ENTREPRENEURIAL DYNAMICS AND HIGHER EDUCATION INSTITUTIONS IN THE POST-COMMUNIST WORLD

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ABSTRACT

This study draws on the institutional and regional entrepreneurship literature to develop a conceptual framework which can analyse the impact of higher education institutions on entrepreneurial dynamics. It is used in this paper to examine the cities of the Commonwealth of Independent States (CIS) during the period 1995 to 2008. Extending the multi-pillar institutional concept, we find that higher education institutions play a prominent role in fostering entrepreneurial dynamics in CIS cities through multiple channels, including human capital development; cultivating a positive attitude towards entrepreneurship; affecting the perceptions of the knowledge and skills needed to start up a successful business, and knowledge spillovers.

Keywords: Entrepreneurial dynamics, small businesses, regional entrepreneurship, higher education institutions, CIS cities

JEL: L26, I23, P25

1. Introduction

It has long been acknowledged that education plays an important role in economic development, with entrepreneurship being identified as a firm-specific channel through which education may affect economic growth (AUDRETSCH and KEILBACH, 2008; DOMS et al., 2010). Generally, education has been shown to influence entrepreneurship through the education of business owners (on the individual level), the average level of education in the local labour market, and 'knowledge spillovers' (on the regional level) (DOMS et al., 2010).

At the individual level, better-educated individuals are more likely to start successful businesses (PARKER, 2009). At the regional level, the relationship between education and entrepreneurship may be observed through the regional level of education (the 'labour pooling' effect) and 'knowledge spillovers' (the 'information sharing' effect). In the first instance, entrepreneurs may benefit from access to a pool of better-educated workers at a lower cost (FREEDMAN, 2008; DOMS *et al.,* 2010). In the second instance, the exchange of ideas within and across industries may generate new ideas that can help create and sustain businesses (SAXENIAN, 1994; AUDRETSCH and KEILBACH, 2007, 2008).

Academic research on the influence of education (human capital) on entrepreneurship from a regional perspective remains fairly scarce and fragmentary, and predominantly focuses on the US (GLAESER *et al.,* 2014). The objective of our study is to develop a conceptual framework to analyse the integrated complexity of the impact of higher education establishments on entrepreneurial dynamics, proxied by the growth rate of small businesses, across the cities of the Commonwealth of Independent States (CIS).

Entrepreneurial dynamism has been particularly vital for transition economies (JACKSON et al., 1999). Communism was characterised by the suppression of private initiative, and with its collapse transition economies have undergone a colossal change involving comprehensive institutional reforms

as they have moved towards becoming market economies. The institutional reform of higher education institutions, whose role has been largely overlooked so far in transition economies, play a prominent role in driving entrepreneurial dynamics in the region.

After undergoing institutional change, higher education institutions have emerged to counterbalance the Soviet legacy. This has benefited entrepreneurship development in the area.

Our conceptual framework extends SCOTT's (1995) and STENHOLM's *et al.* (2013) concept of institutions. Based on these, the paper posits that higher education institutions may influence entrepreneurial dynamics through various channels, such as (1) human capital development; (2) shaping a system of social values and norms which cultivate positive attitudes towards entrepreneurship; (3) affecting individuals' perceptions of the knowledge and skills needed to start up a business; and (4) knowledge spillovers.

These correspond to STENHOLM's *et al.* (2013) four pillars of institutions, which are (1) regulative, (2) normative, (3) cognitive, and (4) conducive. Formally placed within the regulative environment and mandated by national education laws, higher education institutions have become increasingly sustained by other pillars that together are likely to accelerate entrepreneurial dynamics in the region.

The empirical counterpart of this analysis is based on a sample of 98 cities in 7 CIS countries, including Russia, Ukraine, Belarus, Moldova, Georgia, Armenia and Azerbaijan, and it employs the System Generalised Method of Moments (SYSGMM) technique to test the hypotheses.

This study makes several contributions to the field of entrepreneurship and institutional literature. Firstly, it adopts a more comprehensive approach to studying the impact of higher education institutions on entrepreneurship development, drawing on the institutional and regional entrepreneurship literature.

Secondly, it offers a multidimensional perspective on the role of higher education institutions, unveiling different institutional channels via which HEIs are likely to influence entrepreneurial

dynamics in the region, and further measuring this effect. This allows us to argue that the effect of higher education establishments goes beyond human capital development, and manifests itself through the aforementioned channels. It is therefore important to adopt an integrated approach to studying the effects of higher education, rather than narrowing it down to single aspects. This fills a number of gaps in the regional literature, which so far has primarily focused on empirically testing only single aspects of education (DOMS *et al.,* 2010).

Thirdly, it further contributes to the knowledge spillover theory by providing empirical evidence on the role of higher education establishments as the source for endogenous knowledge. These can potentially be exploited further by would-be-entrepreneurs, or can facilitate the learning process of newly-registered businesses, and so increasing their chance of survival.

Fourth, this is the first empirical multi-level study of its kind on entrepreneurial dynamics in the context of the CIS cities. By discussing institutional change and the Soviet legacy, we emphasize specifically why the CIS context is a unique, appropriate, and intriguing area in which to study the effects of higher education. Under a planned economy, the higher education system as an institution had a very distinctive set of characteristics and targets, as compared to the system which prevails in a market economy. The past two decades have seen a massive change in the region's higher education system, one which no other developing or developed economy has ever experienced in such a short time. The paper argues that this unprecedented change has led to desirable outcomes by accelerating the entrepreneurial dynamics crucial for the region's economic growth. The use of sophisticated econometric techniques and a range of controls ensure the robustness of our results in terms of their possible sensitivity to the influence of other fundamental economic and social changes experienced by the post-Soviet countries over the period of analysis, in particular in the first half of the 2000s.

The paper proceeds as follows. Section 2 discusses theoretical concepts, which set the basis for developing our conceptual framework, and introduces our main hypotheses. The next section discusses

data and methodology, while section 4 explains our empirical results. The last section elaborates further on the key findings of the study and makes a number of conclusions.

2. Human capital and entrepreneurial dynamics

According to human capital theory, education is associated with producing skills that raise worker productivity, which has been seen as a key determinant of economic performance (BECKER, 1964; VAN DER SLUIS *et al.,* 2005). In the past decade, increasing numbers of developed and emerging economies have re-considered their growth patterns to be based on knowledge, technology and innovation to boost productivity levels. Knowledge can be broadly divided into tacit (non-codified) and explicit knowledge (conveyed in procedures and processes), and is seen as a firm's most strategically important resource (GRANT, 1996). Entrepreneurial decisions and complex problem-solving use a combination of tacit and explicit knowledge (DAVIDSSON and HONING, 2003). Education is therefore expected to affect entrepreneurship in a much more complex way than has been previously assumed.

Based on academic research into the relationship between human capital and entrepreneurship, there appear to be three ways education may influence entrepreneurial activity. These are (1) owner-level education; (2) area-level education; and (3) knowledge spillovers (DOMS *et al.,* 2010). While the first is a commonly-used measure of human capital at an individual level, the latter two capture the effect of education at a spatial level, and are deeply rooted in the concept of urbanization economies. These three dimensions of human capital are discussed further below.

2.1. Owner-level education

The empirical literature on the relationship between formal education and entrepreneurship posits that such relationships could be both negative and positive (PARKER, 2009). On the one hand, better-

educated individuals are found to prefer paid employment instead of self-employment, with such selection effect found to be stronger for urban residents in the context of developing countries (VAN DER SLUIS *et al.,* 2005).

On the other hand, individuals with higher educational attainment are more likely to start a business (see PARKER, 2009). Formal education may grant would-be-entrepreneurs the ability to learn about markets and technologies, which will enable them to better spot opportunities and launch ventures to exploit them (SHANE, 2000). Better-educated business owners are also likely to survive and expand their businesses (DOMS *et al.,* 2010). Higher education will further increase their ability to gather the information business owners need more efficiently, and enable them to adapt faster to changing market conditions. It will also improve their problem-solving ability and allow them to make decisions more efficiently (DAVIDSSON and HONING, 2003). These factors all positively affect entrepreneurial dynamics.

2.2 Entrepreneurship, human capital and urbanization economies

Entrepreneurship is an urban phenomenon (BOSMA and STERNBERG, 2014). Urban areas have higher levels of 'entrepreneurial human capital', and have heavy concentrations of skills (i.e. individuals with more schooling) (GLAESER *et al.,* 2014). Overall, urbanization economies generate various inter-industrial interactions, diversified labour markets of considerable size, and substantial economies of information flow. They also encourage new firm creation and positively affect firm productivity (GLAESER *et. al.,* 2010; BOSMA and STERNBERG, 2014).

2.2.1 Area-level education

Agglomerations offer the resource base and the cultural environment needed to facilitate the creation of new ventures, and ensures that they are sustainable (BRIXY and GROTZ, 2007; AUDRETSCH and

BELITSKI, 2013). Area-level education benefits entrepreneurs through the 'labour pooling' effect: they get access to a pool of better-educated workers that have greater access to information, and are better at implementing new ideas and adopting new technologies (DOMS *et al.,* 2010). GLAESER *et al.* (2014) show that skills, proxied by the number of years of schooling, are positively associated with entrepreneurship and growth in productivity. An agglomeration of educated and skilled workers will also reduce the cost of searching for specialised skills (FREEDMAN, 2008; DOMS *et al.,* 2010). Clustering entrepreneurial activities may also speed the rate of interactions, promoting faster learning and increasing the chance that the entrepreneurs will survive and succeed (FREEDMAN, 2008).

2.2.2 Knowledge spillovers of entrepreneurship

By commercialising knowledge (that otherwise would remain uncommercialised), entrepreneurship serves as a conduit of knowledge spillovers (AUDRETSCH and KEILBACH, 2007, 2008). Since knowledge spillovers tend to be spatially bounded within close proximity to the source of that knowledge, entrepreneurship opportunities and entrepreneurial activity are greater in contexts which are richer in knowledge (AUDRETSCH and KEILBACH, 2007; 2008).

Knowledge spillovers are seen as a central element to strategic entrepreneurship (AGARWAL *et. al.*, 2010). However, possessing knowledge is not sufficient for the generation of innovative output. AGARWAL *et al.* (2007) developed a model of 'creative construction' which shows how knowledge spillovers, combined with an entrepreneurial action which enables knowledge appropriation, can lead to new firm creation. This also explains the success of industries and regions, and the growth of the economy as a whole.

New firms can make a much stronger contribution to economic growth if they survive, thrive and grow (ACS and PLUMMER, 2005). It is economically vital that a region ensures not only the creation

of as many new firms as possible, but also ensures their sustainability. This can turn the region into a 'growing stock region', with 'sufficient niches and demand so that competition amongst the many new firms does not lead to a high edging out' (BRIXY and GROTZ, 2007: 296). Regions which exhibit high birth rates are also shown to have high survival rates, given that a favourable environment for the founding of new firms would also stimulate the development of these firms (ibid.).

The institutional environment provides a basis for the legitimacy of business operations, making it acceptable and desirable by the society (SUCHMAN, 1995). The quality of the institutional environment affects the allocation of entrepreneurial efforts among its various uses (BAUMOL, 1990). The environment is particularly critical to understanding entrepreneurial developments in transition economies, given the unprecedented changes they have undergone in moving towards a market economy. The latter has assumed the need to develop the institution of private ownership and well-functioning financial institutions, as well as the need to undertake a reform of higher education institutions which possessed very distinctive and entrepreneurship-unfriendly characteristics in the Soviet system. By undergoing institutional change, higher education institutions have emerged to play a very important role in counterbalancing the Soviet legacy. This has benefited entrepreneurship development in the region, which will be discussed this further below. We will adopt an institutional perspective to study the effects of higher education institutions on entrepreneurial dynamics in CIS cities.

2.3 Entrepreneurship in Emerging Markets: An Institutional Perspective

According to JOHANNISSON (1993), 'contextual differences' play an important role in explaining spatial variations in entrepreneurship. An increasing amount of entrepreneurial literature has focused on examining how the institutional context shapes entrepreneurship and defines its success.

The institutional theory has proven particularly useful in examining variations in entrepreneurial activity and strategies in transition countries (AIDIS *et al.*, 2008; MANOLOVA et al., 2008; ESTRIN and MICKIEWICZ, 2011). ESTRIN and MICKIEWICZ (2011) attributed lower rates of entrepreneurial activity in a region compared to developed economies to the negative legacy of communist planning, which needs to be replaced with market-supporting institutions.

The CIS economies have slowly progressed in various aspects of institutional reforms. However, establishing a well-functioning set of new formal institutions takes longer given that informal institutions, comprised of values and norms, are more durable and are the slowest to change (NORTH, 1990). As ESTRIN and MICKIEWICZ (2011) argue, the legacy of communism was not conducive to entrepreneurship. This is as reflected not just in the remnants of the command economy, but more importantly by the social attitudes shaped during the communist era. Academic research looking at the role of the institutional context in transition economies has primarily focused on effects of government activism, property rights protection, the availability of finance, business regulation, and the level of corruption as fundamental institutional domains affecting new firm formation and growth (PISSARIDES *et al*., 2003; AIDIS *et al.,* 2008; MANOLOVA *et al.,* 2008; ESTRIN and MICKIEWICZ, 2011). The effects of higher education institutions on entrepreneurial activity in the region has gained little attention to date. The present analysis of the role of higher education institutions on entrepreneurial dynamics across CIS cities builds upon the theoretical institutional framework created by SCOTT (1995) and developed further by STENHOLM *et al.* (2013).

2.4 Higher education institutions and entrepreneurial dynamics: a multiple-pillar institutional approach

SCOTT (1995) proposes the following three crucial elements of institutions:

(1) A 'regulative' framework comprising regulations, laws and sanctions which are legally binding;

(2) A 'normative' context underpinning social values, norms and beliefs which are morally governed and culturally supported; and

(3) A 'cognitive' pillar constituting the 'shared logics of action' among individuals and organizations, which they use to interpret available information and formulate their expectations and response strategies.

STENHOLM *et al.* (2013) extend SCOTT's three-pillar model to include the 'conducive' dimension - a 'fourth institutional pillar' – which captures the conditions that form the grounds for the generation and dissemination of innovative ideas and technologies, stimulating the rate of high-impact entrepreneurship. This is regarded as an essential part of Baumol's productive entrepreneurship (AGARWAL *et al.,* 2007; STENHOLM *et. al.,* 2013).

SCOTT (2008:54) argues that 'institutions supported by one pillar may as time passes and circumstances change, be sustained by different pillars'. While formally constructed within the regulatory pillar, higher education institutions are also embedded in the normative, cognitive and conducive pillars. It is precisely this embeddedness of higher education institutions within all four institutional pillars and their ability to affect entrepreneurial dynamics through multiple institutional dimensions that allows them to play an important role in entrepreneurship development in the region.

2.4.1 Regulative pillar

Mandated by national laws on education, universities are established to facilitate the rate of human capital formation, which is an important factor influencing entrepreneurial dynamics from the area-level perspective discussed earlier. Along with affecting the supply of highly-educated entrepreneurs, higher

education establishments will affect the availability of resources available to entrepreneurs by reducing the cost of highly-skilled labour through the labour pooling effect.

We postulate our first hypothesis.

H1: Cities with a stronger presence of higher education establishments are likely to have higher rates of growth in the number of small businesses.

2.4.2 Normative pillar

Normative institutions influence social behaviour through a system of values, beliefs and norms. They are typically viewed as the standards of behaviour established, for example, by close social networks (family and friends) or professional associations which underlie organizational goals and objectives (SCOTT, 1995; MANOLOVA *et al.*, 2008). The values and beliefs of social groups can influence entrepreneurial intentions to the extent of communicating a message to individual entrepreneurs of the relative desirability of their activity (KRUEGER *et al.*, 2000). Such beliefs may be embedded in a wider setting of social references underpinned by national culture (STENHOLM et. al., 2013).

In the former Soviet Union until 1988, any kind of private business activity was illegal, and society had a hostile attitude to entrepreneurs. They were seen as speculators, and small businesses were associated with theft from the community rather than the creation of wealth and prosperity (SMALLBONE and WELTER, 2001). This Soviet legacy, embedded in the socio-cultural setting of CIS countries, negatively affected entrepreneurial orientations at the start of the transition. Among other things, a country can cultivate a positive image of entrepreneurship through the educational system (VERHEUL *et al.,* 2002).

The Soviet-style higher education academic tradition was rigidly teacher-controlled, exam-driven and hierarchical, and allowed little personal contact and limited opportunities for active learning. Lecturers primarily relied on rote learning based on memorisation, and discouraged critical thinking. Teaching students how to think was not a priority in the Soviet tradition of higher education.

The past two decades have seen some profound changes in the higher education system across the region. Neoclassical economics advocating free markets and the associated system of values (e.g. individualistic orientation, earning on merit, different thinking, risk tolerance) conducive to entrepreneurship have become increasingly integrated in higher-education curriculums, as well as business-related modules including marketing, management and entrepreneurship. Furthermore, the whole teaching-learning approach has undergone a significant change, with rote learning principles being replaced with critical thinking stimulating innovative ideas and creativity, and an individualistic approach.

It has been argued that cultural values - including the degree to which people prefer to work as individuals rather than in groups, their willingness to accept inequality, tolerate risk and favour virtues of assertiveness, competition and success - influence entrepreneurial orientation (KREISER *et al.,* 2010). More individualistically-oriented cultures with positive perceptions of uncertainty and risk taking have been shown to have a higher entrepreneurship orientation and a greater appreciation of entrepreneurship (BOWEN and DE CLERCQ, 2008; KREISER *et al*., 2010). This paper argues that the rapidly-changing educational system in CIS countries plays an important role in cultivating positive social attitudes towards entrepreneurial activities. It does so by communicating the benefits of entrepreneurship as an alternative occupational choice to students, and in general through a new teaching-learning approach which underlies a change in a system of values more conducive to entrepreneurship. Together, these factors make entrepreneurial activity more socially desirable. Accordingly, the next hypothesis will read as follows.

H2: The national level of higher education (independently of the effect of regional level of human capital development) is positively associated with the growth rate in the number of small businesses.

2.4.3 Cognitive pillar

The cognitive environment represents a common set of references, schemas and scripts specific to a socio-cultural context which are typically learned and adopted through social interactions (SCOTT, 1995; BRUTON *et al*., 2010; STENHOLM *et al*., 2013). BUSENITZ *et al.* (2000: 995) define the cognitive dimension as consisting of 'the knowledge and skills possessed by the people in a country pertaining to establishing and operating a new business'. Public perceptions of the knowledge and skills needed to start a new business are shown to direct the abilities of entrepreneurs to identify and exploit new opportunities (SHANE, 2000).

BUSENITZ *et al.* (2000) emphasize that perceived knowledge about starting new businesses may be particularly prevalent among individuals with higher education attainment. Education may affect individuals by providing them with a sense of autonomy along with the skills needed to discover entrepreneurial opportunities (VERHEUL *et al.,* 2002). Educational capital does not only explain entrepreneurial entry, but also the growth aspirations of entrepreneurs (BOWEN and DE CLERCQ, 2008), and their overall business success, given that growth aspirations have been positively associated with entrepreneurial outcomes (COVIN and WALES, 2012). BOWEN and DE CLERCQ (2008) further distinguish between 'general education' and 'specific education' (i.e. education programmes that specifically promote entrepreneurial skills). They emphasize the importance of 'specific' education in determining the allocation of entrepreneurial effort between high or low-value adding entrepreneurship.

SMALLBONE and WELTER (2006) argue that entrepreneurs in post-communist economies have higher educational attainment, but lack entrepreneurial knowledge and skills due to the Soviet legacy of suppressed private initiative. In particular, during the beginning of the transition throughout mid-to-late 1990s, a large number of highly-educated entrepreneurs struggled to match the knowledge and skills acquired through higher education with market opportunities, and often started up low-skilled and low-value-adding businesses such as retail trade or low-tech services. The transformation of the region's educational system has seen increasing integration of entrepreneurship-related modules in nationwide education curriculums, helping more individuals to acquire the marketing and business management skills needed to enhance their entrepreneurial orientation.

Consequently, business-related education is expected to influence entrepreneurial activity by affecting the knowledge and skills of individuals and preparing them to start new ventures and survive. The next hypothesis therefore reads as follows.

H3: The greater availability of specific (business-oriented) educational programmes is likely to have a positive effect on growth in stock of small businesses.

2.4.4 Conducive pillar

STENHOLM *et al*. (2013) proposed the conducive environment to solve the puzzle of how the three institutional pillars shape entrepreneurial behaviour and direct entrepreneur's efforts to productive ends. It consists of the conditions which underlie the environment filled with new opportunities created by knowledge spillovers, as discussed earlier (AUDRETSCH and KEILBACH, 2007; 2008). Building upon other institutional pillars, the conducive dimension captures how institutional factors shape the quality of entrepreneurial activity, or more precisely high-impact start-ups which focus on innovation

and growth (STENHOLM *et al.*, 2013). This implies that high-impact entrepreneurs do not solely benefit from regulations, normative or cognitive schemas, but their behaviour is intensified by an environment that provides 'support and interplay between innovation, skills, and resources'. This generates the foundation for innovation and the dissemination of creative ideas, while also encouraging productive entrepreneurship (STENHOLM *et al.,* 2013: pp.7-8).

Such conditions include growth, proximity to universities, and the intensity of collaboration between higher education institutions and industry that facilitates the allocation of entrepreneurial efforts towards more productive ends in the pursuit of innovation (D'ESTE et al., 2012). This pillar determines the institutional capability of a country, region or city in order to develop 'strategic entrepreneurship', defined as activities which focus on the search for a competitive advantage by generating new products, processes, markets, and organizational forms which can lead to sustainable long-term wealth creation (AGARWAL *et al.,* 2007; 2010).

These insights led to the formulation of the next hypothesis.

H4: The effects of higher education institutions on entrepreneurial dynamics are reinforced through university-manufacturing industry collaboration.

The above discussion highlighted the role of higher education institutions on entrepreneurial dynamics within the four institutional dimensions. Drawing on this, this study will adopt an integrated approach in studying its effect on entrepreneurship across CIS cities. After undergoing an institutional change, higher education establishments have emerged to counterbalance the Soviet legacy to the benefit of

entrepreneurship development in the region. They may influence entrepreneurial dynamics through various channels, such as:

(1) human capital development at a regional level;

(2) shaping a system of social values and norms which cultivate a positive attitude towards entrepreneurship;

(3) affecting individual's perceptions about the knowledge and skills needed to start up a business and adapt to survive via offering more business-oriented courses;

(4) knowledge spillovers occurring to the manufacturing industry through closer university-industry collaboration.

Figure 1 summarises this conceptual model visually.

2.5 Control variables

Earlier academic research on regional variation in entrepreneurship shows that a number of factors are likely to influence cross-city variation. These can be broadly grouped as socio-economic city characteristics, agglomeration economies controls, and business environment indicators.

As far as socio-economic city characteristics are concerned, the study uses city-level GDP per resident to control for the city's economic development stage. A decrease in the stock of small businesses is expected with an increase in a city-level GDP per resident, reflecting growth of established businesses and the importance of economies of scale. This will raise the competitive pressure, driving less efficient firms out of the market. We also introduce the GDP annual growth rate variable (at a city level) to control for cyclical economic performance.

Along with income level and GDP growth rate, this analysis also considers unemployment as one of the socio-economic characteristics of cities likely to determine its entrepreneurial dynamics. The effect of the rate of unemployment is ambiguous. On the one hand it may have a push effect, with entrepreneurship being seen as the only available occupational alternative. On the other hand, it may simply mirror the economic recession and demand deficiency, adversely affecting the rate of growth in the number of small businesses.

This study also controls for capital investment to GDP ratio at a city level, in order to capture the availability of financial resources in CIS cities. Although generally expected to have a positive effect on entrepreneurial dynamics, the role of capital investment in the context of the CIS cities may be ambiguous. The possibility of a crowding out effect as a result of public funds being channelled to support large-scale state-owned enterprises is not excluded.

Finally, the level of criminality in cities is likely to negatively affect the growth in stock of small businesses, reflecting the higher probability of asset expropriation by private parties (ROSENTHAL and ROSS, 2010).

Among agglomeration economies controls, we introduce population density to control for market size and the effects of consumer demand. Air pollution is used to capture the effect of industrial agglomeration in CIS cities.

The business regulatory environment may simultaneously enhance entrepreneurial activity and constrain it. Based on earlier empirical research on entrepreneurship, property rights protection, government activism, banking sector reform and business regulation are the dimensions of the business environment most likely to affect the rate of change in small businesses.

Strong property rights are important for entrepreneurial activity, to the extent that in the first place property rights guarantee the status quo by providing crucial security of private property against an

arbitrary action of the executive branch of the government (ACEMOGLU and JOHNSON, 2005). Strong property rights protection is likely to incentivise the growth rate in small businesses in CIS cities.

Another important aspect of the regulatory environment is the level of government activism, which is expected to adversely affect entrepreneurship in CIS cities. As the state sector grows it crowds out private activity, absorbing a larger proportion of the resources of the economy (ESTRIN *et al.* 2013). Furthermore, higher tax income is associated with greater government expenditures, and higher marginal tax rates for higher earners are also likely to reduce the expected returns to entrepreneurs, increasing the opportunity cost of switching to entrepreneurship (PARKER, 2009).

Better-developed financial institutions are found to disproportionally benefit smaller firms, to the extent of mitigating external finance constraints (BECK *et al.,* 2005). With a wider supply of finance and competition, financial institutions are pushed to choose more risky financial options including entrepreneurial finance (KOROSTELEVA and MICKIEWICZ, 2011). This is particularly topical for transition economies, for which the scarcity of financial resources is one of the major obstacles for entrepreneurship development (PISSARIDES *et al*., 2003). Progress in banking reform is therefore likely to be positively associated with entrepreneurship in CIS cities.

Finally, more flexible business regulations are expected to foster the growth rate of small businesses. Viewing regulation as benign, socially inefficient and likely to be captured by the industry, it is unlikely to benefit start-ups (see DJANKOV *et al.,* 2002).

This study also controls for industry composition, country, and time effects.

3. Data and methodology

3.1 Sample Description

To investigate variation in the rate of growth in small businesses across CIS cities, this work uses data collected from the Offices of National Statistics in Russia, Ukraine, Belarus, Moldova, Georgia, Armenia and Azerbaijan for the period 1995-2008. The data was collected by local research officers formally employed by the respective Regional Statistical offices. This initiative was funded by project No 09-9031 entitled 'Driving urban economic growth – evidence from transition economies' as a part of the larger 'Cities: An Analysis of the Post-Communist Experience' (2009-2010) project. This was supported by the Economics Education and Research Consortium in co-operation with the Global Development Network.

The dataset contains urban audit indicators across various domains specific to our study, including higher education institutional measures at a city level related to our main hypotheses (e.g. the presence of higher education establishments in a city); and economic and social characteristics of cities and other indicators used as controls. The dataset is represented by 98 cities covering Russia (54 cities), Belarus (6 cities), Ukraine (26 cities), Moldova (1 city-capital), Georgia (5 cities), Armenia (5 cities), Azerbaijan (1 city-capital) (see Appendix A). The city-level data was merged with the institutional country-level data derived from the Polity IV dataset[1], Heritage Foundation[2] and EBRD transition indicators (EBRD Transition Reports, various issues), to also shed light on the effects of institutional settings on entrepreneurial dynamics at a country level.

3.2 Variable Definition

We use the rate of change in the number of small businesses as the dependent variable, proxied by the difference between the natural logarithms of the current level of small businesses and its level in the previous year. The national statistical offices define small businesses as firms with 50 or fewer

employees (100 employees respectively in manufacturing sector). Appendix B illustrates the change in the number of small businesses over the period 1995-2006.

The number of universities in the CIS cities (regional level), obtained from the "Universities in CIS" and "Universities worldwide information resources" databases,[3] will be used to test *Hypothesis 1*. The incidence (a number) of HEIs has been used in previous academic research to capture the effects of higher education on new business formation in innovative industries (see FRITSCH and AAMOUCKE, (2013)). Interestingly, it is precisely the presence (and size) of public academic institutions (rather than indicators that reflect the quality of these institutions) which was shown to have a significant effect on the formation of innovative start-ups (ibid.).

The tertiary education enrolment rate was proxied by the logarithm of the number of students enrolled in tertiary education per 100,000 residents (country level) and obtained from UNESCO Institute for Statistics, and will be introduced to test *Hypothesis 2*.

The effect of specific (business-oriented) education is tested via the number of MBA programmes offered by business schools and other higher education establishments in each city (*Hypothesis 3*). This variable was obtained from the MBA studies guide and Global MBA and Master Programs Directory, as well as university web-sites in CIS countries. Although MBA programmes did not exist in Soviet times, their expansion is expected to harness the managerial skills needed to successfully run a business, and is also important for equipping students with the basic practical skills of how to set up a new venture (see VARBLANE and METS, 2010).

Finally, interacting the university variable with the manufacturing industry control variable allows us to capture the effects of university-industry collaboration (*Hypothesis 4*). Universities may serve as a conduit of knowledge generated in research labs and university departments which is applied in small-scale factories and workshops. Universities can thus contribute to business development, including the establishment of new SEs (RODRÍGUEZ-POSE and CRESCENZI, 2008; PONDS *et al.*, 2010).

For the strength of property rights we use the Polity IV measure of efficient constraints on the arbitrary power of the executive branch of the government, named "constraints on executive". The size of the local government is proxied by city-level government expenditures as a proportion of city-level GDP.

The effects of banking reform are controlled via employing the EBRD transition indicator. They are scored from 1, denoting little progress from a socialist banking system apart from the separation of the central bank and commercial banks, to 4+, which represents a fully-fledged market economy with the institutional standards and norms of an industrialised market economy.

The Heritage Foundation business freedom index is used to measure the rigidity of business regulation. It reflects the various barriers to starting, operating and exiting a business, and is scored from 0 to 100, with 100 denoting the highest degree of business freedom (BEACH and KANE, 2008).

Table 1 displays the variable definitions, including the other control variables. Appendix C shows the correlation matrix between the variables and the descriptive statistics used in this study.

{Table 1 to be inserted here}

3.3 Methodology

The model used to examine the determinants of entrepreneurial activity in a panel of 98 cities during 1995-2008 is specified as follows.

$$dLnSE_{it} = \beta_1 LnS_{it-1} + \beta_2 X_{it} + \beta_3 Z_{it} + u_{it} \quad (1), \quad i=1,..., N; \ t=1,...,T$$

$$u_{it} = v_i + e_{it} \quad (2)$$

where $dLnSE_{it}$ is the rate of change in the number of small businesses at city level, LnS_{it-1} is a lagged value of the number of small businesses taken in logs (predetermined variable). X_{it} is a vector of four potentially endogenous variables, namely GDP per resident, GDP growth rate, the rate of unemployment, and the ratio of capital expenditure to GDP. Z_{it} is a vector of strictly exogenous control variables.

The error term u_{it} consists of the unobserved city-specific effects, v_i and the observation-specific errors, e_{it}. The examples of unobservable city-specific effects captured by the $v_{i,}$ can include specific cultural characteristics of cities, their governance efficiency, and other factors that cannot be directly controlled for in the model as they are unobservable. We also include fixed country and time effects to control for unobserved heterogeneity across a sample of our countries and over time.

The dynamic structure of equation (1) makes both the OLS and fixed effects estimators upwards and downwards biased respectively. They are also inconsistent, since the predetermined variable and endogenous variables are correlated with the error term. To estimate equation (1) we therefore use the System Generalised Method of Moments (SYS GMM) estimator (BLUNDELL and BOND, 1998). The use of this estimator allows us to address econometric problems which arise from the estimating equation (1). These include (a) the problem of potential endogeneity of some of our regressors identified above; (b) the presence of predetermined variables - the lagged dependent variable LnS_{it-1} that gives rise to measurement error as it is correlated with past errors; (c) the presence of fixed effects which may be correlated with the repressors; (d) a finite sample. SYS GMM allows the predetermined and endogenous variables in levels to be instrumented with suitable lags of their own differences (ROODMAN, 2006).

To resolve the problem of potential multicollinearity between a tertiary education enrolment variable and the unemployment rate (see correlation matrix reported in Appendix C), we check the robustness of the results to exclude the unemployment rate in specifications containing a tertiary education enrolment

variable. In the absence of the unemployment rate, economic cyclicality is controlled via the GDP growth rate.

4. Empirical results and discussion

The empirical results are summarized in Table 2, which reports the results based on the three estimation methods: pooled OLS (specification 1), panel fixed effects (specification 2), and System GMM estimation (specifications 3-7). Comparing the results of all three estimators, one can see that the results obtained from the System GMM model (specification 3) are superior given that (a) the autoregressive term is positive and significant, and its value lies between the respective terms obtained by fixed effects (which provide the lower bound) and OLS (which provides the upper bound); (b) there are gains in efficiency; (c) the instrument set is valid, as evidenced by the Hansen test of overidentified restrictions; (d) all variables of interest have expected signs.

Thus the discussion of the results proceeds based on specifications (3-7).

{Table 2 to be inserted here}

This study finds that entrepreneurial dynamics in CIS cities are largely explained by the presence of higher education institutions in a city, affecting both the demand and supply side of entrepreneurship via the higher level of human capital development (*Hypothesis 1*) (Spec 3).

We also find support for *Hypothesis 2*, implying that the more students are enrolled in tertiary education at the national level, the higher is the rate of growth in the number of small businesses in a city. The rapidly-changing higher education system is likely to breed a new generation of individuals possessing knowledge that makes them appreciate entrepreneurship and can communicate its benefits to other members of the society.

The robustness of the above results to multicollinearity (discussed in the methodology section) is further tested by excluding the rate of unemployment from the model (specification 5). The results remain robust.

We also confirm *Hypothesis 3*, showing the important role of targeted (business-oriented) education (specification 6)[4]. The university variable was excluded from this specification given its high correlation with the number of MBA programmes in a specific city and the high presence of higher education establishments. These findings suggest that formal university education is also likely to influence the knowledge and skills individuals perceive they need to start a new venture and succeed.

Finally, in specification 7 the study tests whether the effect of higher education institutions could be further reinforced through collaboration between universities and the manufacturing industry (*Hypothesis 4*). Indeed, we confirm that the effect of the higher presence of universities in a city is strengthened by their collaboration with the manufacturing industry, which retains its significance in the presence of the control for human capital. More specifically, a unit increase in the number of universities, given an average level of manufacturing sector as a share in GDP equal to 12.77%, will result in a 0.1% increase in the number of SEs. The marginal effect of a city-level HEI is further illustrated graphically, allowing for the variation in the number of universities across a valid range of values. In Appendix D, knowledge spillovers are shown to enhance the direct effect of city-level HEI on THE entrepreneurship rate, and this effect is statistically significant. Furthermore, cities with higher than average levels of manufacturing in GDP, demonstrate a significant and positive association between change in SEs and a marginal change in the number of universities (Appendix E).

Overall, we interpret this result as evidence for the importance of agglomeration economies in terms of higher concentrations of knowledge, which may lead to an intensified exchange of ideas via collaboration between small businesses and research institutions. This is an important advancement given state centralisation of research and development activities in the past. In summary, tighter links

between universities and industry may facilitate the development of strategic entrepreneurship in the region (STENHOLM *et al.,* 2013).

In summary, we find that the effects of HEI manifest themselves through multiple channels, with both the number of city-level MBA programmes and the incidence of HEI in cities having the strongest effect. This leads to the conclusion that higher education institutions are likely to affect entrepreneurial dynamics through various channels, which need to be assessed jointly (see Appendix F).

As regards the other control variables, our study failed to find any evidence of the significance of market size when proxied by the logarithm of population density. We find air pollution has a significant and positive effect when used as a proxy for industrial agglomeration effects. The results do not show any significant effect of capital investment or the unemployment rate. The rate of growth in small businesses is negatively associated with the level of GDP per capita. This reflects the fact that CIS cities show signs of being at an efficiency-driven stage of economic development where economies of scale prevail, which constitutes an entry barrier for small businesses. This study also finds some fragmentary support for GDP growth rate, but fails to find any significant effect of the rate of criminality.

Now we turn to discussion of the business environment. Similarly to AIDIS *et al.* (2012), this work finds some support for the effect of property rights protection on the rate of change in the number of small businesses. The findings also suggest that larger size of the state discourages growth in the stock of small businesses. Entrepreneurial dynamics are found to be positively associated with the progress in banking reform that promotes financial development, which benefits small firms in particular. Our results also provide some fragmentary weak support for the argument that more flexible business regulations encourage growth in the stock of small businesses.

5. CONCLUSIONS

In this research we developed a comprehensive framework showing the effect of higher education institutions on entrepreneurial dynamics in the spatial context of the Commonwealth of Independent States.

To develop the conceptual framework, this study draws upon the institutional concept proposed by SCOTT (1995) and STENHOLM *et al.* (2013). They advocated that the institutional environment is comprised of four key pillars covering the regulatory, normative, cognitive and conducive domains. We further extend this theory to highlight the important role of higher education institutions. While formally constructed within the regulative pillar, they are embedded within the other three pillars to facilitate the creation of an environment conducive to the formation of new and sustainable firms.

Higher education institutions are shown to affect entrepreneurial dynamics through the following channels:

(1) human capital development; (2) by shaping a system of societal values and norms which cultivate positive attitudes towards entrepreneurship; (3) affecting individuals' perceptions about the knowledge and skills needed to start up a successful business; and (4) knowledge spillovers which occur through close collaboration between small businesses and research institutions, and which have been actively promoted now in the CIS region via establishment of clusters. These include, for example, the Skolkovo innovation hub in Moscow, and its equivalent in Minsk.

These findings have important policy implications. To promote sustainable growth in the region, local authorities should further invest in higher education. As advocated by BOWEN and DE CLERCQ (2008) and SAXENIAN (2007) to generate higher returns, this investment should specifically target entrepreneurial education, but should not be confined to business students only. Furthermore, to promote strategic entrepreneurship the local authorities should concentrate on encouraging cluster development between universities and local businesses.

Overall, the embeddedness of higher education institutions within all four institutional pillars means they are well-placed to accelerate the development of an environment conducive to positive entrepreneurial dynamics. These results are robust to potential effect of other factors that largely shaped the development of entrepreneurship at the time of the study.

In addition, our results provide evidence on the importance of some other regulatory environment domains for the study of entrepreneurial dynamics in the region. More specifically, this study shows that greater government activism combined with a higher ability of governmental officials to transfer wealth through various corrupt practices reduces growth in the stock of small businesses. Meanwhile, progress in banking reform and secure property rights enhances it. Finally, we also found some fragmentary support for the positive role of flexible business regulations on entrepreneurial dynamics in the CIS region.

NOTES

1. See MARSHALL M. and JAGGERS K. (2009) Polity IV Project: Political Regime Characteristics and Transitions, 1800-2008, Dataset Users' Manual (available at: http://www.systemicpeace.org/polity/polity4.htm).

2. For discussion see BEACH and KANE, 2008.

3. For more detailed information please see http://univer.in and http://univ.cc.

4. Given that MBA programmes equivalent to a Western style MBAs were largely introduced in the former Soviet Union countries in the 2000s, the paper tests the robustness of the results restricting the sample to 2000-2008 and 2005-2008, confirming their robustness (available upon request from the authors).

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Figure 1: The hypothesized conceptual model
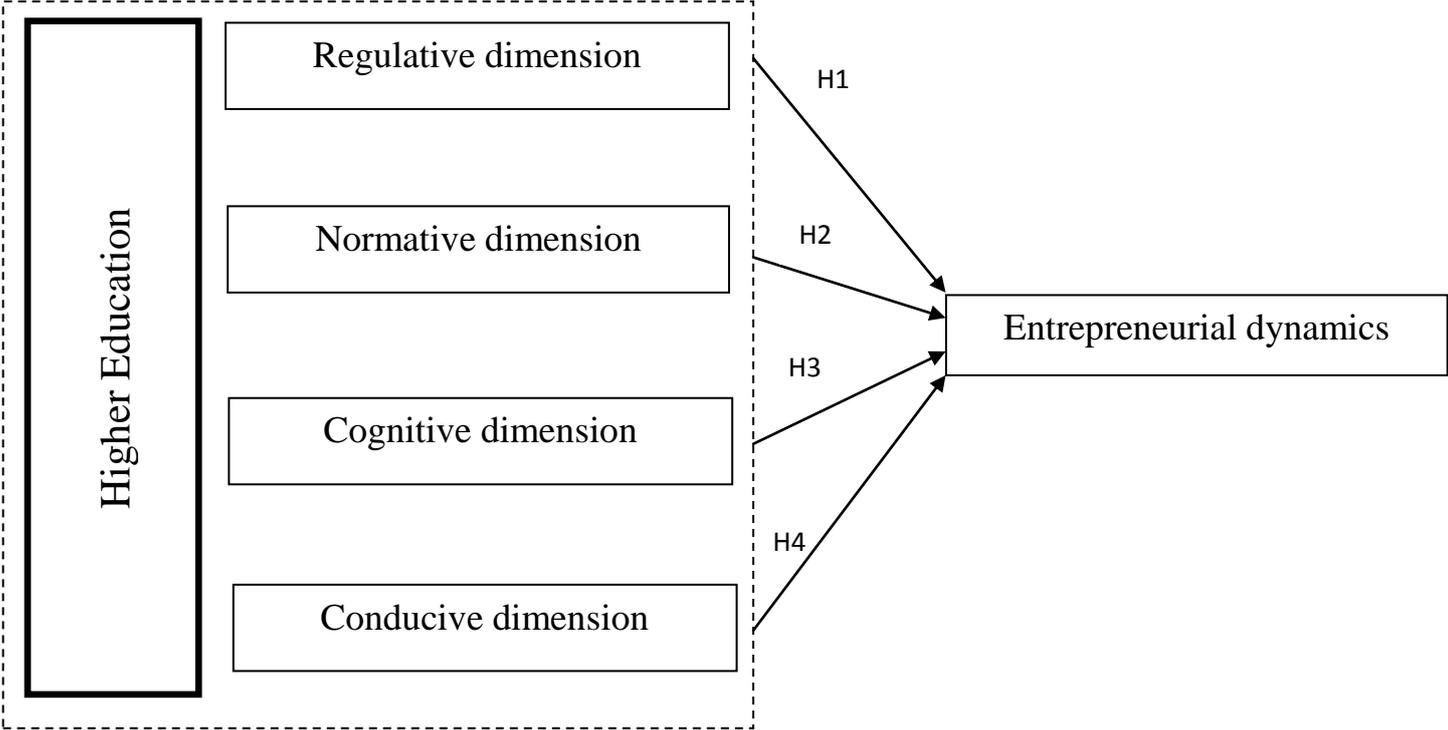
Table 1: Definitions of the variables

Variable	Definition
dLnSEs	The rate of change in the number of small businesses registered, logarithm (city level)
LnSEs lagged	Number of small sized businesses registered taken in logs, first lag (city level)
University	Number of high educational establishments in a city
Tertiary education	Number of students enrolled in tertiary education per 100,000 residents, logarithm (country level)
MBA	The number of MBA programmes taught in a city
University* Manufacturing	Interaction between number of high educational establishments and a share of manufacturing/energy/mining sector in GDP of a city
Controls: socio-economic characteristics of cities and agglomeration economies controls	
GDP per capita	GDP per capita in constant 2005 USD, logarithm (city level)
GDP growth	GDP annual growth rate,% (city level)
Unemployment rate	Unemployment rate - % (city level)
Capital investment	Capital investment to GDP ratio (city level)
Criminality	Number of crimes per 1000 residents, logarithm (city level)
Population density	Population density in the city per sq. km, logarithm
Air pollution	Air pollution, 1000 tons per city resident
Controls: business environment	
Executive constraints	Polity IV project. 'Executive constraints' where 1 represented 'unlimited authority' and 7 'executive parity'(country level)
Public expenditure	Public expenditure to GDP ratio (city level)
Banking reform	EBRD. Banking reform and interest rate liberalization from 4- to 4+, where 1 represents no progress in reform and 4 - major advances (country level)
Business Freedom Index	The Heritage Foundation. The Business freedom index ranges between 0 and 100 with 100 denoting the freest business environment (country level)
Controls: industrial structure	
Manufacturing	Industry contribution to GDP (%) - Manufacturing, energy & mining (city level)
Agriculture/fishery	Industry contribution to GDP (%) - Agriculture and fishery (city level)
Trade	Industry contribution to GDP (%) - Trade (city level)
Constriction	Industry contribution to GDP (%) - Construction (city level)
Transport	Industry contribution to GDP (%) – Transport (city level)
Finance	Industry contribution to GDP (%) - Finance (city level)
Education	Industry contribution to GDP (%) – Education (city level)

Table 2: Regression results
Dependent variable: the rate of change in the No. of SEs (dLnSE)

Specification	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Estimation method	Pooled	Fixed Effects	System GMM	System GMM	System GMM	System GMM	System GMM
Variables related to research hypothesis							
LnSEs lagged	-0.090*** (0.03)	-0.624*** (0.03)	-0.396*** (0.08)	-0.453*** (0.12)	-0.370*** (0.10)	-0.368*** (0.10)	-0.408*** (0.10)
University	0.004** (0.00)	-0.009 (0.01)	0.019*** (0.00)	0.025*** (0.01)	0.028*** (0.00)	-	0.027*** (0.01)
Tertiary education	-	-	-	0.764*** (0.27)	0.916*** (0.27)	0.696** (0.33)	0.824*** (0.29)
MBA	-	-	-	-	-	0.232*** (0.05)	-
University x manufacturing	-	-	-	-	-	-	0.001* (0.00)
City-specific control variables and agglomeration economy controls							
GDP per capita	-0.034 (0.03)	0.015 (0.05)	-0.474** (0.21)	-0.730*** (0.19)	-0.879*** (0.17)	-0.893*** (0.18)	-0.869*** (0.18)
GDP growth	-0.324 (0.24)	-0.108** (0.04)	-0.423** (0.20)	-0.256 (0.18)	-0.333* (0.19)	-0.293 (0.21)	-0.242 (0.19)
Unemployment rate	-0.003 (0.01)	-0.003 (0.01)	-0.010 (0.01)	-0.001 (0.01)	-	-	-
Capital investment	-0.0587 (0.06)	-0.139* (0.08)	0.506 (0.31)	0.153 (0.39)	-0.304 (0.31)	-0.251 (0.35)	-0.259 (0.31)
Criminality	-0.027 (0.02)	-0.018 (0.03)	-0.072 (0.06)	-0.041 (0.07)	-0.018 (0.10)	-0.015 (0.10)	-0.001 (0.10)
Population density	-0.030* (0.02)	0.623*** (0.08)	-0.009 (0.08)	-0.003 (0.09)	-0.070 (0.09)	-0.021 (0.09)	-0.032 (0.10)
Air pollution	-0.012 (0.01)	-0.012 (0.07)	0.104 (0.07)	0.034 (0.07)	0.186* (0.09)	0.179* (0.10)	0.191** (0.09)
Business Environment							
Executive constraints	0.041 (0.05)	0.001 (0.03)	0.118** (0.05)	0.165** (0.08)	0.157** (0.07)	0.156** (0.08)	0.145* (0.07)
Public expenditure	-0.058 (0.04)	-0.046 (0.06)	-0.415** (0.19)	-0.468** (0.22)	-0.370* (0.21)	-0.400* (0.23)	-0.320 (0.20)
Banking reform	0.033 (0.11)	0.167 (0.11)	0.787*** (0.29)	0.644** (0.28)	0.638** (0.25)	0.661** (0.26)	0.617** (0.26)
Freedom of doing business	-0.001 (0.00)	-0.0023 (0.00)	0.006* (0.00)	0.006 (0.00)	0.010** (0.00)	0.008* (0.00)	0.008* (0.00)
Industrial controls							
Manufacturing/ energy/mining	0.002** (0.00)	-0.006 (0.00)	0.003 (0.00)	0.006 (0.00)	0.008** (0.00)	0.004 (0.00)	-0.001 (0.01)
Agriculture/fishery	0.001 (0.00)	0.001 (0.00)	0.006 (0.00)	0.012** (0.01)	0.017* (0.00)	0.016** (0.01)	0.015** (0.01)
Trade	0.001 (0.00)	0.014** (0.01)	0.003 (0.01)	0.006 (0.01)	0.016 (0.01)	0.017 (0.01)	0.010 (0.01)
Construction	0.001 (0.00)	0.006 (0.00)	0.003 (0.00)	0.005 (0.01)	0.007 (0.01)	0.014 (0.01)	0.009 (0.01)
Transport	0.001 (0.00)	0.001 (0.01)	0.013 (0.00)	0.009 (0.01)	0.020 (0.01)	0.023 (0.01)	0.014 (0.01)
Finance	0.004	-0.012	0.026	0.018	-0.027	-0.015	-0.047

	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
Education	-0.038*** (0.01)	0.012 (0.02)	-0.114** (0.05)	-0.147** (0.06)	-0.149*** (0.04)	-0.143*** (0.05)	-0.149*** (0.04)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country controls	Yes	No	Yes	Yes	Yes	Yes	Yes
Number obs.	725	725	720	725	746	746	746
R-square	0.20	0.53					
Pr>z AR(1) / Pr>z AR(2)			0.00/ 0.91	0.00/ 0.04	0.00/0.104	0.01/0.12	0.01/0.11
Hansen test of overid. restrictions, Chi2 (Pr.>chi2)			49.31 (0.785)	42.78 (0.933)	50.70 (0.293)	50.96 (0.29)	46.13 (0.47)

Source: Authors' calculations based on CIS Urban Audit dataset 1995-2008.

Notes: Level of statistical significance is * 0.1%. ** 0.05% and ***, 0.01%. Year type dummies are supressed to safe space, only those important in interpreting the research hypothesis such as sector controls are kept for demonstrative purposes. Standard errors (in parentheses) are robust to heteroskedasticity. The figures reported for the Hansen test and Difference Hansen test are the p-values for the null hypothesis: valid specification. Note: the autocorrelation test shows that the residuals are an AR(1) process which is what is expected. The test statistic for second-order serial correlation is based on residuals from the first-difference equation.

Appendix A: Descriptive characteristics of CIS cities, selectively

City	Country	Population density	GDP per capita 2005 const. prices	GDP per capita annual growth	small business annual growth rate	No of universities in 2008	No of MBSs in 2008
Gyumri	Armenia	3903.97	1083.33	16.01	0.06	1	0
Hrazdan	Armenia	2776.53	1122.52	15.50	0.07	1	0
Vagarshapat	Armenia	1378.15	1093.11	16.46	0.06	1	0
Vanadzor	Armenia	5566,01	1085.28	16.50	0.05	1	0
Yerevan	Armenia	5181.97	1082.33	16.56	0.07	12	1
Baku	Azerbaijan	845.45	2066.95	23.11	0.02	16	4
Brest	Belarus	3767.25	4452.10	18.01	0.15	2	0
Gomel	Belarus	4250.51	4037.57	18.57	0.11	6	0
Hrodna	Belarus	3856.06	4405.14	18.20	0.10	3	0
Minsk	Belarus	5659.08	3020.66	18.72	0.04	27	2
Mogilev	Belarus	4027.46	4166.57	8.85	0.10	3	0
Vitebsk	Belarus	3573.78	4261.84	18.52	0.08	4	0
Batumi	Georgia	6243.39	1265.41	17.39	-0.02	1	0
Gori	Georgia	2994.37	3543.99	14.49	-0.03	1	0
Kutaisi	Georgia	2755.78	1732.52	10.03	-0.04	1	0
Rustavi	Georgia	1986.68	1148.84	10.40	-0.03	1	0
Tbilisi	Georgia	1519.15	1536.36	15.25	0.03	5	7
Kishinev	Moldova	5505.90	1337.90	10.45	0.10	13	1
Arkhangelsk	Russia	1225.24	4218.78	14.35	0.00	4	0
Astrahan	Russia	982.75	2197.6	15.02	-0.02	3	1
Belgorod	Russia	2163.32	3211.65	14.82	0.05	9	0
Bryansk	Russia	2391.36	1643.16	12.61	-0.04	3	0
Cheboksary	Russia	1927.73	2000.23	13.91	-0.01	4	0
Cherkessk	Russia	1705.83	1362.3	13.52	-0.03	2	0
Elista	Russia	474.54	1181.13	18.10	-0.03	1	0
Grozny	Russia	680.97	1489.42	42.10	0.00	2	0
Ivanovo	Russia	4135.97	1293.15	11.41	-0.03	5	0
Izhevsk	Russia	1991.47	3002.35	12.24	0.02	3	0
Kaliningrad	Russia	1969.67	2551.28	17.45	0.03	3	0
Kaluga	Russia	2801.27	2514.45	14.11	-0.01	1	0
Kazan	Russia	2608.67	4181.45	14.50	0.00	13	1
Kirov	Russia	2936.06	2025.03	9.76	0.02	1	0
Kostroma	Russia	1896.27	2033.94	9.69	-0.01	3	0
Krasnodar	Russia	917.91	2781.14	11.30	0.01	3	0
Kyrsk	Russia	2184.58	2365.31	12.50	0.03	7	0
Lipetsk	Russia	1571.38	3703.93	11.99	0.04	1	0
Makhachkala	Russia	1089.69	1136.58	19.54	0.10	7	0

Maykop	Russia	560.48	1420.28	13.24	0.01	1	0
Moscow	Russia	9256.83	10326.82	19.71	0.02	103	10
Murmansk	Russia	2314.96	4840.33	12.01	-0.05	3	0
Nalchik	Russia	2189.89	700.74	9.42	-0.03	2	0
Naryan-Mar	Russia	509.29	37223.14	32.93	0.07	1	0
Nazran	Russia	868.79	586.18	10.16	0.04	1	0
Nizhny Novgorod	Russia	3224.06	2968.23	12.48	0.05	13	0
Orel	Russia	2763.20	2173.70	10.65	0.01	7	0
Orenburg	Russia	1724.37	3451.4	14.32	-0.05	7	0
Penza	Russia	1807.24	1778.84	13.22	0.00	6	0
Perm	Russia	1268.55	3568.82	11.43	-0.02	10	0
Petrozavodsk	Russia	1945.91	3261.65	8.58	0	2	0
Pskov	Russia	2099.19	1995.46	10.59	0.05	3	0
Rostov-on-Don	Russia	2900.01	2051.04	13.10	0.02	12	0
Ryazan	Russia	2213.74	2326.44	10.22	0.02	5	0
Saint Petersburg	Russia	3260.57	2784.98	9.23	0.04	55	3
Samara	Russia	2505.12	3813.53	12.58	0.06	10	2
Saransk	Russia	4643.17	1920.00	13.69	0.01	1	0
Saratov	Russia	2198.86	1758.18	11.45	0.01	8	1
Smolensk	Russia	1971.77	2561.04	10.42	-0.02	7	0
Stavropol	Russia	1456.31	2061.29	11.23	0.04	6	0
Syktyvkar	Russia	1593.38	5589.80	10.53	-0.02	2	0
Tambov	Russia	3348.69	2034.30	12.16	0.01	4	0
Tula	Russia	2856.99	2765.18	13.46	-0.02	3	0
Tver	Russia	2754.85	2589.75	12.16	0.00	7	0
Ufa	Russia	1495.26	3020.00	12.68	0.02	9	1
Ulyanovsk	Russia	2088.57	2070.57	10.77	0.01	7	0
Veliky Novgorod	Russia	2471.84	3399.82	16.12	-0.03	2	0
Vladikavkaz	Russia	1082.84	1402.23	14.72	0.02	3	0
Vladimir	Russia	1089.68	1928.94	10.82	0.00	2	0
Volgograd	Russia	1779.98	2572.99	14.61	-0.03	13	1
Vologda	Russia	2479.32	4883.00	10.56	0.03	1	0
Voronezh	Russia	1466.86	1494.51	12.00	0.05	9	1
Yaroslavl	Russia	2958.25	3082.09	9.93	0.01	8	0
Yoshkar-Ola	Russia	2621.96	1868.27	12.99	0.05	3	0
Cherkassy	Ukraine	4195.40	2008.24	21.34	0.02	3	0
Chernigov	Ukraine	3905.66	1095.34	17.47	0.10	3	0
Chernovtsy	Ukraine	1627.54	1233.34	15.38	0.00	1	0
Kherson	Ukraine	2562.77	1338.03	17.14	0.04	5	0
Dnipropetrovsk	Ukraine	2642.30	2876.52	23.03	0.07	12	0
Donetsk	Ukraine	2894.49	2781.28	20.55	0.05	17	2
Ivano-Frankivsk	Ukraine	3006.06	2570.72	15.51	0.03	2	0

Kharkov	Ukraine	4131.61	4166.15	-2.71	0.02	15	1
Khmelnitsky	Ukraine	2709.44	1561.59	20.01	0.03	5	0
Kiev	Ukraine	3125.34	6846.65	21.1	0.06	74	7
Kirovograd	Ukraine	2471.73	1590.68	14.30	0.03	4	0
Lugansk	Ukraine	1957.43	2108.18	22.24	0.05	5	0
Lutsk	Ukraine	4992.60	2298.88	19.97	0.06	5	0
Lviv	Ukraine	4485.84	1667.58	22.45	0.04	19	1
Nikolayev	Ukraine	1971.24	1185.22	16.43	0.02	4	0
Odessa	Ukraine	4518.51	2333.17	18.31	0.07	18	0
Poltava	Ukraine	3012.06	3491.32	22.24	0.05	4	0
Rivne	Ukraine	4310.4	2023.15	17.89	0.01	1	0
Sevastopol	Ukraine	444.67	1262.44	29.11	0.05	3	0
Simferopol	Ukraine	3207.03	6523.20	22.07	0.09	2	0
Sumy	Ukraine	2033.86	1537.69	17.14	0.00	3	0
Ternopil	Ukraine	3813.78	1252.10	20.28	0.02	4	0
Uzhgorod	Ukraine	2825.74	3256.72	19.39	0.05	2	0
Vinnytsia	Ukraine	4853.22	1692.53	16.84	0.02	2	0
Zaporozhye	Ukraine	2477.7	2330.68	21.89	0.08	5	0
Zhitomir	Ukraine	4463.02	1428.31	21.17	0.01	4	0

Source: CIS Audit database. Note: the paper uses NUTS3 city level data on all CIS cities for which information is available in the official statistics in full. While missing city data may raise some concerns regarding nonrandomness of the sample, this would be the case where selection is based on a dependent variable, which is not the case here. The main objective of the city project was to collect socio-economic indicators for cities with as good coverage as possible to study economic development of cities in transition economies. Respectively, the dataset was constructed by omitting some cities from the sample for which socio-economic indicators were not available. Furthermore, given the focus of the paper on higher education establishments, the city sample was further adjusted, keeping only cities where higher education institutions are present (i.e. their number is greater than zero). Therefore, our data could be subject to potential selection on the basis of independent variables, but this is not a serious problem other that it results in a smaller sample (see, for example, WOOLDRIDGE, 2009).

Appendix B: Growth in the number of Small Businesses Registered in a City, 1995-2006
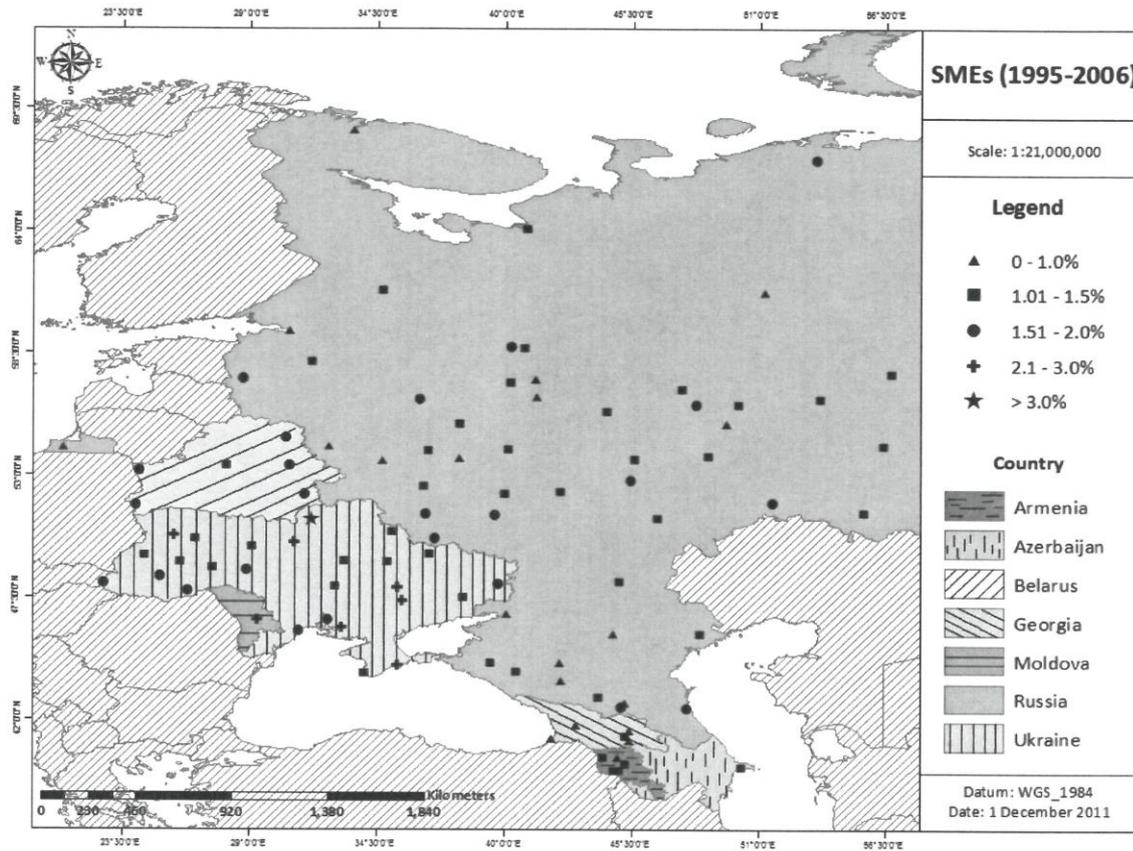
Note: Year 2006 is included instead of 2008 for compatibility of cities with the base year 1995. Data on small businesses in 2008 is missing for twenty out of 96 cities. WGS_1984 stands for World Geodetic System 1984, the reference coordinate system used by the Global Positioning System.

Appendix C: Descriptive statistics and Correlation matrix

	No of obs.	Mean	St. dev.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
dLnSEs (1)	746	0.02	0.24	1.00														
University (2)	746	7.58	14.2	0.02	1.00													
Tertiary education enrolment (3)	746	8.42	0.32	0.02	0.06*	1.00												
MBA (4)	746	0.41	1.41	0.02	0.94*	0.02	1.00											
GDP per capita (5)	746	7.47	0.65	-0.05	0.33*	0.34*	0.31*	1.00										
GDP growth (6)	746	0.07	0.31	-0.09*	0.02	0.23*	0.02	0.29*	1.00									
Unemployment (7)	720	2.79	2.76	0.03	-0.1*	-0.7*	-0.05	-0.3*	0.02	1.00								
Capital investment (8)	746	0.22	0.14	-0.02	0.01	0.13*	0.01	-0.05	0.07*	0.04	1.00							
Criminality (9)	746	2.74	0.52	-0.07*	-0.1*	0.24*	-0.1*	0.15*	-0.1*	-0.4*	-0.2*	1.00						
Population density (10)	746	7.70	0.56	0.04	0.36*	-0.1*	0.33*	0.14*	0.02	0.19*	-0.01	-0.3*	1.00					
Air pollution (11)	746	0.28	0.52	-0.04	-0.1*	0.06	-0.1*	0.34*	-0.02	-0.1*	-0.1*	0.26*	-0.05	1.00				
Executive constraints (12)	746	4.56	1.06	0.05	0.02	0.57*	0.02	0.08*	0.48*	-0.2*	0.24*	-0.2*	0.15*	-0.1*	1.00			
Public expenditure (13)	746	0.59	0.40	0.05	-0.3*	0.09*	-0.2*	-0.4*	-0.04	-0.05	0.10*	-0.1*	-0.3*	-0.05	-0.1*	1.00		
Banking reform (14)	746	2.18	0.41	0.05	0.01	0.23*	0.01	0.40*	0.29*	0.06*	0.25*	-0.4*	0.21*	-0.1*	0.44*	-0.1*	1.00	
Business Freedom (15)	746	55.7	6.57	-0.11*	-0.03	-0.4*	0.00	-0.02	0.05	0.31*	-0.01	0.06*	-0.04	-0.01	-0.4*	0.02	-0.3*	1.00

Note: Level of statistical significance is 5%. Source: CIS Urban Audit 1995-2008. Data on the number of MBA programmes across CIS cities are obtained from the MBA programs worldwide guide (Accessed on June 15, 2015 at http://www.find-mba.com); MBA studies guide (Accessed on June 15, 2013 at: http://www.masterstudies.com/MBA), Global MBA and Master Programs Directory (Accessed on June 15, 2013 at: http://www.mba-spectrum.com/courses/course-search-result.php), and web-sites cites of universities in CIS countries. Data on the number of students enrolled in tertiary education per 100,000 residents originate from UNESCO Institute for Statistics. (Accessed on June 12, 2013 at: http://stats.uis.unesco.org/unesco/TableViewer). All variables are taken in logarithms excluding ratios and binary variables. Table is based on a sample used within specifications 5-7 in Table 2.

Appendix D: The marginal effect of city-level HEI on the rate of change in Small Enterprises, with/without knowledge spillovers
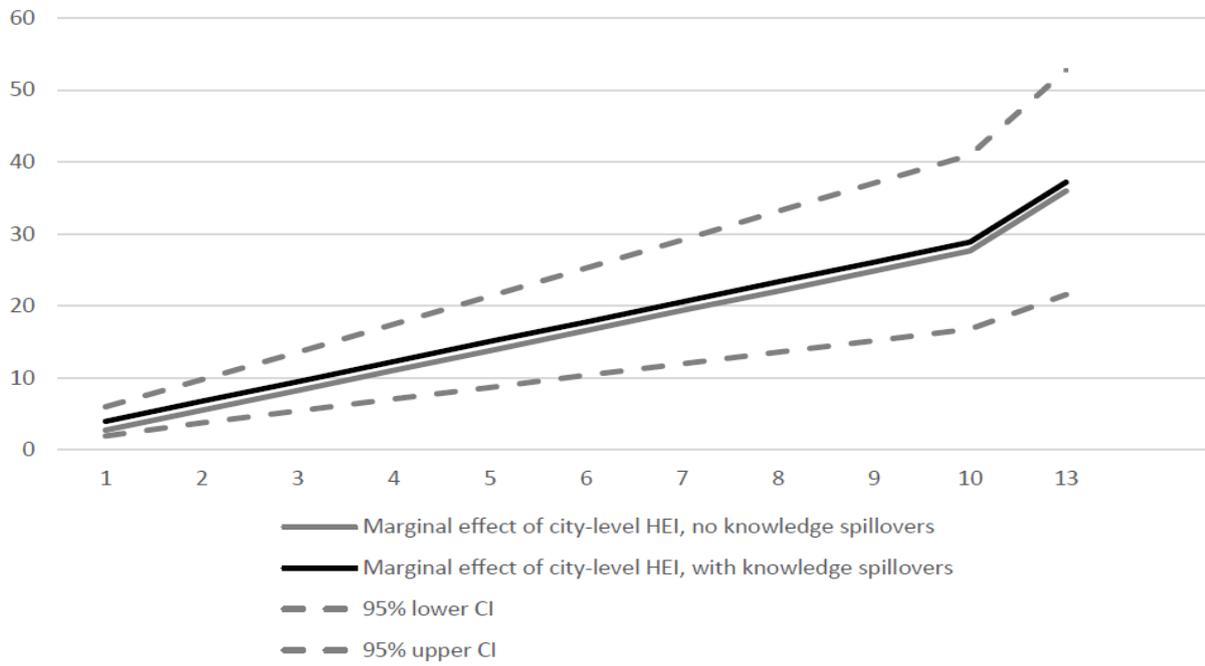
Source: Authors' calculations based on Table 2, specification 7

Appendix E: The marginal effect of city-level HEI on the rate of change in Small Enterprises, conditional on the share of manufacturing in GDP
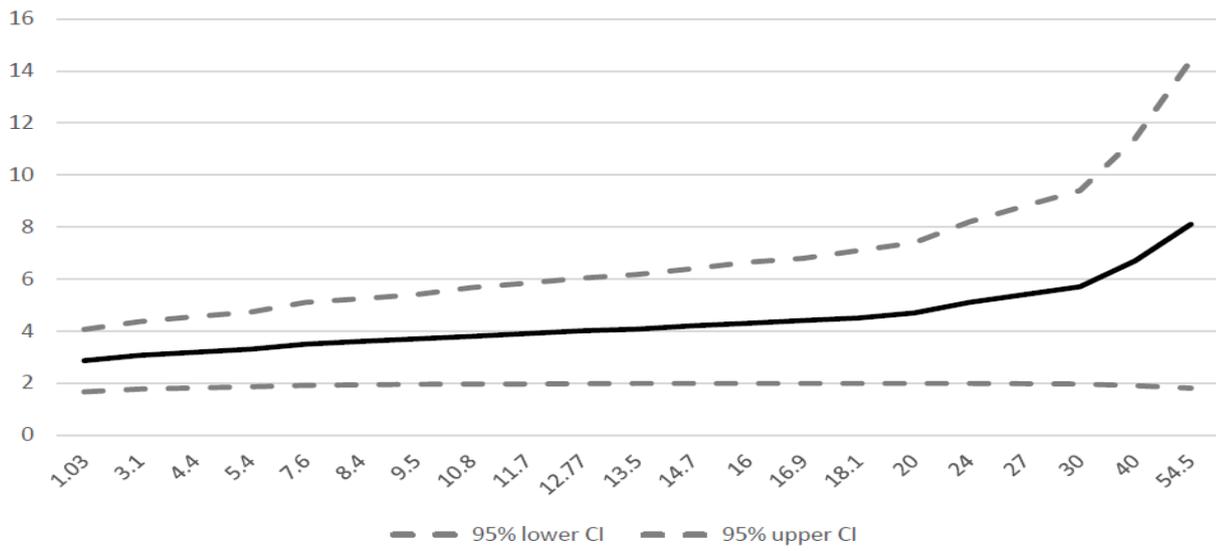
Source: Authors' calculations based on Table 2, specification 7

Appendix F: Summary of the effect of HEI as captured through different pillars

Institutional pillar	Variable to proxy it	Coefficient	Interpreting coefficients
Regulatory	Nos of Universities or their equivalent in cities	0.027***	An unit increase in the number of universities will result in 2.7% increase (100*0.027=2.7%) in the number of SEs (see Appendix D in part of the effect of city-level HEI 'without knowledge spillovers' displayed there)
Normative	Number of students enrolled in tertiary education per 100,000 country residents (country level)	0.824***	A one percent increase in the number of students enrolled in tertiary education per 100,000 residents will result in 0.82% increase in the rate of SEs.
Cognitive	Nos of MBA programmes in cities	0.232***	An unit increase in the number of MBA programmes will result in 23.2% increase (100*0.232=23.2%) in the number of SEs.
Conducive	An interaction between city-level Universities and the share of manufacturing sector in a city	0.001*	An unit increase in the number of universities, given an average level of manufacturing sector as a share in GDP equal to 12.77%, will result in 0.1% increase *(100*0.001=0.1%)* in the number of SEs (for the marginal effect of a city-level HEI at a different range of Nos of universities see Appendix D in part of the effect of city-level HEI 'with knowledge spillovers'). Accordingly cities with higher than average level of manufacturing sector in GDP will contribute more to the rate of change in SEs given a marginal change in the number of universities (see Appendix E).

Source: Authors' calculations based on the results reported in Table 2. Except for the MBA effect reflecting 'cognitive' pillar, the calculations are based on specification (7) of Table 2. The MBA effect was calculated based on specification (6). Note the direct effect of a city-level HEI is larger when interpreted in terms of a standard deviation; the predicted direct effect is equal to 14*0.027*100=38%. At the same time, the effect of a number of MBA programmes at a city-level is 32% once interpreted in terms of a standard deviation increase in a number of MBA programmes (i.e. 1.4*0.232*100=32.5).