Working Paper Series
GRINCOH
Growth-Innovation-Competitiveness
Fostering Cohesion in Central and Eastern Europe

Serie 3
Knowledge, Innovation, Technology

Paper No. 3.08.2

Entrepreneurial Growth Aspirations, Innovation Propensity and National Knowledge Intensity: Unveiling the Complexity of the Relationship, using GEM data

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2014

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This paper was funded under the FP7 project "Growth– Innovation – Competitiveness: Fostering Cohesion in Central and Eastern Europe (GRINCOH)" under the Programme SSH.2011.2.2-1: Addressing cohesion challenges in Central and Eastern Europe; Area 8.2.2 Regional, territorial and social cohesion. Project Nr. 290657

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Please cite as:
Estrin S., Korosteleva J., Mickiewicz T., (2014), 'Entrepreneurial Growth Aspirations, Innovation Propensity and National Knowledge Intensity: Unveiling the Complexity of the Relationship, using GEM data', GRINCOH Working Paper Series, Paper No. 3.08.2

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Abstract

Drawing on entrepreneurship and knowledge spillover theory, we explore the complexity of the relationship between an entrepreneur's innovation orientation, R&D and entrepreneurial employment growth aspirations. We employ the Global Entrepreneurship Monitor surveys in 76 countries for 2001-2011, applying a multilevel estimation framework to test our ideas. We find that innovation orientation of entrepreneurs significantly define their aspirations to generate employment. Furthermore, our findings suggest not all growth-oriented entrepreneurs benefit equally from R&D. This relationship is more complex, and the benefits tend to accrue to entrepreneurs with higher overall predisposition to strategic entrepreneurship, notably entrepreneurs' innovation orientation and export intensity. Finally, our study also sheds some light on the differences on the relationship between entrepreneurs' innovation, R&D and entrepreneurial growth aspirations across EU older member-states and CEE-EU new member-states which we explain in terms of the level of economic development and the legacy of being post-socialist economies in the recent past.

Keywords: Growth Aspirations; Employment; Innovation Orientation; Knowledge Spillovers; Export Intensity; Strategic Entrepreneurship; EU member-states, Central and Eastern Europe.

Content

Introduction

Differences in entrepreneurial ambitions play a critical role in economic dynamism with growth aspiration entrepreneurs standing out as the group which has the highest potential to generate the bulk of new jobs in the economy and therefore contribute the most to economic growth and development (Levie and Autio, 2011; Estrin et al., 2013; Efendic et al., forthcoming).

Although entrepreneurs may often be over-optimistic in their ambitions, those, who are willing to take risks in pursuit of growth and attempt to reach out ambitious targets, tend to generate better outcomes as opposed to their counterparts, through the process of faster learning by trial and error, and intense alertness for correction of errors stemming from over-optimism (Autio and Mickiewicz, 2013). Indeed, a substantial body of empirical research demonstrates that the entrepreneurial level of ambition matters for subsequent venture growth (Kolvereid and Bullvag, 1996; Baum *et al*., 1998; Baum *et al*., 2001; Wiklund and Shepherd, 2003; Delmar and Wiklund, 2008; Aidis *et al*., 2011). Therefore, it is important to understand what determines entrepreneurial growth aspirations.

Another factor that motivates us to study the drivers of entrepreneurial aspirations stems from the need to understand expansion as an entrepreneurial decision *per se*, which could be defined not just by the resource constraints but by attitudes, beliefs and predispositions of entrepreneurs - owners-managers of businesses. Facing an uncertain environment where additional information can only be acquired at an increasing cost, individuals tend to adopt alternative cognitive strategies (DellaVigna, 2007). The more individuals are convinced that certain outcomes are dependent upon certain actions, and the more confident they are that they have capabilities to succeed, the more they will be alert to new opportunities (Harper, 2003). The decision to grow a business may play a particularly significant role at the stage of entrepreneurial process when young firms already survived the initial period of incubation and their owners and managers face a choice of either preserving status quo, or expanding, staying continuously alert to those entrepreneurial opportunities with scope for growth (Estrin et al. 2013).

Following this, a stream of research has looked at the determinants of entrepreneurial growth aspirations, with more recent studies exploring this research agenda not only from the perspective of an individual's own characteristics, but also in the context of the institutional environment, thus enabling a cross-country multilevel perspective on this. The institutional factors investigated so far extend (but not limited) to intellectual property rights protection (Autio and Acs, 2010); regulatory burden and the rule of law (Levie and Autio, 2011); property rights protection (government arbitrariness), corruption and government activism (Estrin et al., 2013).

Surprisingly perhaps, in this strand of research no attention so far has been drawn to the effect of entrepreneurs' innovation orientation and knowledge spillovers on entrepreneurial growth aspirations, whereas both innovation and knowledge have become critical pillars of growth in increasing numbers of developed and emerging economies in the past decade[1].

1 The issues of innovation, efficiency and productivity became central in the discussion of the Lisbon Agenda of the European Union. This was linked to the concern that European countries were lagging behind the US in technological terms and to catch-up they would need higher productivity, more innovation, and more flexible and skilled labour markets. The Europe 2020 strategy has further re-emphasized this, viewing knowledge, innovation and entrepreneurship as the key drivers for smart, sustainable and inclusive growth. A number of emerging economies have followed suit establishing innovation hubs akin in Silicon Valley in California and investing heavily in R&D, education and training.

Innovation is one of the channels through which entrepreneurship is claimed to affect growth (for overview of this literature see Carree and Thurik, 2006). In turn, knowledge, broadly divided into tacit, which is difficult to transfer as it is non-codified and can only be observed through application, and explicit one, written down and conveyed in procedures, processes and institutions, is argued to constitute a firm's most strategically important resource (Grant, 1996). To the extent that knowledge and ideas are public goods, their benefits are not always entirely captured by their creators. Knowledge creation 'has the tendency to carry within it the seeds of further knowledge creation… that could be recognized and developed by others" which what is known as knowledge spillovers (Parker, 2009). Following the knowledge spillover theory of entrepreneurship, entrepreneurs are seen as important conduits of tacit knowledge (Acs and Armington, 2006; Audretsch and Keilbach, 2007, 2008; Acs et al. 2013a; Acs et al. 2013b). Knowledge created by incumbent organisations and research institutions serves as an important source of entrepreneurial opportunities; by commercialising knowledge that otherwise would remain uncommercialized entrepreneurs play critical role in the process of knowledge transfer with further positive implications for growth (Audretsch and Keilbach, 2007; Acs et al. 2013b).

Drawing on the entrepreneurship theory, economic psychology and knowledge spillover theory of entrepreneurship, in this study we examine the complexity of the relationship between entrepreneurs' innovation orientation, national-level innovativeness, proxied by country-level R&D, and entrepreneurs' growth aspirations. We argue that the relationship between R&D and employment growth aspirations of entrepreneurs is non-monotonous, and that R&D's spillovers do not automatically accrue to all growth-aspiration entrepreneurs. More specifically, the effect of R&D appears to be conditional upon entrepreneurs' innovation orientation, and other dimensions of strategic entrepreneurship predisposition, entrepreneurs' export intensity. We test the hypotheses derived from this theoretical framework using a multi-level modelling method on a large cross-country cross-individual dataset over the period of 2001-2011, comprising a minimum of 2,000 people in each of 76 countries. We distinguish between product and technology innovation of entrepreneurs that has further important implications for interpretation of our findings. Finally, we explore the complexity of these relationships between old EU member –countries and new EU member-states of Central and Eastern Europe (CEE), expecting some differences between these two comparator groups. We further attribute such differences to the peculiarities of the R&D system in CEE, influenced by the legacy of a planned economy, and to the level of their economic development with the cost of research-driven innovation in these economies being still comparatively higher than in the majority of EU older member-states, that makes us question whether pursuing a development strategy, based on primarily prioritising R&D in capital-intensive industries, as opposed to the development of imitative entrepreneurship, is necessarily to ensure better outcomes and speedier convergence.

Growth aspirations, innovation & knowledge spillovers: theoretical framework

Innovative entrepreneurship and growth aspirations

Innovation *per se* is seen as a complex phenomenon. On the one hand it may take the form of invention, with a new product or service introduced to the market, replacing obsolete technology, and underlying thus the process of creative destruction advocated by Schumpeter (1911) as primary cause for growth. Such type of innovation happens through expenditure in Research and Development (R&D) and commercialisation of technological discoveries by entrepreneurs. On the other hand, innovation may take simpler forms often consisting merely in 'filling in a market niche that has not been exploited yet' via replication of technologies developed elsewhere (Minniti and Levesque, 2010). This type of innovation underlies creative imitation which is expected to contribute to technological upgrading and growth

through provision of product diversity and increase in competition with no incurring of R&D. Both R&D-based innovation and creative imitation are theorised to be beneficial for economic growth, even if conducting to different patterns of sustainability (ibid.).

Indisputably, entrepreneurship entails innovation, regardless its form, which emerges as one of the channels through which entrepreneurship contributes to economic growth. The evidence shows that industries with high rates of entry by small firms demonstrate high rates of innovation and productivity growth (for overview of the literature see Parker, 2009). Furthermore, a number of studies reveal that innovative new entrants also tend to deliver superior post-entry outcomes (Vivarelli and Audretsch, 1998; Arrighetti and Vivarelli, 1999).

More specifically, Arrighetti and Vivarelli (1999) argue that the initial population of entrepreneurs is not homogenous and, among other characteristics, start-ups vary in their motivation to set up a new venture that largely explains differences in firms' subsequent post-entry performance. They study this relationship drawing on a sample of Italian spin-offs, relating motivation and other factors which appeared to be decisive for individuals to leave a mother company to start a new venture to the post-entry performance of start-ups, constructed as a joint measure taking into account both annual post-entry employment growth and the relative profitability of the new-born firm (in comparison with the sectoral average). Their findings provide clear evidence that innovative motivation tends to be linked to a superior post-entry performance.

Interestingly, while previous studies have typically employed profitability as a standard measure of firm's performance, they have chosen employment growth as a second objective measure of performance of start-ups, motivating it by the fact that 'since these firms generally start very small and they decide to hire new employees only in the case of very positive expectations regarding current and future incomes' (Arrighetti and Vivarelli, 1999: 932). Therefore, it is plausible to assume that more innovative entrepreneurs in expectation to capture monopoly profits (even if only temporarily), would have higher employment growth aspirations compared to mediocre entrepreneurs.

In the light of this, we hypothesise that:

Hypothesis 1. Innovative entrepreneurship positively affects entrepreneurial growth aspirations.

Knowledge-intensive environment, entrepreneurial innovation orientation & knowledge spillovers

New knowledge and ideas are often outcomes of small firms either intentionally or unintentionally interacting with private R&D laboratories or with public research organisations, such as, for example, universities. The ability of some knowledge intensive environments to foster new ideas is one of the potential reasons of an economy's success and sustainability (Saxenian, 1994). Motivated by the new economic geography and endogenous growth literature (respectively, Krugman, 1991, and Romer, 1990), seeing knowledge spillovers as a driving force of the new economy, the knowledge spillover theory of entrepreneurship (Acs and Armington, 2006; Audretsch and Keilbach, 2007, 2008; Acs et al. 2013a; Acs et al. 2013b) posits that knowledge created by incumbent organisations and research institutions serves as an important source of entrepreneurial opportunities.

Possessing knowledge is not sufficient for generation of innovative output. Agarwal, Audretsch and Sarkar (2007) develop a model of 'creative construction' which shows how knowledge spillovers combined with an entrepreneurial action, enabling knowledge appropriation, leads to new firm creation and explains the

success of industries and regions and the growth of economy as a whole. Thus, the knowledge spillover theory of entrepreneurship emphasizes the central role entrepreneurs play as conduits of knowledge spillovers through commercialisation of knowledge that otherwise would remain uncommercialized (Audretsch and Keilbach, 2007; 2008).

Knowledge spillovers are seen as a central element to strategic entrepreneurship (Agarwal *et. al.*, 2010). According to Ireland et al. (2003) and Agarwal et al. (2007; 2010) strategic entrepreneurship is defined as activities based on the search of competitive advantage which through generation of new products, processes, markets, and organizational forms can lead to wealth creation sustainable in the long run. From this perspective an entrepreneur's innovation predisposition appears to be one of the dimensions of strategic entrepreneurship. The latter itself is deeply rooted into psychological constructs that are empirically claimed to determine alertness to opportunities (for overview of this literature see Harper, 2003). Such psychological constructs are described as entrepreneurs' personal beliefs, conceptualised as a composite of 'locus of internal control' and perceived self-efficacy to successfully undertake such actions (ibid.).

Internal control gives individuals perception that they are in charge of certain events, and it is precisely their actions which largely determine their economic rewards. Based on ample empirical and theoretical evidence Harper (2003) argues that it is exactly the differences in perception of internal control that significantly determine individual differences in learning processes in different contexts.

The internals – individuals with higher locus of internal control, - tend to possess many attributes pertinent to strategic entrepreneurs, including traits related to "creativity, such as autonomy, seeking out information that might lead to change, independence of judgement, a willingness to take reasonable risks, self-confidence, and a creative self-image" (Strickland 1989:7). Bolton and Thompson (2000) have stressed the importance of creativity in the process of invention and innovation, regarding it as the starting point whether it is associated with invention or opportunity spotting. This creativity is turned to practical realisation through innovation, whereas entrepreneurship then sets that innovation in the context of business venture. Interestingly, 'internality' is found to be greater for owners of new businesses that had survived the three-year period from their foundation (Brockhaus, 1980), who are the focus of our analysis in this study.

Due to their higher 'perceptual sensitivity' internal individuals also tend to demonstrate higher levels of incidental or spontaneous learning, described by Kirzner as 'entrepreneurial discovery without deliberate search' (Harper, 2003:45). Based on this, by seeing internal locus of control as indisputable determinant of entrepreneurial alertness (Harper, 2003), we expect more innovation-oriented entrepreneurs to be more superior than mediocre entrepreneurs in their ability to grasp, synthesise potential strategic information and use it to exploit new potential growth opportunities. In other words, we expect them to benefit the most from knowledge spillovers which could be particularly intensified in knowledge-rich environment.

Thus, our next hypothesis is formulated as follows.

Hypothesis 2. National innovation and knowledge intensity positively influences the relationship between entrepreneurs' innovation orientation and their growth aspirations.

Export orientation

Innovative entrepreneurship is not the only dimension of strategic entrepreneurship. To the extent of capturing entrepreneurs' pro-activeness and willingness to take reasonable risks in expectation of higher

returns, we could also argue that internalisation of young firms, associated with discovery of export markets with attractive growth opportunities, could also be viewed as one of the dimensions of strategic entrepreneurship.

This also finds its confirmation in the economic theory based on the propositions of the sunk costs-entry model (see, for example, Clerides, Lach and Tybout, 1998). More specifically, it suggests that profit maximising firms will only enter export markets if their expected profits exceed the fixed costs associated with entry to foreign markets. It further follows from the model that export firms are also more productive than their non-export counterparts due to reduction in costs they achieve through the learning from foreign competitors, buyers, and adopting better practices in business operation to stay internationally competitive (ibid).

Therefore, it is plausible to assume that innovative firms would benefit more from knowledge spillovers if they are also export-intensive ventures. Based on this we posit:

Hypothesis 3. Entrepreneurs' export intensity further positively reinforces the effect of entrepreneurs' innovativeness on their growth aspirations, and even more so for innovative young firms which tend to benefit from R&D spillovers.

Growth aspirations, innovation intensity and knowledge spillovers: exploring cross-EU country differences

The issues of innovation, efficiency and productivity became central in the discussion of the Lisbon Agenda of the European Union which defined a growth pattern for Europe to be based on knowledge, technology and innovation. This was linked to the concern that European countries were lagging behind the US in technological terms and to catch-up they would need higher productivity, more innovation, and more flexible and skilled labour markets. Consequently, the 2003 Green Paper outlined the need and the strategy of building up an entrepreneurial society[2]. The Europe 2020 strategy has further re-emphasized this, viewing knowledge, innovation and entrepreneurship as the key drivers for smart, sustainable and inclusive growth[3].

Following our earlier discussion of innovation typology, countries can adopt different development strategies based either on imitation of existing technology or products, or by innovating at the technology frontier. According to Acemoglu et al. (2006) the former strategy predominates at the earlier stages of economic development where credit constraints make R&D costly, while the development based on innovative entrepreneurship is more typical for economies which approach the technology frontier and credit constrains ease up, making R&D more cost-efficient.

Despite unified policies promoting sustainable growth based on entrepreneurship and innovation within the EU, EU countries tend to exhibit some degree of heterogeneity in terms of innovation patterns, and the role R&D plays in promoting growth in the region. Countries of Central and Eastern Europe that joined the EU during the two recent waves of EU expansion, have some features which make them different from the rest of EU countries, so called EU older member states, in the aspect of prevailing patterns of innovation. Given their socialist past and peculiarity of a R&D system inherited from the Soviet times, where the main

[2] For further details see http://ec.europa.eu/services_general_interest/green_en.htm, last retrieved 30 December 2013.

[3] For further details see http://ec.europa.eu/europe2020/index_en.htm, last retrieved 30 December 2013.

source of R&D was extramural public R&D organizations with universities playing marginal role in R&D activities until recently, and no R&D being generated within business enterprises which were stated-owned until the beginning of transition in late 1980s, it has become challenging for these economies to shift towards a new pattern of a private-enterprise-based R&D system along with also the need to undertake other structural and institutional reforms.

Despite CEE-EU member-states' colossal progress in transforming their economies, that enabled them to join the EU in the mid-late 2000s, they are still away from approaching the technology frontier. To comply with EU-wide innovation policies, their policy-makers extensively promote R&D at the level of firms hrough developing cluster initiatives, business hubs and providing public funding to support innovative business ideas, but entrepreneurship in this region still largely exhibits more features of imitative than innovative entrepreneurship with R&D playing fairly marginal role in facilitating economic growth through innovative entrepreneurs commercializing new economic knowledge.

Consistent with this, we posit:

Hypothesis 4. R&D are expected to increase growth aspirations of innovative entrepreneurs in older EU member-states, whereas they will have no effect in the context of CEE-EU member states.

The next section discusses the data, variables and methodology employed to test our hypotheses.

Data and methodology

Individual Data

We construct the dataset to test our hypotheses by merging data from the Global Entrepreneurship Monitor (GEM) with country-level innovation and macroeconomic variables obtained from the Word Bank 2012 World Development Indicators dataset (WB WDI). The GEM data are collected through the adult population surveys in 2001-2011 that covers 76 countries worldwide in our sample. The GEM data captures a wide range of business creation activities, distinguishing between (a) individuals who intend to create a new venture, (b) who are in the process of establishing a new firm (start-ups, or nascent entrepreneurs), (c) currently operating young firms (under 3.5 years), and (d) other owners-managers of established businesses (for details of the sampling procedure and variable definitions see Bosma *et al*. 2012).

In this study, we use *young firms* (under 3.5 years old) as our proxy for entrepreneurial entry. This category serves well the purpose of our study because growth aspirations refer to firms already in existence, and unlike nascent entrepreneurs, the young firm category has good coverage of the current level of employment used in defining our dependent variable. More importantly, focusing on young firms gives us the opportunity to study expansion as an entrepreneurial decision, defined not only by the resource constraints, but also, importantly, by the attitudes and predispositions of owner-managers of newly established businesses, for whom making a choice of remaining a life-style business or expanding is particularly critical at the stage when they have survived the initial stage of incubation (Estrin et al. 2013).

The use of young firms as our category of interest, also allows overcoming some statistical problems attributed to potential endogeneity between growth aspirations, on the one hand, and innovation and export orientation, on the other hand, that would be the case if the category of nascent entrepreneurs is employed here. For nascent entrepreneurs all three are classified as aspirations that are not realised yet, and they may be expected to materialise at some point in time, most probably, mutually affecting each

other. However, this is not the case with employing the category of young firms, for whom both innovation and internalization having actually happened prior growth expectations are formed. with feedback of success of such actions co and based on some financial feedback placed well entrepreneur's employment growth aspirations.

Dependent variable

We use employment growth aspirations (EGA) of entrepreneurs as our dependent variable showing the intentions of newly established entrepreneurs to increase employment over a five year horizon. As discussed earlier, the use of aspirations to indicate outcomes has a sound theoretical and empirical base derived from the central role attributed to 'strategic dynamism' in the analytical construct of 'entrepreneurial orientation' (Estrin et al., 2013; Covin and Wales, 2011; Levie and Autio, 2011). An entrepreneur's employment growth aspirations are calculated as the difference between the natural logarithms of the current and expected levels of employment in five years time, adding also the owner-manager to the level of employment, as justified by earlier studies (Parker, 2009; Estrin *et al.,* 2013).

Micro data and cross-country variables related to our hypotheses

To test a hypothesis related to innovation orientation of entrepreneurs (H1) and their growth aspirations, we use GEM innovation variables, distinguishing between product and technology innovation (as self-perceived by owner-managers of young firms). More specifically, 'innovative product' (i.e. innovation by product) is captured through a GEM question of whether "all, some, or none of your potential customers consider this product or service new and unfamiliar". We use a dummy with 1 denoting if 'all/some customers agree that product/service of this business is new'. In turn, 'innovative technology' (i.e. innovation by technology) is captured through the question of whether 'the technologies or procedures required for producing this product or service have been available for less than a year, or between one to five years, or longer than five years'. Respectively, a dummy coded as '1' denotes if 'technology is within less than 5 yrs old'; zero otherwise.

We also employ narrower definitions of young firms' innovation orientation by coding each of the two measures of innovation ('innovative product1' and 'innovative technology1') as '1' if respondents answered 'all customers...' and 'technology is less than 1 yr old' respectively; zero otherwise. To examine the effect of country-level innovation propensity on growth aspirations (H2), we employ R&D expenditure (as % of GDP) obtained from a WB WDI dataset. R&D is commonly regarded as an input measure of innovation, and it has widely been used in previous empirical research as a measure of innovation (for overview of the literature on innovation measures see Parker 2009: 303). It serves the purpose of our study well, given that we investigate the possibility of knowledge spillovers occurring to entrepreneurs, and it may prove easier for individuals to intercept new ideas generated by R&D private or public enterprises or institutions at the stage when a product and/or technology are not patented yet, but are still at the process of development. We lag R&D variable by one year to allow for some time elapsing for the effect to take place (l_R&D), and mediate it with a set of a young firm's innovation measures described above.

In order to test Hypothesis 3, we mediate the R&D-entrepreneurs' innovativeness relationship with a GEM variable denoting 'export intensity' of young firms. It is scored as a continuous variable originally ranging from '1' denoting 'more than 90% of customers normally live outside the country', to '7' – 'none' of them. We reverse the scale of the original GEM variable for easier interpretation of the multi-way interactions results, with 1 now denoting no export orientation and 7 indicating the highest level of export intensity.

Control Variables

We introduce a number of control variables both at the country and individual levels. Thus, we include the national level of development with per capita (pc) GDP at purchasing power parity which we break down into five quintiles of its distribution using dummy variables to shed some light on the effect of different stages of economic development on growth aspirations of entrepreneurs as long as to address potential problem of collinearity between GDP pc ppp and R&D, which is high in the case of the CEE countries sub-sample (Estrin et al., 2013). We also introduce the GDP annual growth rate variable (l_gdp growth) to reflect cyclical economic performance, expecting that in a recession, entrepreneurs are less likely to launch ambitious projects (Koellinger and Thurik 2009).

At a country-level we also control for density of established innovation businesses expecting them to be negatively related to entrepreneurial growth aspirations through a competition effect, driving out less efficient small-scale firms from the market. The innovation density measures are constructed as country-year aggregates of respective innovation dummies for established businesses separately for product/product1 and technology/technology 1 with original dummies coded similarly to the innovation dummies for baby businesses, discussed above.

We also control for the main personal characteristics of entrepreneurs/young firms that may influence their growth aspirations (Parker, 2009). Similarly to Estrin et al. (2013) we introduce the current level of employment, expecting a higher initial level of employment to be negatively related to employment growth intentions (Ln of current employment level). Previous GEM-based research shows that entrepreneurs with higher educational attainment are more likely to direct their efforts towards high-growth activities (Autio, 2005) so we control for post-secondary education (*education: post-secondary*). We also control for the age (*age*) of the entrepreneur, introducing the age squared along with age to allow for non-linearity effect of age: previous GEM studies suggest that middle-aged persons are more likely to start a business (Minnitti et al., 2005). Entrepreneurial activity is found to vary significantly with gender. Being a male is more likely to affect growth aspirations (Estrin and Mickiewicz, 2011), so we introduce a dummy variable for gender (*male).*We also introduce a dummy variable denoting some individual experience of being a business angel in the past that is expected to be positively associated with the use of external funding and the overall financial scale of the new project (*bus angel in last 3 yrs*). Social networking, also referred to as bonding capital or localised trust, are found to play an important role for entrepreneurs via social learning using role models (Minniti et al., 2005) and via facilitating entrepreneurs' access to finance (Johannisson, 2003). It is also regarded as an intangible asset that can be used to overcome difficulties arising from failure of formal institutions (Estrin *et al.*, 2013). We control for social networking through utilising a dummy variable with 1 denoting of whether the individual knows an entrepreneur involved in any start-up personally (*knows other entrepreneurs*). Finally, owning another existing business may raise the opportunity cost of a new involvement at a larger scale, and the latter would be chosen only if its expected net present value is significant, as is the case with high-growth aspiration projects. Thus, we control for *portfolio entrepreneurship*, introducing a dummy variable with '1' denoting entrepreneurs who are owner-managers of both young-firm businesses and established businesses (over 3.5 years old).

Finally, we introduce a set of sectoral (industry) controls in all our specifications to take account of sectoral differences in capital-intensity and optimum size of the firm that may affect growth aspirations. For definitions of all variables, data sources and descriptive statistics see Table 1 below.

Table 1: Descriptive statistics and definitions of explanatory and variables

Variable	Definition	Mean	S.D.
Explanatory variables: young firms' characteristics (related to hypotheses postulated)			
Innovative product	1 ='all/some customers agree that product/service of this business is new'; 0 otherwise (broader definition of innovation by product)	0.38	0.49
Innovative technology	1='technology is within less than 5 yrs old'; 0 otherwise (broader definition of innovation by technology)	0.30	0.46
Innovative product1	1 ='all customers agree that product/service of this business is new'; 0 otherwise (narrower definition of innovation by product)	0.13	0.34
Innovative technology1	1='technology is within less than 1 year old'; 0 otherwise (narrower definition of innovation by technology)	0.09	0.28
Export intensity	Scaled from 1 to 7 with '1' denoting 'none' customers normally living outside the country, and '7' denoting the range of 91 to 100% of customers living overseas.	6.2	1.4
Explanatory variables: individual-level controls			
Age	The exact age of the respondent between 18 and 64 at time of interview, taken in log	3.6	.29
Male	1=male, 0 otherwise	.58	.49
Current employment	Current number of employees + owner-manager, taken in log	.91	.99
Education: post-secondary	1=respondent has a post-secondary education	.43	.49
Portfolio entrepreneurship	1=entrepreneurs are owner-managers of both baby businesses (within 42 months old) and established businesses (over 42 months old)	.04	.20
Bus angel in last 3 years	1=business angel in past three years, 0 otherwise	.09	.29
Knows other entrepreneurs	1=personally knows entrepreneurs in past two years, zero otherwise	.61	.49
	Explanatory variables: country-level characteristics		
R&D (t-1)	Research and development expenditure (% of GDP), lagged by one year (WB WDI 2012)	1.32	0.92
Innovative Product Density	GEM country-year aggregates of innovative product dummies for established businesses; original dummies are coded similar to the innovative product dummies for baby businesses (GEM 2001-11).	0.31	0.15
Innovative Technology Density	GEM country-year aggregates of innovative technology dummies for established businesses; original dummies are coded similar to the innovative technology dummies for baby businesses.	0.17	0.11
Innovative Product1 Density	GEM country-year aggregates of innovative product1 dummies for established businesses; original dummies are coded similar to the innovative product1 dummies for baby businesses (GEM 2001-11).	0.11	0.08
Innovative Technology1 Density	GEM country-year aggregates of innovative technology1 dummies for established businesses; original dummies are coded similar to the innovative technology1 dummies for baby businesses.	0.05	0.07
GDP growth rate (t-1)	Annual GDP growth rate, lagged by one year (WB WDI 2012)	4.28	2.88
GDP per capita ppp (t-1)	GDP per capita at purchasing power parity, constant at 2005 international $USD, lagged by one year and taken in log (WB WDI	9.71	0.84

	2012)		
iq2	The second quintile of the logarithm of GDP pc at PPP (t-1)	.17	.37
iq3	The third quintile of the logarithm of GDP pc at PPP (t-1)	.22	.42
iq4	The fourth quintile of the logarithm of GDP pc at PPP (t-1)	.14	.35
iq5	The fifth quintile of the logarithm of GDP pc at PPP (t-1)	.14	.35
Dependent variable:			
Entrepreneur's employment growth aspirations (EGA)	Percentage change in the expected level of employment in 5- yrs' time over the current level of employment by new firms, taken in log	.37	.73

Source: GEM 2001-2011 unless specified otherwise; the reported statistics are based on the set of observations actually used in estimations 5.1-5.2 to eliminate the joint effect of missingess in all variables. Descriptive statistics for a narrower sample used in estimations 3-4 and 5.3-5.4 are very similar, and are not reported here to save some space but they are available upon request from the authors.

Methodology

We use multilevel modelling to address unobserved heterogeneity within the context of a cross-country-time, cross-individual dataset. Multilevel modelling takes account of the fact that the dataset has a hierarchical structure in which *individuals* represent level one, *country-years* samples represent level two. This allows us to control for clustering of the data first within a country and second within a country-year subsample. Failure to do this would lead to biased results (Rabe-Hesketh et al., 2005).

We tested whether the choice of multilevel modelling with country-year effects was justified by calculating the interclass correlation coefficient (ICC) that indicates what percent of the variance in entrepreneurs' employment growth aspirations is attributed to differences between country across time. Based on the key specifications we use for interpretation of our results (Table 5 specifications 1 & 2) ICC is equal to 6 and 8 % respectively (after controlling for individual and country-level effects) that falls within the normal range of 5-20% reported by Bliese (2000:361) and justifying the use of multilevel modelling. We further confirm the significance of country-year effects by comparing the null multilevel model with a null single-level model, by calculating the likelihood ratio (LR) test statistic. In both cases (spec 1 & 2 reported in Table 5) it is significant at 0.005% point, suggesting strong evidence of country-year effects on entrepreneurs' growth aspirations, therefore also (along with ICC text) justifying the need to employ the multi-level model with country-year effects[4].

While starting from the basic Random Intercept Model (RIM) (reported in Tables 3 and 4 spec 1) we also tested the appropriateness of employing Random Slope Model (RSM) vis-a-vis Random Intercept Model (RIM), allowing for both the intercept and slope to vary randomly across country-year groups. More specifically, we tested whether the difference in entrepreneurs' innovation orientation is the same across country-year groups by introducing two random coefficients for our two key individual-level innovation variables (defined by product and technology). LR test statistics comparing RIM and RSM models,

[4] For specifications reported in Table 5(specifications 1 & 2) used as reference point here the likelihood ratio test statistics are respectively equal to the following: (1) LR=2(-16094-(-16239))=290 and (2) LR=2(-16129-(-16257))=256 whereas the critical value at 0.005 on 3 df is equal to 12.8.

statistically significant at 1 % level[5], justified the use of Random Slope Model as a better fit for our data. Furthermore, the statistical significance of random slope coefficients for each of our individual-level innovation variables confirmed the choice of Random Slope Model, suggesting that the relationship between an entrepreneur's innovation orientation and growth aspirations differs depending on a country-year. This prompts us to explore further what may be the country-level variable to explain such variability.

Therefore, we further build up our model allowing for cross-level interaction between innovative product/technology variables, entering regression each at a time, and country-level innovation variable, proxied by R&D. Next, to explore the complexity of the relationship between entrepreneurs' innovation orientation and R&D we follow Aguinis et al. (2013) to examine multi-way interactions (a) allowing for innovative product and technology to enter a regression jointly, and interacting them individually and jointly with a R&D variable within the same regression; (b) allowing for the effect of export intensity on the relationship between entrepreneurs' innovation orientation (defined by both product and technology)-R&D and growth aspirations. By using the LR test, we verify whether the inclusion of cross-level interaction effects is justified.

Our baseline (Random Slope Model) regression model is therefore specified as follows:

$$\begin{aligned} EGA_{ij} &= \beta_0 + \beta_1 CurrEmp_{ij} + \beta_2 Age_{ij} + \beta_3 Age\hat{}2_{ij} + \beta_4 Male_{ij} + \beta_5 EducPost_{ij} + \beta_6 PortfolioEntrep_{ij} + \\ &+ \beta_7 BusAngel_{ij} + \beta_8 KnowsEntrep_{ij} + \beta_9 InnovP_{ij} + \beta_{10} InnovT_{ij} + \beta_{11} InnovDensP_j + \beta_{12} InnovDensT_j + \\ &+ \beta_{13} l\_R\&D_j + \beta_{14} l\_GDPgrowth_j + \beta_{15} iq2_j + \beta_{15} iq3_j + \beta_{15} iq4_j + \beta_{15} iq5_j + u_j + v_{ij} InnovP_{ij} + \\ &+ \varphi_{ij} InnovT_{ij} + \varepsilon_{ij} \end{aligned} \quad (1)$$

where *EGA*$_{ijk}$ is our measure of entrepreneurial growth aspirations,

$$\left\{ \begin{matrix} CurrEmp_{ij}, Age_{ij}, Age\hat{}2_{ij}, Male_{ij}, EducPost_{ij}, PortfolioEntrep_{ij}, BusAngel_{ij}, KnowsEntrep_{ij} \\ InnovP_{ij}, InnovT_{ij} \end{matrix} \right\}$$

represent individual-level direct effects,

$$\{ InnovDensP_j, InnovDensT_j \}$$

represent country-year mean effects of innovation density by established firms, defined by product and technology, and

$$\{ l\_GDPgrowth_j, iq2_j, iq3_j, iq4_j, iq5_j \}$$

represent the lagged values of the macroeconomic controls, with lagged value of GDP pc ppp being replaced with 5 quintile dummies reflecting its distribution.

The combination of $u_j, v_{ij} InnovP_{ij}, \varphi_{ij} InnovT_{ij}, \varepsilon_{ij}$ represents the random part of the equation, where u_j are the country-year level residuals, $v_{ij} InnovP_{ij}$ and $\varphi_{ij} InnovT_{ij}$ are the random slopes of individual-level variables measuring entrepreneurs' orientation, and ε_{ij} are individual-level residuals.

Our study may be subject to some potential endogeneity because the country-year individual growth aspirations when aggregated are likely to affect some of the macro variables, for instance GDP growth rate. We alleviate this issue by lagging the macroeconomic variables by one year. To investigate potential multicollinearity problems, we calculated variance inflation factors (VIF) for all our variables based on the

[5] For specification reported in Table 5(specifications 1 & 2) used as reference point here the likelihood ratio test statistics are respectively equal to the following: (1) LR=2(-16104-(-16118))=28 and (2) LR=2(-16151-(-16160))=18 whereas the critical value at 0.005 on 2 df is equal to 10.6.

full sample[6]. Apart from the *Age_squared* and its composite, we found no indication of multicollinearity problems based. Thus the VIF for all other variables are well below the conventional level of 10. Moreover, for our sample, the impact of multicollinearity is to some extent counterbalanced by the large sample size, i.e. we do not face the "micronumerocity" problem (Goldberger, 1991) which can be another source of instability in coefficients.

In addition, we also check simple correlations to guide our approach to specification in the face of multicollinearity. We use a cut-off point of over 0.7 to determine the specifications. The correlation matrix, reported in Table 2, is produced based on the set of 15,032 observations actually used in estimations (5.1-5.2) which are central to our discussion of the results. The correlation matrices based on the sets of observations used in estimations 3-4 and 5.3-5.4 are fairly similar with no specific variables raising any concerns over multicollinearity; these tables are available from the authors upon request. Similarly to what we find calculating VIF, correlation coefficients for all our variables are far below the conventional level of 70 per cent for the full sample. We also produce separate correlation matrices for two of our sub-samples, notably EU older member states, and CEE-EU new member states. They also appear to be in line with correlations obtained based on the full sample with one exception of high correlation of 85% for R&D and GDP pc ppp for CEE countries. We replace it with GDP pc ppp quintile dummies to address the problem of multicollinearity in the case of the CEE subsample. We also test the robustness of these results by dropping the quintile dummies from the regression; all variables retain their sign and magnitude of the effect. For consistency purposes we employ GDP pc ppp quintile dummies in all of our specifications. On top of controlling for potential multicollineairty problems, this also allows to evaluate the differences of the effect of different stages of economic development on entrepreneurs' growth aspirations.

[6]Based on specification (1.1) in Table 5.

Table 2: Correlation matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Entrepreneur's Growth Aspirations (1)	1																			
Innovative product (2)	0.09	1																		
Innovative Technology (3)	0.04	0.19	1																	
Export intensity (4)	0.03	0.12	0.06	1																
Current employment level, in log (5)	-0.12	0.10	0.06	0.21	1															
Age, in log (6)	-0.06	-0.05	-0.05	0.00	-0.00	1														
Male (7)	0.06	-0.01	0.00	0.06	0.12	-0.01	1													
Education: postsecondary (8)	0.05	0.06	0.00	0.10	0.12	0.03	0.05	1												
Portfolio entrepreneurship (9)	0.04	0.04	-0.04	0.05	0.09	0.04	0.02	0.02	1											
Bus angel in last 3 years (10)	0.03	0.05	0.03	0.08	0.15	-0.01	0.07	0.05	0.10	1										
Knows other entrepreneurs (11)	0.08	0.05	0.03	0.07	0.11	-0.10	0.08	0.10	0.03	0.12	1									
Innovative product density (12)	0.02	0.31	0.26	0.05	0.11	-0.02	0.01	-0.01	0.05	0.03	0.01	1								
Innovative technology density (13)	-0.01	0.06	0.13	0.07	0.07	-0.07	0.01	-0.01	0.04	0.03	0.02	0.23	1							
R&D (t-1) (14)	-0.02	-0.03	-0.10	0.11	0.05	0.14	0.06	0.20	-0.03	0.02	0.07	-0.16	-0.22	1						

GDP growth rate (t-1) (15)	0.02	0.06	0.07	-0.08	0.04	-0.16	-0.03	-0.17	-0.03	0.02	0.04	0.24	0.09	-0.3	1					
GDP per capita ppp, in log (t-1) (16)	-0.02	0.01	-0.07	0.18	0.07	0.19	0.07	0.26	0.06	-0.01	0.02	-0.08	-0.09	0.63	-0.63	1				
iq2 (17)	-0.02	0.09	-0.02	0.06	0.12	-0.04	0.05	0.05	-0.05	0.00	0.02	0.31	0.03	-0.08	0.07	0.01	1			
iq3 (18)	-0.02	-0.01	0.04	0.00	-0.01	0.04	0.01	0.04	0.20	0.01	-0.03	-0.00	0.27	-0.02	-0.32	0.34	-0.24	1		
iq4 (19)	0.00	-0.03	-0.07	0.04	-0.02	0.09	0.02	0.11	-0.05	-0.02	0.02	-0.16	-0.18	0.44	-0.24	0.33	-0.18	-0.22	1	
iq5 (20)	-0.00	-0.02	-0.06	0.11	0.04	0.11	0.03	0.12	-0.04	0.03	0.03	-0.14	-0.21	0.40	-0.2	0.41	-0.18	-0.22	-0.16	1

Source: GEM 2001-2011; World Bank WDI 2012. All variables except for dummy variables are standardised. The correlation matrix is produced based on the set of 15,032 observations actually used in estimations (5.1-5.2).

Empirical results

Our empirical results are presented in Tables 3-6. We report a variety of specifications to indicate the robustness of our findings. Table 3 summarises the results of estimating entrepreneurs' growth aspirations determined in terms of innovative product with further extending our model to include a cross-level interaction term between entrepreneurs' innovation (by product) and R&D. First, in Table 3 we report the results of Random Intercept Model (specification 1.1). We next perform the likelihood ratio (LR) test to check whether the use of Random Slope Model (specification 1.2) will improve the goodness of fit of the model, and we confirm this. Specifications 1.3 and 1.4 report next the results of RSM allowing also for moderation of entrepreneurs' innovation orientation (defined by product) and their growth aspirations by R&D, while employing wider measure of entrepreneurs' innovation by product (specification 1.3) and its narrower definition (for definitions of these variables see Table 1; they are also discussed in the previous section). We replicate the same steps replacing entrepreneurs' innovation (by product) with innovation (by technology) (reported in Table 4). Table 5 (specifications 1.1-1.2) reports the results of the specifications that bring both innovation measures together and also allowing for their interactions with R&D individually and jointly within the same specification. Table 5 (specifications 1.3-1.4) also reports the results of more complex multi-way interactions allowing for entrepreneurs' export intensity to moderate the relationship between entrepreneurs' innovation orientation, R&D and growth aspirations of entrepreneurs. We further test the differences in the effect of innovation propensity of young firms (defined both by product and technology) and knowledge spillovers across the two samples: EU old member-states comprising Austria, Belgium, Denmark, Finland, France, Ireland, Italy, Germany, Greece, Netherlands, Portugal, Spain, Sweden and United Kingdom in our GEM sample, and EU new member states of Central and Eastern Europe, comprising Croatia, Czech Republic, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia in our GEM sample (Table 6). For this we replicate specifications 5.1-5.2 for each of the two groups of countries. While previous specifications were estimated using Random Slope Model, here we employ Random Intercept Model as the attempt of replicating specifications (5.1) and (5.2) leads to identification problem in the case of the CEE sample. Similarly, for this reason we could not estimate more complex model with the use of multi-way interactions allowing for the conditional effect of export intensity. It is also important to note that while in the case of EU old member-states LR test shows that a multilevel model is preferred[7], in the case of the CEE sample, Chi-sq statistic, comparing RIM vs. OLS, is insignificant, indicating that the model can be estimated with the use of OLS. However, for consistency purpose to allow comparing the results for EU old member-states and EU new member-states of CEE, we employ RIM in both cases. We check the robustness of these results for the CEE sample using OLS which are similar to the ones obtained with the use of RIM.

Considering our results, we find entrepreneurs' innovation orientation (defined independently by product and technology to be highly significant across all specifications (see Tables 3-4), supporting Hypothesis 1 that innovation-oriented entrepreneurs tend to exhibit higher growth aspirations. These results hold for both broader and narrower definitions of innovation by product and by technology.

[7] Chi-sq statistic on 1 df is equal to 17.94 and it is significant at 1% level of significance.

Table 3: Estimation results for entrepreneur's growth aspirations (young firms), EGA, young firms' innovation propensity (defined by product) and R&D, using a Multilevel model

Explanatory variables/ Model specification	(1.1)	(1.2)	(1.3)	(1.4)
Ln of Current employment level	-0.112***	-0.112***	-0.112***	-0.110***
	(0.005)	(0.005)	(0.005)	(0.005)
Ln Age	0.599***	0.599***	0.597***	0.583***
	(0.126)	(0.126)	(0.126)	(0.126)
Ln Age squared	-0.652***	-0.650***	-0.649***	-0.639***
	(0.126)	(0.126)	(0.126)	(0.126)
Portfolio entrepreneurship	0.183***	0.186***	0.186***	0.188***
	(0.029)	(0.029)	(0.029)	(0.029)
Male	0.112***	0.112***	0.112***	0.107***
	(0.010)	(0.010)	(0.010)	(0.009)
Education: postsecondary	0.065***	0.064***	0.064***	0.071***
	(0.011)	(0.011)	(0.011)	(0.011)
Bus angel in last 3 years	0.071***	0.071***	0.071***	0.074***
	(0.018)	(0.018)	(0.018)	(0.018)
Knows other entrepreneurs	0.103***	0.103***	0.103***	0.107***
	(0.011)	(0.011)	(0.011)	(0.011)
Innovative Product Density (GEM country-year aggregates for established businesses)	-0.005	-0.005	-0.003	0.023**
	(0.012)	(0.012)	(0.012)	(0.012)
l_R&D (lagged value of R&D as % of GDP)	-0.002	-0.005	-0.015	-0.008
	(0.012)	(0.012)	(0.013)	(0.012)
Innovative product (young firms)	0.146***	0.146***	0.146***	-
	(0.011)	(0.014)	(0.014)	-
Innovative product1 (young firms)	-	-	-	0.120***
	-	-	-	(0.021)
l_R&D_x_innovative product	-	-	0.033***	-
	-	-	(0.012)	-
l_R&D_x_innovative product1	-	-	-	0.073***
	-	-	-	(0.019)
l_gdp_growth	0.023*	0.023*	0.022*	0.021
	(0.014)	(0.013)	(0.013)	(0.013)
Ln_GDP per capita PPP (t-1): iq2	-0.024	-0.024	-0.022	-0.033
	(0.032)	(0.031)	(0.031)	(0.031)
Ln_GDP per capita PPP (t-1): iq3	-0.052	-0.044	-0.043	-0.051
	(0.045)	(0.043)	(0.043)	(0.044)
Ln_GDP per capita PPP (t-1): iq4	-0.028	-0.033	-0.029	-0.030
	(0.043)	(0.042)	(0.042)	(0.042)
Ln_GDP per capita PPP (t-1): iq5	0.019	0.019	0.023	0.020
	(0.039)	(0.038)	(0.038)	(0.038)
Constant	0.107**	0.110**	0.107**	0.143***
	(0.034)	(0.034)	(0.034)	(0.034)
Industrial controls	Yes	Yes	Yes	Yes
Observations	21221	21221	21221	21221

Number of country-year groups	271	271	271	271
Wald Chi2	1121***	1040***	1051***	975***
Log Likelihood	-23051	- 23038	-23034	-23098
sigma_u	0.132***	0.122***	0.115***	0.127***
	(0.010)	(0.010)	(0.012)	(0.010)
sigma_v	-	0.101***	0.096***	0.147***
	-	(0.016)	(0.016)	(0.027)
sigma_e	0.712***	0.711***	0.711***	0.713***
	(0.003)	(0.003)	(0.003)	(0.003)

Note: Standard errors in parentheses; ***p<0.01, ** p<0.05, * p<0.10; all explanatory variables with exception of dummy variables are standardised.

Table 4: Estimation results for entrepreneur's growth aspirations (young firms), EGA, young firms' innovation propensity (defined by technology) and R&D, using a Multilevel model

Explanatory variables/ Model specification	(1.1)	(1.2)	(1.3)	(1.4)
Ln of Current employment level	-0.115***	-0.116***	-0.114***	-0.114***
	(0.006)	(0.006)	(0.006)	(0.006)
Ln Age	0.463**	0.470**	0.473**	0.473***
	(0.149)	(0.149)	(0.149)	(0.149)
Ln Age squared	-0.510***	-0.516***	-0.520***	-0.520***
	(0.148)	(0.148)	(0.148)	(0.149)
Portfolio entrepreneurship	0.207***	0.204***	0.204***	0.199***
	(0.031)	(0.031)	(0.031)	(0.031)
Male	0.096***	0.096***	0.096***	0.096***
	(0.012)	(0.012)	(0.012)	(0.012)
Education: postsecondary	0.073***	0.074***	0.073***	0.074***
	(0.013)	(0.013)	(0.013)	(0.013)
Bus angel in last 3 years	0.073***	0.073***	0.073***	0.074***
	(0.021)	(0.021)	(0.021)	(0.021)
Knows other entrepreneurs	0.102***	0.102***	0.103***	0.103***
	(0.012)	(0.012)	(0.012)	(0.012)
Innovative Technology Density (GEM country-year aggregates for established businesses)	-0.039***	-0.039**	-0.041**	-
	(0.014)	(0.014)	(0.014)	-
Innovative Technology1 Density (GEM country-year aggregates for established businesses)	-	-	-	-0.052***
	-	-	-	(0.015)
l_R&D (lagged value of R&D as % of GDP)	-0.006	-0.006	-0.020	-0.006
	(0.016)	(0.016)	(0.016)	(0.016)
Innovative technology (young firms)	0.065***	0.076***	0.094***	-
	(0.013)	(0.016)	(0.016)	-
Innovative technology1 (young firms)	-	-	-	0.112***
	-	-	-	(0.029)
l_R&D_x_innovative technology	-	0.060***	0.059***	-
	-	(0.014)	(0.015)	-

l_R&D_x_innovative technology1	-	-	-	0.056**
	-	-	-	(0.025)
l_gdp_growth	0.023	0.023	0.023	0.025
	(0.018)	(0.018)	(0.018)	(0.018)
Ln_GDP per capita PPP (t-1): iq2	-0.010	-0.016	-0.015	-0.014
	(0.038)	(0.038)	(0.038)	(0.037)
Ln_GDP per capita PPP (t-1): iq3	-0.064	-0.063	-0.066	-0.071
	(0.057)	(0.057)	(0.057)	(0.056)
Ln_GDP per capita PPP (t-1): iq4	-0.061	-0.071	-0.068	-0.057
	(0.059)	(0.058)	(0.058)	(0.058)
Ln_GDP per capita PPP (t-1): iq5	-0.028	-0.035	-0.035	0.028
	(0.050)	(0.050)	(0.050)	(0.049)
Constant	0.142***	0.144***	0.141***	0.150***
	(0.044)	(0.043)	(0.044)	(0.049)
Industrial controls	Yes	Yes	Yes	Yes
Observations	15061	15061	15061	15061
Number of country groups	189	189	189	189
Wald Chi2	698***	696***	713***	693***
Log Likelihood	-16193	-16190	-16183	-16193
sigma_u	0.142***	0.137***	.140***	0.138***
	(0.012)	(0.012)	(0.012)	(0.012)
sigma_v		0.086***	0.064***	0.132***
		(0.023)	(0.025)	(0.038)
sigma_e	0.704***	0.703***	0.703***	0.703***
	(0.004)	(0.004)	(0.004)	(0.004)

Note: Standard errors in parentheses; ***p<0.01, ** p<0.05, * p<0.10; all explanatory variables with exception of dummy variables are standardised.

However, once we introduce both innovation measures (product and technology) jointly in the regression this affects slightly weakens for the measure of innovative technology (when broader definition of both innovative product and technology) are employed, and disappears fully for innovative technology, when we use narrower definitions of innovation (Table 5 specifications 1.1.-1.2). We further observe that this effect for innovative technology gets partly absorbed through interaction of the innovative product and technology variables in specification 1.1 (Table 5), using broader definitions of innovation, and it is fully absorbed in specification 1.2 (Table 5), suggesting that the positive effect of product innovation on an entrepreneur's growth aspirations will be further reinforced when its production involves the use of new technology, i.e. high-tech entrepreneurs will exhibit higher growth aspirations.

Table 5: Estimation results for entrepreneur's growth aspirations (young firms), EGA: baby young firms' innovation propensity (defined both by product and technology), R&D & export intensity by young firms, using Multilevel Slope Coefficient model

Explanatory variables/ Model specification	**(1.1)**	**(1.2)**	**(1.3)**	**(1.4)**
Ln of Current employment level	-0.118***	-0.115***	-0.123***	-0.121***
	(0.006)	(0.006)	(0.006)	(0.006)
Ln Age	0.499***	0.492***	0.502***	0.504***
	(0.148)	(0.148)	(0.151)	(0.151)
Ln Age squared	-0.544***	-0.540***	-0.547***	-0.552***
	(0.148)	(0.148)	(0.150)	(0.151)
Portfolio entrepreneurship	0.202***	0.199***	0.193***	0.190***
	(0.031)	(0.031)	(0.032)	(0.032)
Male	0.099***	0.096***	0.097***	0.093***
	(0.012)	(0.012)	(0.012)	(0.012)
Education: postsecondary	0.066***	0.072***	0.063***	0.067***
	(0.013)	(0.013)	(0.013)	(0.013)
Bus angel in last 3 years	0.067***	0.068***	0.057***	0.060***
	(0.021)	(0.021)	(0.021)	(0.021)
Knows other entrepreneurs	0.099***	0.104***	0.098***	0.102***
	(0.012)	(0.012)	(0.012)	(0.012)
Export intensity	-	-	0.015	0.034***
	-	-	(0.09)	(0.007)
Innovative Product Density (GEM country-year aggregates for established businesses)	0.006	-	0.005	-
	(0.014)	-	(0.014)	-
Innovative Product1 Density (GEM country-year aggregates for established businesses)	-	0.028**	-	0.025**
	-	(0.013)	-	(0.015)
Innovative Technology Density (GEM country-year aggregates for established businesses)	-0.038***	-	-0.051***	-
	(.14)	-	(0.015)	-
Innovative Technology1 Density (GEM country-year aggregates for established businesses)	-	-0.052***	-	-0.065***
		(0.015)	-	(0.015)
l_R&D (lagged value of R&D as % of GDP)	-0.023	-0.004	-0.024	-0.005
	(0.017)	(0.016)	(0.017)	(0.016)
Innovative product (young firms)	0.111***	-	0.10***	-
	(0.019)	-	(0.019)	-
Innovative product1 (young firms)	-	0.078***	-	0.070***
	-	(0.024)	-	(0.024)
Innovative technology (young firms)	0.039*	-	0.031	-
	(0.021)	-	(0.022)	-

Innovative technology1 (young firms)	-	0.042	-	0.040
	-	(0.031)	-	(0.031)
l_R&D_x_innovative product	0.018	-	0.013	-
	(0.017)	-	(0.017)	-
l_R&D_x_innovative product1	-	0.046**	-	0.046**
	-	(0.022)	-	(0.022)
l_R&D_x_innovative technology	0.032*	-	0.026	-
	(0.020)	-	(0.020)	-
l_R&D_x_innovative technology1	-	0.002	-	0.004
	-	(0.027)	-	(0.028)
l_R&D_x_export intensity	-	-	-0.023**	0.002
	-	-	(0.009)	(0.007)
Innovative product_x_export intensity	-	-	0.011	-
	-	-	(0.015)	-
Innovative product1_x_export intensity	-	-	-	-0.018
	-	-	-	(0.017)
Innovative technology_x_export intensity	-	-	0.011	-
	-	-	(0.02)	-
Innovative technology1_x_export intensity	-	-	-	0.004
	-	-	-	(0.025)
Innovative product_x_l_R&D_x_export intensity	-	-	0.045***	-
	-	-	(0.014)	-
Innovative product1_x_l_R&D_x_export intensity	-	-	-	0.015
	-	-	-	(0.016)
Innovative tech_x_l_R&D_x_export intensity	-	-	0.056***	-
	-	-	(0.02)	-
Innovative tech1_x_l_R&D_x_export intensity	-	-	-	-0.023
	-	-	-	(0.023)
Innovative technology_x_innovative product	0.059**	-	0.053*	-
	(0.029)	-	(0.03)	-
Innovative technology1_x_innovative product1	-	0.291***	-	0.020***
	-	(0.006)	-	(0.007)
Innovative technology_x_innovative product_x_l_R&D	0.033	-	0.03	-
	(0.028)	-	(0.03)	-
Innovative technology1_x_innovative product1_x_l_R&D	-	0.244***	-	0.163***
	-	(0.056)	-	(0.061)
Innovative technology_x_innovative product_x_export intensity	-	-	0.033	-
	-	-	(0.026)	-

Innovative technology1_x_innovative product1_x_export intensity				.121***
				(0.045)
Innovative technology_x_innovative product_x_export intensity_l_R&D	-	-	-0.054**	-
			(0.026)	
Innovative technology1_x_innovative product1_x_export intensity_l_R&D	-	-	-	.130***
	-	-	-	(0.043)
l_gdp_growth	0.019	0.019	0.023	0.022
	(0.018)	(0.018)	(0.018)	(0.018)
Ln_GDP per capita PPP (t-1): iq2	-0.023	-0.036	-0.024	-0.040
	(0.038)	(0.038)	(0.029)	(0.039)
Ln_GDP per capita PPP (t-1): iq3	-0.057	-0.078	-0.056	-0.086
	(0.054)	(0.055)	(0.057)	(0.056)
Ln_GDP per capita PPP (t-1): iq4	-0.073	-0.067	-0.082	-0.079
	(0.056)	(0.057)	(0.058)	(0.058)
Ln_GDP per capita PPP (t-1): iq5	-0.036	-0.036	-0.054	-0.060
	(0.048)	(0.048)	(0.050)	(0.049)
Constant	0.124***	0.158***	0.133***	0.168***
	(0.043)	(0.043)	(0.044)	(0.044)
Industrial controls	Yes	Yes	Yes	Yes
Observations	15032	15032	14531	14531
Number of country groups	189	189	189	189
Wald Chi2	772***	755***	808***	790***
Log Likelihood	-16094	-16129	-15554	-15589
sigma_u	0.127***	0.132***	0.134***	0.136***
	(0.012)	(0.012)	(0.013)	(0.012)
sigma_v (product innovation)	0.057***	0.121***	0.064***	0.126***
	(0.026)	(0.035)	(0.027)	(0.037)
sigma_ϕ (technology innovation)	0.105***	0.115***	0.098***	0.091***
	(0.019)	(0.037)	(0.020)	(0.041)
sigma_e	0.700***	0.701***	0.699***	0.701***
	(0.004)	(0.004)	(.004)	(0.004)

Note: Standard errors in parentheses; ***p<0.01, ** p<0.05, * p<0.10; all explanatory variables with exception of dummy variables are standardised.

We also find evidence in support of Hypothesis 2. Once we employ both innovation measures independently, there is clear evidence that the relationship of entrepreneurs' innovation orientation is further positively reinforced through R&D, thus providing evidence for knowledge spillover effects (see Tables 3-4). When we have two measures of innovation jointly in the regression, employing their broader definition, we only find the interaction term of innovative technology significant at 10 % level, and no evidence of knowledge spillovers accruing to entrepreneurs who introduce a new/relatively new product to the market (Table 5 specification 1.1). However, the results are much more interesting once we employ narrower definitions of innovative measures (Table 5 specification 1.2). More specifically, we find that R&D not only reinforce the positive effect of entrepreneurs' innovation (defined by product) on growth aspirations, but also the positive effect of the interaction between innovative product and technology.

We examine the complexity of these relationships further through moderating them by export intensity and we find very clear evidence in the case of employing narrower definitions of innovation that export intensity further positively and significantly reinforcing the effect of the interaction term between innovation product and innovation technology; and its more complex interaction with R&D, overall providing the evidence for growth aspirations being particularly higher for young firms with the most predisposition to strategic entrepreneurship (see Table 5 specification 1.4).

Finally, we also test the differences in such relationships across the two groups of EU economies. Our results (reported in Table 6) demonstrate significant differences in the effect of entrepreneurial innovation orientation and R&D on entrepreneurs' growth aspirations. More specifically, while we find, as expected, some evidence of the positive effect of knowledge spillovers on the effect of entrepreneurs' innovation (defined by product) on growth aspirations in the case of EU old member-states in addition to the positive direct effects of entrepreneurs' innovation defined by both product and technology, and their joint interaction, we fail to find any importance of knowledge spillovers for entrepreneurs' growth aspirations in the case of Central and Eastern Europe. Furthermore, in the latter group of economies, it is only product innovation (defined broadly) which matters for entrepreneurs' growth aspirations, but even so, this effect disappears once we employ narrower definition of innovation, where 'all' customers find product new (as self-reported by business owners). Bearing in mind the sensitivity of these results to the definition of innovation employed here and insignificance of the R&D variable, we could possibly suggest that this provides some indication of the prevalence of imitative entrepreneurship, with only temporary possibility of capturing higher rates of return, until emergence of more imitators and greater competition driving these rents down. In the context of EU old member states though, we need to emphasize that R&D appears to only benefit innovative young firms, while its effect is negative for growth aspirations of young businesses overall, likely leading to crowding out of less efficient businesses from the market. This intuition is further strengthened through finding innovative technology density by established businesses as being consistently negative and significant for growth aspirations of young firms in all specifications based on the EU older member-states' sub-sample and beyond.

Table 6: Estimation results for entrepreneur's growth aspirations (young firms), EGA: baby young firms' innovation propensity (defined both by product and technology) & R&D comparing EU old member-states with CEE-EU new member-states, using Multilevel Intercept model

Explanatory variables/ Model specification	**(1.1)**	**(1.2)**	**(1.3)**	**(1.4)**
Country groups	EU old members	CEE-EU new member-states	EU old members	CEE-EU new member-states
Ln of Current employment level	-0.156***	-0.125***	-0.153***	-0.126***
	(0.009)	(0.021)	(0.009)	(0.021)
Ln Age	0.556**	-0.341	0.580**	-0.345
	(0.258)	(0.668)	(0.258)	(0.671)
Ln Age squared	-0.610**	0.298	-0.640**	0.296
	(0.255)	(0.663)	(0.255)	(0.666)
Portfolio entrepreneurship	0.178***	0.614***	0.179***	0.669***
	(0.038)	(0.174)	(0.038)	(0.176)

Male	0.090***	0.071	0.083***	0.063
	(0.019)	(0.051)	(0.019)	(0.051)
Education: postsecondary	0.019	-0.041	0.025	-0.038
	(0.019)	(0.050)	(0.019)	(0.051)
Bus angel in last 3 years	0.091***	-0.023	0.095***	-0.021
	(0.033)	(0.080)	(0.033)	(0.080)
Knows other entrepreneurs	0.083***	0.152***	0.090***	0.148***
	(0.019)	(0.055)	(0.019)	(0.055)
Innovative Product Density (GEM country-year aggregates for established businesses)	-0.022	0.062	-	-
	(0.033)	(0.043)	-	-
Innovative Product1 Density (GEM country-year aggregates for established businesses)	-	-	-0.048	0.037
	-	-	(0.033)	(0.045)
Innovative Technology Density (GEM country-year aggregates for established businesses)	-0.056***	-0.065**	-	-
	(0.016)	(0.029)	-	-
Innovative Technology1 Density (GEM country-year aggregates for established businesses)	-	-	-0.048***	-0.088**
		-	(0.013)	(0.045)
l_R&D (lagged value of R&D as % of GDP)	-0.087***	0.122	-0.056**	0.204
	(0.029)	(0.140)	(0.024)	(0.136)
Innovative product (young firms)	0.106***	0.239**	-	-
	(0.024)	(0.115)	-	-
Innovative product1 (young firms)	-	-	0.073**	0.131
	-	-	(0.029)	(0.173)
Innovative technology (young firms)	0.057**	0.207	-	-
	(0.028)	(.158)	-	-
Innovative technology1 (young firms)	-	-	0.028	0.050
	-	-	(0.042)	(0.203)
l_R&D_x_innovative product	0.048	0.207	-	-
	(0.03)	(0.138)	-	-
l_R&D_x_innovative product1	-	-	0.085**	-0.170
	-	-	(0.042)	(0.205)
l_R&D_x_innovative technology	0.113***	0.199	-	-
	(0.041)	(0.186)	-	-
l_R&D_x_innovative technology1	-	-	0.092*	-0.222
	-	-	(0.041)	(0.258)
Innovative technology_x_innovative product				-
	0.067*	-0.222	-	
	(0.041)	(.213)	-	-
Innovative technology1_x_innovative product1	-	-		
	-		0.203**	0.072
		-	(0.084)	(.459)
Innovative technology_x_innovative product_x_l_R&D	0.036	-0.261	-	-
	(0.058)	(0.266)	-	-

Innovative technology1_x_innovative product1_x_l_R&D	-	-	0.747***	0.945
	-	-	(0.122)	(0.647)
l_gdp_growth	0.063*	0.054**	0.051*	0.051*
	(0.034)	(0.025)	(0.028)	(0.028)
Ln_GDP per capita PPP (t-1): iq2	0.147***	-0.020	0.136***	-0.015
	(0.057)	(0.111)	(0.044)	(0.118)
Ln_GDP per capita PPP (t-1): iq3	0.174**	-0.190*	0.158**	-0.178
	(0.087)	(0.104)	(0.044)	(0.114)
Ln_GDP per capita PPP (t-1): iq4	0.129**	-0.296***	0.134**	-0.266**
	(0.064)	(0.113)	(0.053)	(0.120)
Ln_GDP per capita PPP (t-1): iq5	0.175***	-0.371	0.162***	-0.287
	(0.060)	(0.193)	0.050	(0.197)
Constant	-0.086	0.486**	-0.048	0.524**
	(0.061)	(0.283)	(0.054)	(0.225)
Industrial controls	Yes	Yes	Yes	Yes
Observations	6455	1052	6455	1052
Number of country groups	63	32	63	189
Wald Chi2	535***	97***	546***	94***
Log Likelihood	-7048	-1221	-7047	-1220
sigma_u	0.078***	0.014***	0.052***	0.049***
	(0.02)	(0.143)	(0.021)	(0.051)
sigma_e	0.719***	0.772***	0.720***	0.770***
	(0.006)	(0.017)	(.006)	(0.017)

Note: Standard errors in parentheses; ***p<0.01, ** p<0.05, * p<0.10; all explanatory variables with exception of dummy variables are standardised. Interquintile GDP pc ppp dummies are generated for each of the respective sub-samples of EU old members and CEE –EU new members.

Turning to the control variables, the patterns largely conform to expectations and findings elsewhere in the literature. We find that initial level of employment is negatively and significantly related to growth aspirations. Our results provide from evidence for non-monotonous bell-shaped relationship between age and entrepreneurial ambitions to generate employment. Higher or postsecondary education and being a male is positively associated with growth aspirations, as is previous experience as a business angel. Being a portfolio entrepreneur has highly significant positive effect on growth aspirations of young firms that could be explained from the resource-based perspective, and active learning from the parental company. The impact of knowing other entrepreneurs are highly significant and positive across all specifications. We find some weak positive effect of GDP growth on growth aspirations, but we find no effect of the level of economic development in the majority of our specifications with exception of EU old member states and CEE. EU old member states which fall within the four highest 20th percentiles of GDP per capita are found to have higher growth aspirations, whereas, in CEE countries this pattern is reversed for the third and fourth 20th percentiles of GDP pc, perhaps indicating that in their majority they exhibit features of efficiency-driven economies where economies of scale have developed.

Discussion

Drawing on entrepreneurship and knowledge spillovers theory of entrepeneurship, this study explores the relationship between entrepreneurs' innovation orientation, R&D and entrepreneurial

growth aspirations. Through allowing for multi-way interactions in the model, following Aguinis's et al. (2013) recommendations, we unveil the complexity of this relationship, showing that not all growth aspiration entrepreneurs equally benefit from R&D. We find that either R&D has no direct effect on growth aspirations of entrepreneurs, or this effect is negative as in the case of EU old member states. However, it positively affects the relationship of entrepreneurs' innovation orientation on entrepreneurs' growth aspirations, with this effect being further reinforced by export intensity. These findings have important contribution to the development of the knowledge spillover theory, suggesting that not all entrepreneurs could be seen as conduits of knowledge spillovers as the theory posits. Knowledge spillovers tend to accrue only to entrepreneurs with higher predisposition to strategic entrepreneurship overall, captured here through entrepreneurs' innovation and export orientation.

This study also provide interesting insights into the pattern of innovation and significance of R&D in the two EU groups of the economies. While we find some evidence of knowledge spillover effects positively affecting the relationship between entrepreneurs' innovation orientation and their growth aspirations and the case of EU old member-states, we fail to confirm this for Central and Eastern Europe. Furthermore, our findings provide some indication of possible imitative entrepreneurship pattern prevailing in CEE region. However, following Minniti and Levesque (2010) we conclude that development strategies based on increase of an economy's imitation rate with firms introducing products considered to be new in the context of national economies, but existing elsewhere, could also generate positive outcomes and ensure a speedy convergence as opposed to a strategy prioritising R&D in capital intensive (but comparatively disadvantaged) industries.

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