the countries' unemployment rate, being these non-significant.[20] As an alternative measure of our variable capturing entrepreneurs' education level, we use entrepreneurs' education level as a five-point scale (Giotopoulos et al., 2017), remaining the results reported here robust. Since our dependent variable can be considered as either continuous or discrete (Schøtt and Jensen, 2016; Hoogendoorn et al., 2020), we also run multilevel ordered logit models to verify our findings, which remain stable. Additionally, to examine the stability of the models proposed and to obtain 95 % bias-corrected confidence intervals, we run multilevel models using parametric bootstrapping procedures based on 1000 samples; results confirm the robustness of our findings (Luo et al., 2021).

Finally, we acknowledge that our independent variable capturing urban agglomeration within a country serves as a general proxy for agglomeration economies (Lewis, 2014; Brülhart and Sbergami, 2009). This conceptualization focuses on the relative distribution within a country of urban versus rural areas (Estrin et al., 2017). This corresponds to the centralization–dispersion dimension of agglomeration economies, whereas the monocentric–polycentric dimension (i.e., concentration degree within urban centres) requires measures capturing the hierarchy of urban agglomerations (Hoogerbrugge et al., 2021). Thus, based on Frick and Rodríguez-Pose (2018), we calculate a Herfindahl-Hirschman Index using OECD's functional urban areas (FUAs) data, multiplied by the country's domestic market size to account for urban concentration and market size considered by Acs et al. (2017) core aspects of agglomeration economies for entrepreneurial ecosystems.

Table 4 presents the specifications using this independent variable; results remain consistent with those obtained in Table 3.[21] The moderating role of entrepreneurial capabilities is significant, steepening the inverted U-shaped relationship as suggested in Table 3, but the moderating role of entrepreneurs' entrepreneurial experience is non-significant. These results should be interpreted with caution due to the reduced sample used of 33 OECD countries, which only includes a subset of our initial dataset, and thereby loosing information. Our findings that urban agglomeration within countries exerts an inverted U-shaped relationship and that this relationship is moderated in a similar way by entrepreneurs' characteristics, remain under both centralization–dispersion and monocentric–polycentric dimensions of agglomeration.

5. Discussion and conclusion

Recognizing that innovative new ventures are one of the key drivers of economic growth (Audretsch et al., 2006; Baumol, 2010) and that the decision to become an innovative entrepreneur is influenced by internal characteristics as well as the national context (Acs et al., 2016), it is therefore critical to understand what drives an individual to engage in particular types of innovation and how different contextual dimensions influence this process. Thus, this research explores how urban agglomeration together with internal resources and capabilities affect entrepreneurial innovation.

To that end, we adopt the lens of NSE theory, which stresses the interaction of individual and contextual level factors in determining entrepreneurial intent and outcomes (Schillo et al., 2016). We focus on the effect of urban agglomeration of economic activities at the national level addressing the existence of a proximity paradox, which implies that despite initial positive effects, too much agglomeration could hamper entrepreneurial innovation. We developed a multilevel-framework that includes individuals' internal resources and capabilities and country-year level variables to capture the multidimensional nature of the entrepreneurial process, and to examine cross-level interactions to address the entrepreneurs- and context-level heterogeneity in entrepreneurs' innovativeness. We used data for 97 countries from

[19] We followed the testing procedure noted by Haans et al. (2016, p. 1187).

[20] We used alternative measures such as the index of Economic Freedom of the World (EFW) from the Fraser Institute to control the quality of the institutions, or R&D expenditures over GDP (WBI) as proxy of innovation system. Our results remain stable.

[21] The inverted U-shaped relationship and moderation effects are tested using the procedure proposed by Haans et al. (2016); results are presented in the Online Supplementary Materials.

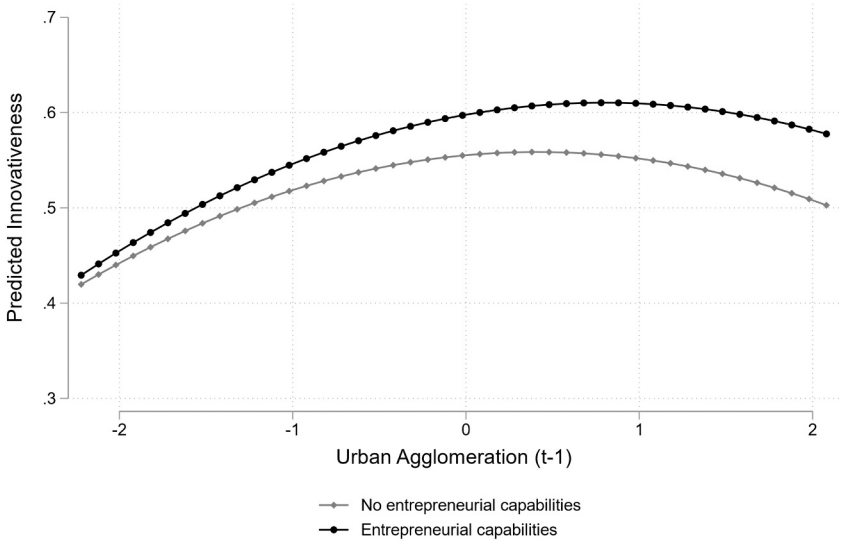

Fig. 5. Moderating effect of entrepreneurial capabilities for the inverted U-shaped relationship between urban agglomeration and new ventures' innovativeness (predictive margins).

2007 to 2017. This allowed us to analyse new ventures' innovation propensity from an international perspective. Findings show that the strategic behaviour of entrepreneurs is influenced by both individual and context level factors, with individuals being the core element to overcome contextual constraints.

Our results show that urban agglomeration at the national level has an inverted U-shaped effect on entrepreneurial innovativeness, as hypothesized. This finding supports the proximity paradox (Boschma, 2005; Boschma and Frenken, 2010), suggesting that the effect of geographical proximity between economic actors on innovation is not linear. While proximity fosters the creation and dissemination of new knowledge within a country, too much proximity between agents hampers the exchange of knowledge and subsequent innovations. The inverted U-shaped impact of urban agglomeration on new ventures' innovativeness suggests, therefore, that urban agglomeration economies initially foster innovative strategies among entrepreneurs by enhancing interactions between economic actors, facilitating knowledge creation and transfer, reducing uncertainty, and increasing resource availability (Carlino et al., 2007; Tran and Santarelli, 2017). However, as urban agglomeration increases, congestion effects, strong competition and agglomeration diseconomies become dominant, which hamper entrepreneurial innovativeness (Folta et al., 2006; Fritsch and Franke, 2004; Pouder and St. John, 1996).

Furthermore, our findings reveal that the influence of the external environment on new ventures' innovativeness differs according to the internal resources and capabilities of the entrepreneur. Specifically, we find that entrepreneurs obtain heterogeneous benefits from urban agglomeration effects depending on their level of education, entrepreneurial experience and entrepreneurial networks.

We found that entrepreneurs with higher education levels are, in general, better positioned to benefit from agglomerations and mitigate its negative impacts, compared to entrepreneurs with lower education levels, as their curve is always above. This finding reinforces the "knowledge competition argument" noted in the literature addressing the contingent role of firm level resources on agglomeration externalities (Cohen and Levinthal, 1990; Ter Wal and Boschma, 2011; Grillitsch and Nilsson, 2019). However, our results indicate that entrepreneurs' general knowledge base provided by secondary or higher education levels weakens the concavity of the inverted U-shaped relationship between urban agglomeration and new ventures' innovativeness (Fig. 2). This implies that the upsides and downsides of urban agglomeration are attenuated for entrepreneurs with higher education levels.

At low levels of urban agglomeration, we found that entrepreneurs with lower levels of knowledge experience a faster growth in their marginal returns from positive agglomeration externalities (Hervas-Oliver et al., 2018; Potter and Watts, 2010). That is, for entrepreneurs with lower levels of their knowledge base, the benefits of spatial agglomeration become more pronounced. This corresponds to the "knowledge equilibrium argument" suggested in the literature on the factors moderating the effects of agglomeration economies, arguing that the knowledge available in the system is more valuable for firms with lower levels of knowledge until the differences between them disappear (Shaver and Flyer, 2000; Alcácer and Chung, 2007). Speldekamp et al. (2020) state that the knowledge equilibrium argument and its net effect on innovation is determined by effects of substitution and complementarity between firms' internal and external knowledge. Thus, our results reveal that when the external knowledge devaluates slowly, the substitution effect that entrepreneurs with lower education experience from urban agglomerations is more relevant than the complementarity effect of entrepreneurs with higher education (Grillitsch and Nilsson, 2019). In these contexts, strong entrepreneurs in terms of their knowledge base may find the external knowledge to innovate more redundant and suffer greater knowledge leakages to competitors. Hence, they rely more on their internal resources, as well as other agglomeration economies such as specialization, and extra-national knowledge through global networks (Grillitsch and Nilsson, 2017; Beaudry and Schiffauerova, 2009; Pe'er et al., 2008). This reduces the net complementary effect that they can receive from urbanization, while the substitution effect that

Table 4
Multilevel random intercept models for new ventures' innovativeness (urban agglomeration based on HHI).

	Model 1	Model 2	Model 3	Model 4	Model 5
Individual-level control variables					
Age	−0.00168	−0.00184	−0.00169	−0.00169	−0.00171
	(0.0020)	(0.0020)	(0.0020)	(0.0020)	(0.0020)
Gender (male)	0.00255	0.00288	0.00254	0.00248	0.00250
	(0.0040)	(0.0040)	(0.0040)	(0.0040)	(0.0040)
Individual-level variables					
Education level	0.0208***	0.00140	0.0208***	0.0208***	0.0207***
	(0.0055)	(0.0086)	(0.0055)	(0.0055)	(0.0055)
Entrepreneurial experience	0.0216***	0.0213**	0.0193	0.0217***	0.0216***
	(0.0084)	(0.0084)	(0.012)	(0.0084)	(0.0084)
Entrepreneurial capabilities	0.0591***	0.0590***	0.0591***	0.0738***	0.0592***
	(0.0054)	(0.0054)	(0.0054)	(0.0077)	(0.0054)
Entrepreneurial networks	0.0395***	0.0396***	0.0395***	0.0396***	0.0481***
	(0.0041)	(0.0041)	(0.0041)	(0.0041)	(0.0059)
Country-year level control variables					
GDP per capita (t − 1)	0.00684	0.00695	0.00688	0.00696	0.00712
	(0.0093)	(0.0093)	(0.0093)	(0.0093)	(0.0093)
Institutional quality (t − 1)	0.0509***	0.0509***	0.0509***	0.0511***	0.0510***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Financial system (t − 1)	−0.0368***	−0.0368***	−0.0368***	−0.0368***	−0.0368***
	(0.0096)	(0.0096)	(0.0096)	(0.0096)	(0.0096)
Innovation system (t − 1)	−0.0403***	−0.0400***	−0.0403***	−0.0403***	−0.0405***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Land area (t − 1)	−0.00199	−0.00192	−0.00203	−0.00205	−0.00213
	(0.0089)	(0.0089)	(0.0089)	(0.0089)	(0.0089)
Total population (t − 1)	0.0296**	0.0290**	0.0296**	0.0300**	0.0297**
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Country-year level means					
Education level	0.308***	0.304***	0.308***	0.309***	0.309***
	(0.083)	(0.083)	(0.083)	(0.083)	(0.083)
Entrepreneurial experience	4.709***	4.718***	4.713***	4.712***	4.718***
	(0.51)	(0.51)	(0.52)	(0.51)	(0.52)
Entrepreneurial capabilities	−0.0136	−0.0101	−0.0138	−0.0150	−0.0144
	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)
Entrepreneurial networks	0.426***	0.409***	0.426***	0.419***	0.424***
	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
Country-year level variables					
Urban agglomeration HHI (t − 1)	0.0403***	0.0595***	0.0407***	0.0336**	0.0386***
	(0.013)	(0.014)	(0.013)	(0.014)	(0.013)
Squared urban agglomeration HHI (t − 1)	−0.0373***	−0.0539***	−0.0374***	−0.0251***	−0.0319***
	(0.0075)	(0.0098)	(0.0075)	(0.0088)	(0.0080)
Interactions					
Urban agglomeration HHI (t − 1) × education level		−0.0224***			
		(0.0076)			
Squared urban agglomeration HHI (t − 1) × education level		0.0190***			
		(0.0069)			
Urban agglomeration HHI (t − 1) × entrepreneurial experience			−0.00936		
			(0.010)		
Squared urban agglomeration HHI (t − 1) × entrepreneurial experience			0.00267		
			(0.0088)		
Urban agglomeration HHI (t − 1) × entrepreneurial capabilities				0.00804	
				(0.0069)	
Squared urban agglomeration HHI (t − 1) × entrepreneurial capabilities				−0.0146***	
				(0.0055)	
Urban agglomeration HHI (t − 1) × entrepreneurial networks					0.00222
					(0.0052)
Squared urban agglomeration HHI (t − 1) × entrepreneurial networks					−0.00851**
					(0.0042)
Constant	−0.399**	−0.367**	−0.400**	−0.406**	−0.405**
	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)
Model fit statistics					
Variance of random intercept country-year	0.0089	0.0089	0.0089	0.0089	0.0089
Num. of groups country-year	271	271	271	271	271
$ICC_{country\text{-}year}$	0.029	0.029	0.029	0.029	0.029
Observations	81,962	81,962	81,962	81,962	81,962

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Table 4 (*continued*)

	Model 1	Model 2	Model 3	Model 4	Model 5
Log likelihood	−66,707.855	−66,702.827	−66,707.417	−66,704.1	−66,705.217
Chi-square	2008.13	2006.13	2008.89	2008.39	2010.13
Probability > chi-square	***	***	***	***	***
AIC	133,499.7	133,493.7	133,502.8	133,496.2	133,498.4
LR test of model fit[a]	–	***	–	**	*
Industry controls	Yes	Yes	Yes	Yes	Yes

Note: Standard errors in parentheses. Level of significance: *p < 0.10, **p < 0.05, ***p < 0.01. Continuous variables are standardized.

[a] Likelihood ratio test (LRT) was conducted comparing Model 1 with each of the interactions considered (Models 2 to 5) to test the significance of the interaction effect.

experience entrepreneurs with a lower knowledge base is comparatively more relevant as these entrepreneurs tend to suffer resource scarcity and urbanization provides them valuable knowledge and information to innovate, which leads to strategic and technological convergence at national level (Mathias et al., 2021; Speldekamp et al., 2020; Stuart and Sorenson, 2003).

At high levels of urban agglomeration, intense competition together with congestion effects decrease the flows and creation of novel ideas within the national system as well as the breadth of entrepreneurs' knowledge links as they need to be selective to increase their productivity (Tavassoli et al., 2017; Berliant et al., 2006). The relevant knowledge to innovate tends to be outside these links. Hence, entrepreneurs with higher education levels have greater absorptive capacity to access and integrate relevant information outside firms' boundaries within these turbulent environments, which increase their innovativeness (Escribano et al., 2009). Likewise, this knowledge base increases their ability to benefit from their established links with suppliers and customers, which increases new ventures' innovativeness (Pe'er and Keil, 2013). Thus, the negative externalities of spatial agglomeration at country level are accentuated in the case of entrepreneurs with lower levels of education, revealing a divergence between them and higher educated entrepreneurs as entrepreneurs' knowledge base becomes a key resource to compete. In contexts where new knowledge devaluates rapidly, the complementary effect that strong entrepreneurs in terms of their knowledge base experience is clearly greater than the substitution effect that weak entrepreneurs can have (Grillitsch and Nilsson, 2019; Speldekamp et al., 2020).

Regarding entrepreneurial experience, we found that entrepreneurship-related knowledge is a relevant resource to benefit from agglomeration as well as to minimize its negative effects since the curve of experienced entrepreneurs is above novice entrepreneurs. This result reveals the "competition" argument also for this type of knowledge. However, we found that having experience in launching and managing businesses weakens the concavity of the inverted U-shaped relationship between urban agglomeration and new ventures' innovativeness (Fig. 3), attenuating the upsides and downsides of urban agglomeration. At low levels of urban agglomeration, entrepreneurs with knowledge and capabilities gained from prior ventures exhibit slower growth in their marginal returns from urban agglomeration benefits, supporting the "equilibrium" argument (Pe'er et al., 2008; Grillitsch and Nilsson, 2019). In other words, we found that novice entrepreneurs, in these contexts, experience a greater substitution effect of their less entrepreneurial know-how by external knowledge from urban agglomerations than the complementarity effect faced by experienced entrepreneurs for their entrepreneurship-related knowledge. Thus, the knowledge provided by urban agglomerations in these stages may be redundant for experienced entrepreneurs (Frenken et al., 2015), while for novice entrepreneurs is more valuable and they are more prone to integrate it (Kotha et al., 2011; Diez-Vial and Fernández-Olmos, 2017; Mathias et al., 2021). This may also reflect that as competitive pressure increases, experienced entrepreneurs tend to adopt less risky behaviours, non-innovative ventures, and focus on the financial success in the short-time based on their managerial competencies (Baron and Ensley, 2006).

Additionally, at high levels of urban agglomeration, our results emphasise the important role that managerial competencies acquired from previous experiences may play within highly competitive environments to obtain financing and effectively manage firms' resources to innovate (Pe'er et al., 2008; Cao and Im, 2018). In contexts characterized by highly competitive pressures and lock-in situations, entrepreneurial experience provides relevant capabilities to find value outside firm boundaries, increasing the complementary effect that experienced entrepreneurs may receive compared to the substitution effect of novice entrepreneurs (Bahlmann, 2016; Vaillant and Lafuente, 2019). This is revealed in the divergence that exists between experienced and novice entrepreneurs in their capacity to introduce innovations under high levels of congestion effects. Moreover, this divergence is stronger than that observed between high and low levels of education, with entrepreneurial experience strongly attenuating agglomeration drawbacks (see Figs. 2 and 3).

Our results indicate that entrepreneurs in contact with other entrepreneurs obtain greater returns from urban agglomeration and suffer less its negative impacts as their curve is always above. However, we found evidence that entrepreneurial networks strengthen the concavity of the inverted U-shaped relationship between urban agglomeration and new ventures' innovativeness (Fig. 4). Hence, this form of social capital accentuates the upsides and downsides of urban agglomeration. The entrepreneurs' social ties with peers improve access to relevant information, knowledge and resources which foster innovation, and increase the exposure to opportunities of learning, and in turn their absorptive capacity, enhancing the benefits from agglomeration (Nahapiet and Ghoshal, 1998; Giotopoulos et al., 2017; Ramos-Rodriguez et al., 2010). However, as urban agglomeration becomes excessively high, our results indicate that the negative effects for entrepreneurs in contact with other entrepreneurs are accentuated, decreasing the advantage that they can achieve from these networks and converging with the entrepreneurs not in contact with other entrepreneurs. This finding suggests that in highly agglomerated countries, access to the knowledge required for innovation via this type of social ties can become inefficient. The over-selectiveness of the firms' knowledge links to effectively compete alongside the over-embeddedness of information flows in the context where they operate, might foster a collective blindness favouring the inertia of existing practices and hindering the adoption of innovations (Ter Wal et al., 2016; Tura and Harmaakorpi, 2005). Furthermore, this finding underscores how too much diversity of external sources could adversely impact innovation performance, owing to added complexity and coordination and integration costs (Garcia Martinez et al., 2019; Audretsch and Belitski, 2020).

Finally, it is important to note that we did not find evidence that entrepreneurs' start-up capabilities weaken the concavity of the relationship between spatial agglomeration at country level and their innovativeness. However, we found that it shifts the inverted U-shaped curve to the right (Fig. 5). This finding contrasts with the view by Shaver and Flyer (2000) that the best firms in terms of knowledge and capabilities gain less from agglomeration and that external knowledge may be less important for strong entrepreneurs due to their reliance on internal knowledge (Hervas-Oliver et al., 2018). Indeed, our results reveal that specific capabilities, such as those required to start a new venture,

increase the benefits of agglomeration due to increased absorptive capacity to extract value from externally generated knowledge (Cohen and Levinthal, 1990; Wales et al., 2013). Thus, for entrepreneurial capabilities we did not find evidence for the "equilibrium argument", with the "competition argument" only present, which denotes the importance of these capabilities to properly develop innovative entrepreneurship (McCann and Folta, 2011; Grillitsch and Nilsson, 2019).

5.1. Contributions and implications for research

Our study has important implications for research and practice. First, this paper empirically analyses the impact of individuals' internal resources and capabilities together with their spatial context on entrepreneurial innovativeness. In doing so, it addresses recent calls for more multilevel research considering both individual- and context-level factors (Autio et al., 2014). Previous entrepreneurship research on innovative new ventures has tended to focus on institutional environments; thereby, obviating the spatial dimension of the entrepreneurial ecosystem, which determines and shapes the knowledge flows that are precursors of innovation (Tavassoli et al., 2017). Thus, this study complements and extends prior research by analysing how the urban agglomeration of economic activities at country level shapes the propensity of new ventures to introduce innovations in their marketplace.

Second, the proposed multilevel framework extends to innovative new ventures the theoretical basis of NSE that entrepreneurial intent and outcomes are the result of the dynamic interactions between entrepreneurs' internal attributes and their context (Acs et al., 2014, 2016). Furthermore, by examining a curvilinear (inverted U-shaped) relationship between external influences and entrepreneurs' behaviour, this study goes beyond the NSE literature and highlights the ecosystem perspective, its evolutionary dynamics, and the need to consider non-linearities of external influences to avoid risks of an oversimplified understanding of the external factors affecting productive entrepreneurship (Audretsch et al., 2018; Colombelli et al., 2019; Mack and Mayer, 2016; Wang and Tan, 2019). In fact, we find that the influence exerted by urban agglomeration at country level on new ventures' innovativeness is subject to a proximity paradox, revealing that too little or too much geographical concentration between economic actors can harm entrepreneurial innovativeness (Boschma and Frenken, 2010). This finding reconciles divergent results on the relationship between urban agglomeration and entrepreneurs' innovation reported in previous studies. For example, Lasch et al. (2013) and Cavallo et al. (2018) found beneficial effects of urban agglomerations on innovative start-ups, while other studies claim that it might have negative impacts on entrepreneurship and innovation (Bosma et al., 2008; Qian et al., 2012). By focusing on entrepreneurs offering innovations, we shed light on the debate around the advantages of agglomeration economies on knowledge sharing, innovation, and entrepreneurship (Pe'er and Keil, 2013; Plummer and Acs, 2014).

Third, cross-level interactions between entrepreneurs' resources and capabilities and the non-linear effect of urban agglomeration advance knowledge on innovative entrepreneurship by identifying what type of entrepreneurs benefit from specific environments. The investigation of cross-level interactions has been widely applied in the strategic management literature (e.g., explaining firm-level heterogeneity and performance) and reinforces the core assumption of NSE theory that entrepreneurship is an individually driven action that interacts with its environment (Van Oort et al., 2012; Pindado and Sánchez, 2019). In doing so, we confirmed that despite the influence of spatial agglomeration on new ventures' innovativeness, entrepreneurs obtain different levels of benefits from agglomeration (Knoben et al., 2016). This reinforces the view that firms follow complex and multiple pathways to innovation, and internal and external factors are not sufficient in isolation (Speldekamp et al., 2020).

Indeed, we found that entrepreneurs with higher levels of general human capital or prior entrepreneurial experience are better equipped to innovate regardless of the country's level of urban agglomeration, as well as, to suffer less its drawbacks. At the same time, entrepreneurs with higher knowledge may experience, at lower levels of urban agglomeration, diminishing marginal gains from this form of agglomeration compared to entrepreneurs with lower knowledge. Further, in the case of entrepreneurial capabilities, the competition argument seems to be the dominant without presence of the equilibrium argument. This reveals how these capabilities are a valuable and inimitable resource and reinforces that the contingent role depends on the specific resource analysed and the capacity to be replicated (Pe'er and Keil, 2013). Thus, the above results indicate that the "knowledge competition" and "knowledge equilibrium" arguments noted in the literature on firm level contingencies and agglomeration externalities coexist, and their predominance depend on the specific externality, context, firm, and resource addressed (Grillitsch and Nilsson, 2019). Furthermore, our findings show how the net effect of these arguments is determined by complex and simultaneous substitution and complementarity effects between entrepreneurs' internal and external knowledge provided by urbanization economies (Speldekamp et al., 2020).

So instead of treating them as mutually exclusive mechanisms, it seems fruitful to analyse the contingent role of firms' resources on agglomeration forces considering its non-linear dynamics as we proposed. Furthermore, the results reported here indicate that business owners-managers' human and social capital matters for innovation and the net effect of agglomeration externalities. Agglomeration studies have tended to focus on firm level resources, obviating the individual level agency (e.g., Knoben et al., 2016; Speldekamp et al., 2020). Thus, we contribute to this strand of the literature by showing how not only firm resources matters but also those at the individual level (Rutten, 2014).

5.2. Practical implications

Our findings indicate that individuals' internal resources and capabilities, a country's level of urban agglomeration and the interaction between both, are relevant in terms of entrepreneurs' innovativeness. This could facilitate the design of policies aimed at improving entrepreneurial ecosystems since much of the current policies and support schemes foster imitative entrepreneurship (Brown and Mason, 2014). In this regard, we show how a high level of agglomeration economies can harm entrepreneurs' innovativeness. Therefore, this requires specialized institutions and services within these areas (e.g., knowledge intensive business services), and an appropriate structure of cross-regional social networks to foster knowledge exchange and avoid the negative effects of agglomeration (Delgado et al., 2014). Furthermore, since there is no "one-size-fits-all" innovation policy and the nonlinearities between proximity, knowledge exchange, and innovation are highlighted in this research, there is a need to monitor and differentiate the absorptive capacity of entrepreneurs within different regions of countries (i.e., dense versus sparse) in order to offer solutions for the specific innovation pattern followed (Camagni and Capello, 2013). This means that policy makers need regular information, both at the entrepreneurial and contextual levels, on the specificities of each region within a country to identify the weaknesses of entrepreneurial ecosystems, which are not static systems and evolve over time (Stam, 2015). Moreover, we must not forget that entrepreneurial outcomes are mainly self-determined and our study shows that strong players can better overcome the negative externalities of agglomeration. Thus, entrepreneurs with innovative aspirations should develop their entrepreneurial competencies through education and training, and increase their exposure to new knowledge and information by participating in innovation platforms and this is especially relevant in highly agglomerated areas (Parjanen and Hyypiä, 2018).

5.3. Limitations and future research

Although the current study provides valuable findings on innovative entrepreneurship, it has some limitations that have to be acknowledged and could provide the basis for future research. First, we recognize that the use of cross-country GEM data, despite being the most relevant research initiative on entrepreneurial activity from an international perspective, limits research on the role that specific forms of human and social capital play in entrepreneurs' innovation behaviour. The variables used to capture entrepreneurs' experience, capabilities, and social capital, despite their validity has been established by prior research, are dichotomous which limits us to make a continuous assessment of them (Bohlmann et al., 2017). Thus, it would be useful to improve this cross-country dataset with multi-item measures capturing the breadth and depth of entrepreneurs' social networks, as well as entrepreneurs' previous experience and managerial capabilities. Future studies should use more fine measures of entrepreneurs' social networks, capturing the nature of these and the entrepreneurs' position within them, to provide additional insight of how firms overcome negative externalities (Ter Wal and Boschma, 2011). Additionally, the use of cross-sectional data does not allow us to identify and specify the unobserved individual heterogeneity. While we include a set of demographical features, such as gender and age to take in account differences between individuals (see Combes and Gobillon, 2015), subsequent studies based on panel data should address it. In this sense, the cross-sectional nature of the data used does not allow to fully assert causality, being necessary longitudinal studies to verify the findings revealed here (Maula and Stam, 2020). Likewise, despite our measure of innovativeness has been used in prior research and is aligned with innovation measures of other cross-country surveys, it would be necessary to improve GEM's innovation measurement, including additional questions to validate the degree of radicalness or capture the benefits obtained from it through less subjective questions (Cirera and Muzi, 2020).

Second, taking into account that entrepreneurs develop their economic activity within entrepreneurial ecosystems, which can be addressed at different spatial levels (i.e., local, regional, national and supra-national) and the importance of sub-national entities (i.e., regions) for policy implementation, additional cross-regional research is needed to extend the findings revealed here at the national level for innovative entrepreneurs at regional level. This research could use data from European CIS, American Business R&D and Innovation Survey (BRDIS), or other regional innovation surveys, identifying lower levels of aggregation than the used here. Additionally, due to the complexity of innovation processes across different and complementary industries (Delgado et al., 2014), future research should take into account industry-specific level variables. To that end, larger and complex databases of a given entrepreneur over time are necessary; this would allow the application of panel data techniques to analyse how changes in entrepreneurs' competencies and industry dynamics shape innovative entrepreneurship.

Finally, we focused on urban agglomeration at the national level due to its implications on entrepreneurial intent and post-entry behaviours (Acs et al., 2017). The proposed measure serves as a general proxy for agglomeration economies at country level, however, future studies should analyse alternative measures of spatial and sectoral concentration (i.e., localization economies) such as the Theil, Ellison and Glaeser, or Adjusted Geographic indexes, among others, as well as consider spatial units based not only on administrative boundaries (Gardiner et al., 2011; Estrin et al., 2017). The use of entropy measures for related and unrelated variety of agglomeration economies —the sectoral composition and its complementarities— would generate a finer picture of the relationship between agglomeration economies and entrepreneurship (Frenken et al., 2007). Additionally, future studies could include other dimensions of proximity (e.g., cognitive, organizational, social and institutional) in order to improve our understanding of the existence of a proximity paradox for innovative entrepreneurs. It would be also interesting to address the interaction between urban agglomeration with other contextual variables such as informal institutions to analyse how these shape innovative opportunities under the effects revealed in this paper (Speldekamp et al., 2020). Furthermore, a detailed characterization of the specific knowledge generated within agglomerated areas together with distance-based measures of agglomeration will shed light on the impact of its externalities at different distances (Cainelli and Ganau, 2018). Likewise, future research should explore what other regional attributes (e.g., social structure) might influence entrepreneurial innovative behaviours and consider the attributes of neighbouring areas. We encourage entrepreneurship researchers to explore the nonlinearities of external factors affecting entrepreneurial outcomes and the moderating role that entrepreneurial resources and capabilities can exert on environmental forces to ascertain which individuals benefit from their context.

Availability of data and material

Data and results are available from the authors on request.

Code availability

Code is available from the authors on request.

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CRediT authorship contribution statement

Emilio Pindado: Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing, Supervision. **Mercedes Sánchez:** Conceptualization, Writing – original draft, Writing – review & editing, Supervision. **Marian García Martínez:** Conceptualization, Writing – original draft, Writing – review & editing, Supervision.

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.

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Appendix A

Table A1

	N	New ventures' inno.	Age	Gender	Edu. level	E. Exp.	E. Cap.	E. Net.	GDP p.c. (t − 1)	Institutional quality (t − 1)	Financial system (t − 1)	Innovation system (t − 1)	Land area (t − 1)	Total population (t − 1)	Urban agglomeration (t − 1)
Algeria	1109	0.487	33.491	0.688	0.568	0.173	0.775	0.796	10,986.714	3.246	2.747	2.519	2,381,740	36,009,784	273.999
Angola	1184	0.514	32.985	0.571	0.572	0.135	0.8	0.771	7837.282	2.856	2.579	2.085	1,246,700	24,845,314	216.7
Argentina	2745	0.594	37.143	0.544	0.797	0.081	0.857	0.577	23,383.025	2.903	3.156	3.032	2,736,690	41,468,632	441.353
Australia	1133	0.624	40.68	0.587	0.868	0.044	0.843	0.645	46,944.006	5.285	5.419	4.467	7,683,887.1	23,182,179	432.11
Austria	1222	0.587	38.965	0.576	0.838	0.051	0.843	0.744	53,029.231	5.181	4.498	4.824	82,539.628	8,491,135.8	250.843
Bangladesh	232	0.244	34.496	0.815	0.319	0.034	0.129	0.578	2883.467	3.242	4.179	2.612	130,170	1.48E+08	129.46
Barbados	1240	0.442	36.233	0.518	0.906	0.061	0.912	0.542	15,225.912	4.933	4.665	3.522	430	284,001.28	54.765
Belgium	801	0.627	39.501	0.644	0.928	0.051	0.838	0.554	48,315.429	5.031	4.818	4.783	30,280	10,936,722	438.369
Bolivia	2588	0.538	34.931	0.466	0.587	0.118	0.839	0.585	6635.71	2.842	3.345	2.477	1,083,300	9,986,953.7	194.101
Bosnia and Herzegovina	1066	0.485	37.456	0.648	0.921	0.077	0.85	0.603	11,247.04	3.321	3.605	2.762	51,200	3,651,909	133.665
Botswana	2416	0.527	33.527	0.508	0.588	0.168	0.85	0.599	16,185.276	4.684	4.336	3.023	566,730	2,055,345.8	183.212
Brazil	7559	0.298	35.774	0.474	0.527	0.047	0.744	0.517	15,163.2	3.627	4.341	3.418	8,358,140	1.99E+08	481.807
Bulgaria	223	0.307	38.094	0.57	0.861	0.018	0.933	0.821	19,736.265	3.416	4.078	3.141	108,560	7,174,193.2	264.302
Burkina Faso	1304	0.359	35.328	0.634	0.049	0.063	0.84	0.763	1894.856	3.312	3.153	2.876	273,600	17,307,749	70.356
Cameroon	2003	0.334	33.84	0.515	0.442	0.121	0.892	0.711	3355.429	3.477	3.533	3.194	472,710	22,649,499	169.978
Canada	1468	0.723	39.965	0.602	0.943	0.065	0.853	0.683	47,181.256	5.428	5.321	4.576	8,965,590	35,410,080	434.217
Chile	11,987	1.035	38.78	0.552	0.854	0.086	0.858	0.648	23,052.635	4.791	4.764	3.472	743,532	17,490,476	372.244
China	5226	0.553	36.225	0.545	0.678	0.064	0.619	0.772	9682.827	4.217	4.072	3.876	9,424,700.7	1.35E+09	338.681
Colombia	10,048	0.698	36.615	0.563	0.794	0.073	0.842	0.537	12,333.047	3.425	4.117	3.18	1,109,500	45,528,598	358.961
Costa Rica	809	0.517	36.467	0.545	0.46	0.063	0.885	0.67	16,815.688	4.251	3.889	3.673	51,060	4,626,577.7	228.195
Croatia	1532	0.514	38.296	0.637	0.893	0.049	0.886	0.613	24,688.148	3.636	3.892	3.161	56,163.146	4,260,583.1	188.059
Cyprus	364	0.706	37.717	0.651	0.964	0.022	0.865	0.591	35,191.15	4.182	3.324	3.451	9240	1,164,473.7	167.682
Czech Republic	562	0.593	36.683	0.68	0.947	0.039	0.79	0.568	33,735.67	3.722	4.324	3.842	77,232.918	10,500,170	307.395
Denmark	672	0.796	38.973	0.655	0.923	0.054	0.815	0.768	52,068.077	5.896	5.265	4.631	42,028.616	5,525,555.5	353.801
Dominican Republic	1032	0.567	36.055	0.485	0.573	0.212	0.925	0.687	11,615.604	3.154	3.567	2.676	48,310	9,339,707	247.576
Ecuador	4035	0.587	36.792	0.497	0.584	0.102	0.872	0.485	11,128.373	3.217	3.521	2.877	248,360	15,459,730	233.089
Egypt	1604	0.521	33.91	0.757	0.749	0.116	0.81	0.491	10,214.498	3.819	3.481	2.876	995,450	87,203,536	205.598
El Salvador	936	0.49	37.202	0.409	0.566	0.072	0.847	0.601	7856.488	3.173	3.769	2.848	20,720	6,263,738.4	209.962
Estonia	1545	0.651	36.485	0.631	0.946	0.039	0.819	0.711	30,453.02	5.002	4.636	3.957	43,150.544	1,318,540.5	179.976
Ethiopia	382	0.53	31.236	0.55	0.526	0.01	0.945	0.812	1360.939	3.995	3.266	2.757	1,129,208.1	90,139,927	63.213
Finland	1227	0.522	39.436	0.642	0.918	0.037	0.847	0.786	46,328.82	6.067	5.462	5.58	303,943.69	5,373,136.3	337.926
France	614	0.686	39.464	0.638	0.829	0.054	0.806	0.689	42,837.518	4.914	4.803	4.712	547,557	65,623,844	447.353
Georgia	248	0.417	40.456	0.528	0.956	0.073	0.758	0.504	12,186.567	4.197	3.89	2.698	69,490	3,721,594.7	160.058
Germany	2569	0.548	40.93	0.615	0.911	0.045	0.844	0.657	49,068.596	5.39	4.827	5.37	348,748.17	81,415,118	449.187
Ghana	2039	0.399	33.361	0.444	0.157	0.181	0.846	0.594	3988.741	3.89	4.241	2.809	227,540	25,067,639	163.469
Greece	1425	0.553	38.662	0.621	0.881	0.045	0.826	0.562	32,796.542	3.812	3.557	3.102	128,900	11,005,563	332.621
Guatemala	3296	0.747	34.014	0.537	0.465	0.052	0.826	0.544	7753.48	3.31	4.491	3.07	107,160	14,937,914	170.414
Hungary	1554	0.45	39.411	0.666	0.804	0.041	0.798	0.555	25,490.982	3.798	4.177	3.593	90,424.157	9,962,316.3	275.381
Iceland	808	0.691	42.13	0.626	0.688	0.08	0.821	0.785	50,045.691	5.831	5.124	4.402	100,250	312,145.46	227.162
India	2079	0.72	35.11	0.667	0.694	0.08	0.77	0.655	4834.181	4.084	4.573	3.699	2,973,190	1.27E+09	200.103
Indonesia	3530	0.488	36.508	0.502	0.707	0.035	0.843	0.837	9584.748	4	4.237	3.813	1,814,652.6	2.53E+08	277.12
Iran	3161	0.298	32.855	0.733	0.82	0.075	0.74	0.581	13,281.168	3.682	3.133	3.168	1,628,760	76,425,688	363.108
Ireland	1463	0.739	40.59	0.64	0.923	0.059	0.854	0.643	59,423.636	5.331	4.288	4.658	68,890	4,584,163.8	239.041
Israel	1319	0.615	37.992	0.612	0.969	0.089	0.718	0.713	36,175.588	4.614	5.084	5.382	21,640	7,917,586.4	378.473
Italy	871	0.613	40.059	0.651	0.76	0.041	0.782	0.569	42,479.14	3.562	3.598	3.59	294,140	59,574,475	380.93
Jamaica	2707	0.476	36.624	0.518	0.575	0.115	0.924	0.597	9686.794	3.65	4.428	3.063	10,830	2,821,353.5	141.603
Japan	688	0.505	44.451	0.686	0.964	0.033	0.654	0.563	38,300.473	5.124	4.754	5.302	364,500	1.28E+08	553.25
Jordan	348	0.629	35.494	0.753	0.664	0.138	0.899	0.678	11,039.501	4.763	4.293	3.51	88,461.897	7,670,109.8	269.407
Kazakhstan	1011	0.377	36.108	0.505	0.933	0.046	0.865	0.804	23,010.689	4.024	3.723	3.24	2,699,700	16,991,727	233.866
Latvia	1977	0.578	35.344	0.641	0.963	0.056	0.821	0.634	24,352.825	3.994	4.394	3.169	62,175.002	2,061,071.1	196.142
Lebanon	1723	0.827	35.875	0.598	0.706	0.057	0.916	0.814	16,525.637	3.003	3.773	3.037	10,230	6,468,675.7	296.652

(*continued on next page*)

Table A1 (*continued*)

	N	New ventures' inno.	Age	Gender	Edu. level	E. Exp.	E. Cap.	E. Net.	GDP p.c. (t − 1)	Institutional quality (t − 1)	Financial system (t − 1)	Innovation system (t − 1)	Land area (t − 1)	Total population (t − 1)	Urban agglomeration (t − 1)
Libya	248	0.635	35.262	0.685	0.919	0.125	0.794	0.415	18,806.787	3.689	2.678	2.496	1,759,540	6,285,750	195.967
Lithuania	812	0.557	35.103	0.656	0.983	0.033	0.661	0.664	26,658.972	4.004	3.874	3.48	62,674.53	3,014,501.5	214.573
Luxembourg	740	0.797	41.378	0.618	0.895	0.07	0.861	0.731	108,849.31	5.68	5.098	4.853	2430	555,306.17	233.59
Macedonia	860	0.492	37.079	0.676	0.94	0.064	0.886	0.671	13,560.656	3.748	4.077	2.989	25,222.733	2,071,929.7	146.758
Madagascar	430	0.383	36.293	0.46	0.249	0.079	0.735	0.612	1565.867	3.097	3.131	3.11	581,800	24,894,380	93.904
Malawi	1242	0.856	32.522	0.512	0.13	0.259	0.951	0.847	982.53	3.942	3.987	3.06	94,280	15,166,831	35.692
Malaysia	1153	0.491	37.427	0.579	0.775	0.065	0.802	0.752	22,975.746	4.9	5.266	4.475	328,550	29,384,490	331.097
Mexico	3940	0.515	36.563	0.515	0.532	0.065	0.762	0.68	18,773.047	3.436	4.201	3.277	1,943,950	1.18E+08	430.497
Montenegro	295	0.451	36.81	0.658	0.854	0.105	0.953	0.814	16,400.264	4.282	5.015	3.294	13,450	618,294	122.922
Morocco	698	0.41	34.807	0.672	0.354	0.082	0.852	0.646	6699.441	4.154	3.861	3.072	446,300	33,727,137	237.151
Namibia	618	0.87	31.668	0.487	0.422	0.154	0.887	0.676	9474.337	4.189	4.445	2.932	823,290	2,194,784	102.2
Netherlands	2083	0.619	39.765	0.605	0.859	0.038	0.877	0.695	52,604.164	5.637	4.894	5.029	33,716.135	16,693,771	420.77
Nigeria	2564	0.431	34.55	0.505	0.659	0.035	0.922	0.84	5056.724	3.287	3.985	3.013	910,770	1.64E+08	198.036
Norway	997	0.551	41.421	0.699	0.953	0.069	0.811	0.689	62,472.507	5.788	5.417	4.676	365,214.58	4,917,716.7	323.491
Pakistan	572	0.544	34.143	0.89	0.278	0.044	0.719	0.631	3922.357	3.342	4.111	3.046	770,880	1.80E+08	163.04
Panama	2359	0.52	37.404	0.523	0.677	0.039	0.83	0.698	25,336.795	3.881	4.945	3.422	74,262.315	3,803,597	204.615
Peru	5234	0.626	36.094	0.526	0.738	0.102	0.844	0.638	10,476.077	3.38	4.525	2.766	1,280,000	29,344,841	324.141
Philippines	1241	0.686	39.196	0.367	0.822	0.086	0.915	0.591	6641.304	3.717	4.336	3.203	298,170	98,747,205	207.659
Poland	1425	0.571	36.745	0.646	0.951	0.051	0.822	0.665	26,508.802	4.069	4.474	3.298	306,214.54	38,019,944	298.116
Portugal	1121	0.534	37.952	0.628	0.656	0.039	0.844	0.571	30,896.948	4.346	3.776	3.898	91,597.595	10,481,274	257.943
Puerto Rico	491	0.564	36.892	0.544	0.931	0.051	0.923	0.54	33,904.223	4.65	4.815	4.231	8870	3,582,893.3	316.894
Qatar	1134	0.668	34.934	0.757	0.866	0.081	0.844	0.638	95,597.496	5.892	5.108	4.84	11,570.741	2,424,908.2	364.131
Romania	1129	0.531	37.216	0.647	0.906	0.076	0.818	0.645	21,432.594	3.497	4.045	3.054	230,044.67	20,198,133	229.814
Russia	996	0.401	35.947	0.552	0.961	0.064	0.798	0.776	24,797.359	3.218	3.3	3.219	16,376,914	1.43E+08	416.258
Saudi Arabia	1160	0.484	34.339	0.647	0.622	0.078	0.911	0.818	47,572.485	5.018	4.298	3.739	2,149,690	30,673,127	420.826
Senegal	906	0.281	35.638	0.511	0.181	0.093	0.979	0.708	2868.318	3.814	3.797	3.394	192,530	14,174,731	127.504
Serbia	204	0.544	38.235	0.618	0.848	0.069	0.926	0.667	14,227.282	3.382	3.814	3.083	87,460	7,369,128.4	184.091
Singapore	628	0.525	38.541	0.605	0.952	0.053	0.57	0.449	83,275.781	6.074	5.835	5.306	705.629	5,295,848.8	413.943
Slovakia	1457	0.539	38.137	0.655	0.745	0.065	0.86	0.654	27,110.585	3.447	4.503	3.083	48,085.735	5,410,564.9	198.893
Slovenia	1340	0.642	37.73	0.681	0.88	0.028	0.893	0.765	33,863.264	4.181	3.811	3.754	20,142.874	2,042,326.7	166.85
South Africa	1739	0.742	35.311	0.588	0.68	0.094	0.862	0.618	12,719.149	4.474	5.392	3.659	1,213,090	53,149,046	302.185
Spain	14,153	0.553	39.699	0.592	0.775	0.036	0.882	0.612	37,781.058	4.251	4.322	3.581	499,523.69	46,014,031	422.32
Suriname	103	0.32	37.417	0.602	0.621	0.019	0.883	0.68	18,081.563	3.579	3.591	2.635	156,000	542,480.09	94.992
Sweden	1284	0.59	41.12	0.639	0.971	0.047	0.825	0.751	49,429.51	5.754	5.198	5.482	408,168.04	9,620,495.8	378.726
Switzerland	1119	0.607	42.168	0.572	0.971	0.027	0.83	0.613	65,178.027	5.776	5.243	5.703	39,516.009	8,052,072.8	318.518
Thailand	3383	0.555	38.399	0.487	0.69	0.054	0.695	0.509	15,299.654	3.841	4.461	3.197	510,890	67,888,301	220.897
Trinidad & Tobago	1391	0.372	36.214	0.568	0.801	0.053	0.942	0.577	28,778.541	3.694	4.419	2.928	5130	1,336,968.9	130.647
Tunisia	394	0.567	35.272	0.708	0.797	0.061	0.896	0.662	10,167.087	4.27	3.673	3.323	155,360	10,836,742	238.938
Turkey	4773	0.831	36.75	0.797	0.759	0.065	0.825	0.593	22,430.003	3.913	4.358	3.296	769,630	74,311,195	374.343
Uganda	3628	0.336	30.859	0.466	0.167	0.238	0.913	0.727	1907.985	3.378	3.974	2.987	200,247.58	33,159,702	60.103
United Arab Emirates	1098	0.653	35.117	0.792	0.912	0.159	0.891	0.779	68,092.332	5.437	4.669	4.22	71,020	7,960,891.1	356.257
United Kingdom	5514	0.627	41.174	0.604	0.818	0.053	0.88	0.6	43,853.485	5.356	5.589	5.144	241,930	62,781,323	466.06
United States	3640	0.673	41.392	0.583	0.916	0.064	0.878	0.623	55,847.736	4.733	5.197	5.498	9,149,312.2	3.12E+08	566.908
Uruguay	2410	0.656	36.984	0.61	0.633	0.088	0.863	0.595	18,288.968	4.631	3.891	3.135	175,020	3,373,456.1	291.852
Vietnam	1309	0.434	34.372	0.471	0.817	0.052	0.754	0.725	6146.144	3.628	3.823	3.172	310,070	91,724,901	146.405
Zambia	2347	0.367	33.498	0.529	0.523	0.159	0.876	0.81	3171.67	3.978	4.454	3.149	743,390	13,956,285	97.18

Appendix B. Supplementary materials

Supplementary materials to this article can be found online at https://doi.org/10.1016/j.respol.2022.104625.

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