ESSAYS ON MACROECONOMICS, SELF-EMPLOYMENT AND SMALL BUSINESS IN CITIES

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Maksim Belitski

Department of Economics

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ABSTRACT

The first essay studies the effects of exogenous and endogenous shocks on output sustainability in Central Eastern Europe and Russia during the 2000s. It expands traditional vector autoregressive model to a multi-country model that relates bank real lending, the cyclical component of output and spreads and accounts for cross-sectional dependence across the countries. Impulse response functions show that exogenous positive shock lead to a drop in output sustainability for nine over twelve Central Eastern European countries, when the endogenous shock is mild and ambiguous. Moreover the effect of the exogenous shock is more significant in the aftermath the crises.

The second essay investigates variation in entrepreneurial activity, as proxied by the rate of self-employment, across 374 European cities during the period of 1989-2010. While controlling for various spillover effects across cities we find that the rate of self-employment is largely explained by the level of education, urbanisation economies, institutional environment and industrial structure of a city. Self-employment rates are higher in agriculture and fishing industry; trade, hotels and restaurants industry; meanwhile mining, manufacturing and energy sector with higher positive effect of scale abandon self-employment. At the same time a U-shaped relationship per resident income determines existence of both necessity driven and genuine self-employment.

The third essay explains variation in entrepreneurship across cities of Commonwealth of Independent States during 1995-2008, utilizing a unique database and employing dynamic panel data analysis. The findings suggest that banking reform facilitates entrepreneurship, whereas the size of the state discourages it. A U-shaped relationship between per capita income and entrepreneurship is confirmed. It's established that a city with a higher concentration of universities is likely to have higher entrepreneurial entry that provides some evidence for the importance of agglomeration economies in terms of knowledge concentration which leads to intensified exchange of ideas and drive knowledge-based entrepreneurship.

To People in Transition Economies……

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DECLARATION

Some of the material contained in this thesis has been presented in the following publications:

Chapter 1.

Journal Papers:

1. Belitski, M., Péliová, J., 2011. Output Sustainability to Exogenous and Endogenous Shocks: Evidence from Emerging Economies. International Journal of Sustainable Economy 3(3), 255-280

2. Belitski, M., Péliová, J., 2009. Analysis of ad-hoc monetary shocks in Central and Eastern Europe (Analýza ad-hoc monetárnych šokov v strednej a východnej Európe), Nová ekonomika: vedecký časopis Národohospodárskej fakulty Ekonomickej univerzity v Bratislave = Faculty of National Economy, University of Economics in Bratislava scientific journal = The New economy. - Bratislava: EKONÓM, 2009. - ISSN 1336-1732. - Roč. 2, č. 3, s. 86-99. (published)

Chapter 2.

Journal Papers:

Belitski M, Korosteleva J. 2010. Entrepreneurship across European cities. In Frontiers of Entrepreneurship research, The Arthur M. Blank Center, Babson College, Babson Park, MA.

Papers in Refereed Conference Proceedings:

1. Belitski, M., and Korosteleva, J., 2010. Entrepreneurial activity across European cities. 13th Uddevalla Symposium Special Session on: "Innovation and Multidimensional Entrepreneurship - Economic, Social and Academic Aspects". (published)

2. Belitski, M., and Korosteleva, J., 2011. Does Self-Employment Capture Genuine Entrepreneurship?A Cross-City Study in Europe. Academy of Management Conference 2011.

Chapter 3.

Journal Papers:

Belitski, M. and Korosteleva, J. (2011) Entrepreneurship and cities: Evidence from post-communist world, WIFO Working Papers, 2011. Available at: http://www.icsb2011.org/download/18.62efe22412f41132d41800011708/74.pdf

Books:

1. Belitski, M. 2010. Foreign direct investment in innovation: policy coordination in regional unions. In Rudenkov, V. (Ed.). International business vectors (pp.308-318). Minsk: Institute of Economics. Publisher Law & Economics. (published)

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Chapter 1. Output Sustainability to Exogenous and Endogenous Shocks: Evidence from Emerging Economies[1]

1.1. Introduction

Sustainable economic development programmes of the former Soviet bloc countries were suddenly brought down by a severe economic downturn starting from the beginning of 2008. One by one the economies were affected with downturn of output, lack of internal and external funds for government and business. Output, private credit to GDP, jobs, stock prices fell dramatically with large capital outflows from the Central Eastern Europe and Russia. The purpose of this paper is to build a multi-country model for thirteen Central and Eastern European countries (Croatia, Romania, Bulgaria, Slovakia, Czech Republic, Poland, Hungary, Lithuania, Latvia, Estonia, Russia, Slovenia and Ukraine) structured as a panel data model and to estimate the impact of external (exogenous[2]) and domestic (endogenous) shocks on output sustainability in these countries over a period of 2001-2009. A particular focus is on establishing the differences in the output response to shock within 2001-2009 and in the aftermath of financial crises (2007-2009).

The cointegration relationships between the variables of interest was not modelled here, as for the newly established countries like Croatia, Latvia, Lithuania, Estonia, Ukraine and other, or substantially transformed Russia, the long-run relationships have time to develop (Charamza et al. 2009). Regarding the reduction of the dimensionality

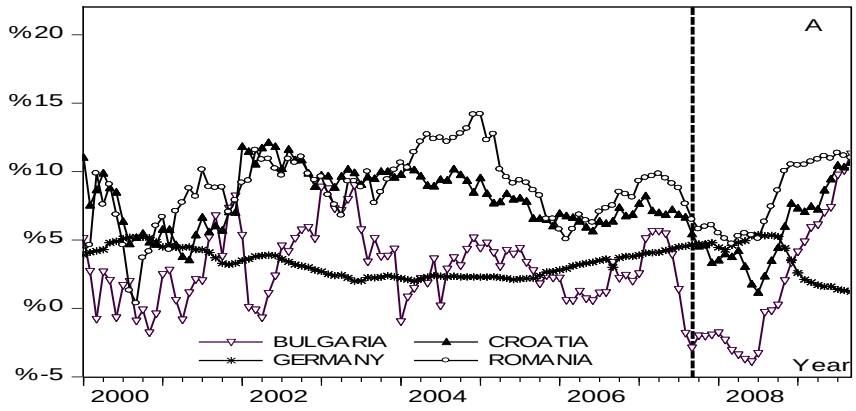
[1] This essay is the result of collaboration with Professor Jana Péliová from the Economic University in Bratislava (Slovakia) during my stay in Bratislava funded by the International Visegrad Fund scholarship (2009-2010). In this essay I attempted to introduce my contribution to the joint paper Belitski, M., Péliová, J. (2011). Output Sustainability to Exogenous and Endogenous Shocks: Evidence from Emerging Economies. International Journal of Sustainable Economy 3 (3), 255-280

[2] Exogenous shock is used interchangeably with external shock; endogenous shock is used interchangeably with domestic shock.

problem, cross-country augmentations, discussed by Chudik and Pesaran (2007, 2009) and Charamza et al. (2009) were originally implemented in the Infinite vector autoregressive model (IVAR). This model has shown the consistency of the cross-country augmentations in case where the number of countries is large and there is no dominant country in the panel Chudik and Pesaran (2009).

We model endogenously generated shocks, as a temporary increase in the risk premium faced by domestic borrowers —that is, an increase in a real lending rate. The dynamic of the real lending rate fluctuations is shown in Figure 1.1. The dotted vertical line corresponds to the beginning of the world financial crisis (Sept. 2007). Real lending rates in Germany are given for a benchmark.

Approach to modelling external shock is motivated in large part by the increase in US corporate bond yield spread i.e. change of Moody's BAA Corporate Bond Yield relative Moody's AAA Corporate Bond Yield[3], see Figures 1.2. The indicator is sometimes called Moody's BAA-AAA default spread. A vertical line corresponds to the beginning of the world financial crisis (Sept. 2007).



[3] Moody's BAA Corporate Bond Yield and Moody's AAA Corporate Bond Yield series are seasonally adjusted.

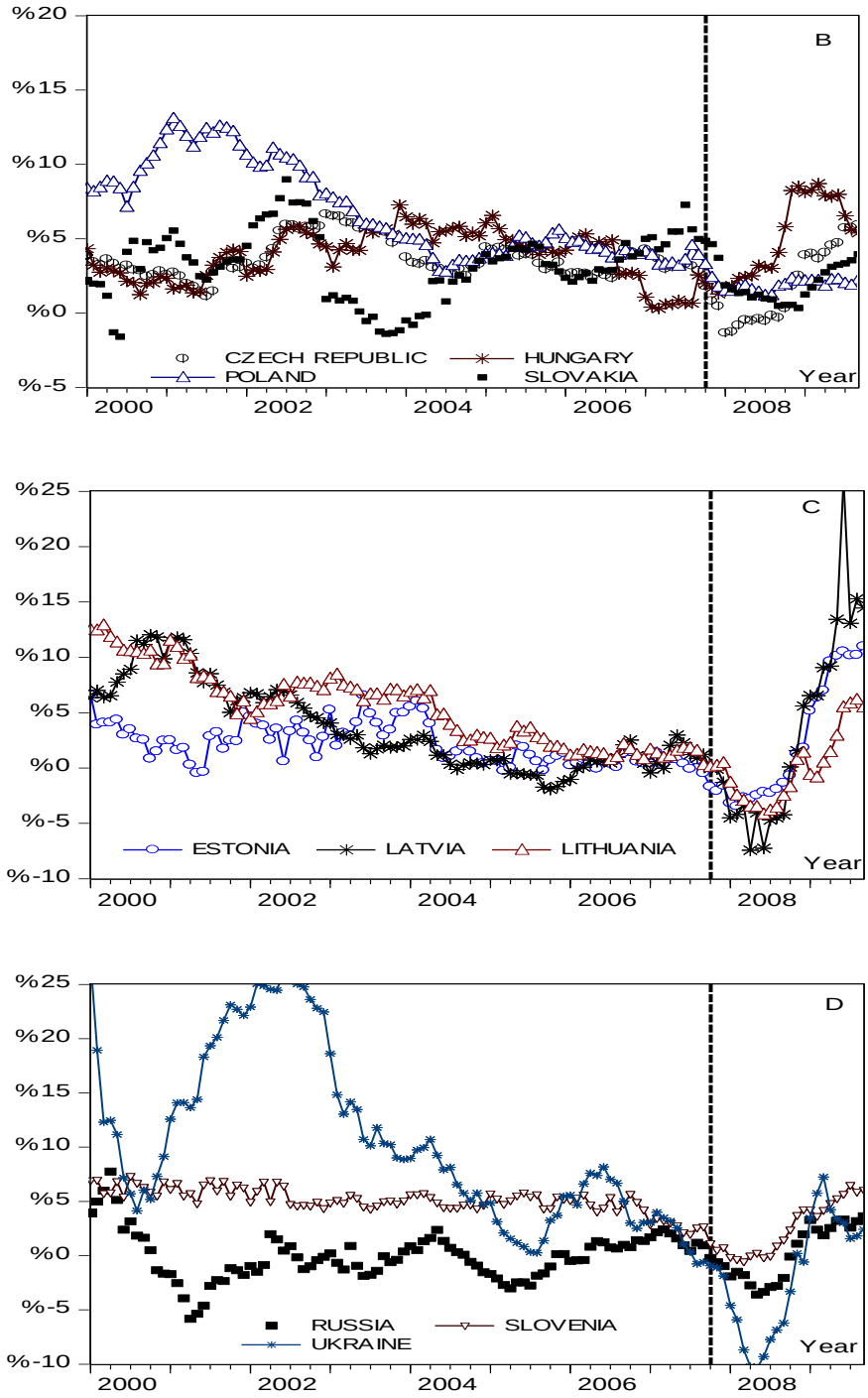


Figure 1.1 Real lending rates: Croatia, Romania, Bulgaria and Germany (A); Slovakia, Czech Republic, Poland, Hungary (B); Lithuania, Latvia and Estonia (C); Russia, Slovenia and Ukraine (D), Jan. 2000- Oct. 2009

Sources: Datastream; IMF International Financial Statistics; National Bank of Ukraine for Ukraine wired http://www.bank.gov.ua/Statist/sfs.htm and Deutsche Bundesbank for Germany wired http://www.bundesbank.de/statistik/statistik_zeitreihen.en.php; Croatian Central Bureau of Statistics for Croatia wired http://www.dzs.hr/default_e.htm

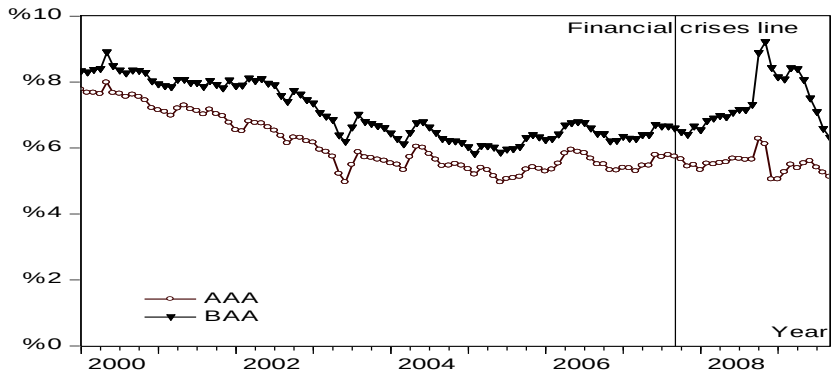


Figure 1.2 Moody's yields on corporate bonds – all industries, AAA and BAA, Jan. 2000- Oct. 2009

Source: www.moodys.com

Like yields on Treasury securities, US corporate bond yields spread embody a reward to investors for forgoing consumption today and saving. But corporate yields are almost always higher than yields on Treasuries of comparable maturities because of the implicit default risk and a host of other factors. The US corporate bond yield spread is also used as a measure of credit stress. It signifies the degree of risk-aversion of a lender. Widening the gap between BAA and AAA corporate bond yields signifies that lenders have become extremely risk-averse.

Evidence on the predictive ability of the external shocks on economic performance proxied by output gap of the country, would be useful to businesses and policymakers. These countries present new business opportunities for European companies. For example, European businesses and policy-makers would benefit from better forecasts of foreign real economic activity because projections for European counties exports depend on forecasts of foreign economic growth.

We find that variance decompositions and impulse responses corrected for cross-country interdependence demonstrated that output gap associated both with external and internal shocks is growing faster in short horizons, which signifies an immediate impact of a shock to business activity in the economies analysed. The impact of external shock as an indicator of external investor's risk-aversion in the aftermath of crises was clearly

higher in 2007-2009 compared to 2001-2009 for the majority of the countries with few exceptions.

The external shocks associated with a decrease of a risk appetite of international investors were a threat to economic sustainability brining down economic performance in a short run, in particular for Czech Republic, Hungary, Latvia, Lithuania, Russia and Slovenia; in a long run for Estonia, Poland and Slovakia. Romania and Bulgaria seem to behave even which could be explained by existence of investment mechanisms for these countries and large foreign direct investments.

The plan of this paper is as follows. Section 1.2 presents the theoretical framework and establishes research hypothesis. Section 1.3 presents Infinite VAR model (for the period January 2001 – October 2009)**.** Variance decompositions are discussed in section 1.4. Section 1.5 uses impulse response functions to analyse the effects of external shocks, defined as an increase in the US corporate bond yields spread; and of domestic shock defined as an increase in the real lending rate. Section 1.6 assesses the movements in output in the aftermath of financial crises 2007–2009. Section 1.7 concludes.

1.2. Theoretical framework and hypothesis tested

The theoretical framework is based on the works of Gilchrist et. al. (2009) and works of Federal Reserve bank of St. Louis emphasizing the fact that US corporate bond yields spread contain substantial predictive power for economic activity and outperform—especially at longer horizons—standard default-risk indicators. Much of the predictive power of bond spreads for economic activity is embedded in securities issued by intermediate-risk rather than high-risk firms. According to impulse responses from a structural factor-augmented vector autoregression model proposed in their paper,

unexpected increases in corporate bond spreads cause large and persistent contractions in economic activity.

Famous studies in this field, but not for transition economies include Genberg (2003) on of output fluctuations and risk premiums. Using variance decompositions, he finds that external shocks are important determinants of movements in the level of prices and GDP. Furthermore, Genberg and Sulstarova (2008) incorporated the assessment of sovereign debt sustainability and showed how the volatility of the macroeconomic variables as well as potential interactions between them influence country risk. Gilchrist et. al. (2009) analysed the impulse responses from a structural factor-augmented vector autoregression, where unexpected increases in corporate bond spreads cause large and persistent contractions in economic activity. They have proved that shocks emanating from the corporate bond market account for more than 30 percent of the forecast error variance in economic activity in the US at the two- to four-year horizon. Overall, their results imply that credit market shocks contributed significantly to US economic fluctuations during 1990–2008.

The determinants of output sustainability theories for developed and developing world were discussed extensively by Agénor and Aizenman (1998), Barajas, Steiner and Salazar (1999), Demirgüç-Kunt and Huizinga (1999), Afanasieff, Priscilla and Nakane (2002), McMillan (2002), Mody and Taylor (2003, 2004), Botric and Slijepcevic (2008), Papadamou S. (2009), Gilchrist et. al (2009). At the same time scarce research has been done so far on the impact of exogenous shocks (proxied by yields on a BAA corporate bond and AAA corporate bond of comparable time to maturity) on economic activity in transition economies of CEE. This paper aims to bridge this gap along with estimating the effect of external shocks on economic activity over the period of 2001-2009 and in aftermath of financial crises 2007-2009. Taking into account that the spreads are mainly

driven by global financial conditions (e.g. , Aizenman and Hoffmaister, 2008; Özatay, Özmen and Şahinbeyoğlu, 2009; Chen et. al. 2009), transition economies of CEE in spite of the declared sustainable economic growth are sensitive to exogenous shocks in international credit and equity markets. Understanding the way external shocks affect outputs is relevant for monetary and fiscal policy implications in these countries, which could enable policy makers to use the most sophisticated financial and monetary instruments.

The aspect that is in the focus relates to the direct impact of shocks on business that finance their capital needs via domestic / international banking system. Therefore, the research hypotheses to be tested are following:

Definition 1: A higher external cost of credit, r_i^* *due to increase in the risk premium nationally or internationally, raises the price of money (domestic real lending rate), therefore lowers the demand for inputs and business activity, and reduces expected aggregate output in the economy.*

Definition 2: A higher BAA-AAA corporate bond yields spread will signify that lenders are becoming extremely risk-averse and dislike risk. Therefore lenders are expected to stay away from adding high-risk stocks or investments to their portfolio linked to the economies with the increased default risks. Negative response of output gap to a shock to BAA-AAA corporate bond yields spread explains that the lenders are cautious about their investment or stocks market operations in the country in focus. The contrary is true for positive response of output gap to BAA-AAA corporate bond yields spread shock.

Summing up the results in Definition 1 and 2 are consistent with those obtained

with more developed, general-equilibrium models, such as those of Neumeyer and Perri (2005) and Gilchrist et al. (2009). There are crucial differences between the model developed by Neumeyer and Perri (2005) and our studies. Their framework is nonmonetary in nature, so that capital needs to depend on real interest rates. In our model, where firms and government borrow from home and international markets, domestic lenders are assumed to receive back the full value of their loans (plus interest) making borrowing risk free. The banking system and credit market are explicitly considered here. However, this is done in a deterministic setting with no account of credit market imperfections.

1.3. VAR Estimation and Analysis

Panel data sets are likely to exhibit substantial cross-sectional dependence, which may arise due to the presence of common shocks and unobserved components that become part of the error term. See, for example, Robertson and Symons (2000), Pesaran (2004), Anselin (2001) and Baltagi (2008). One reason for this development for transition countries may be that during the last decade transition countries experienced an ever-increasing economic and financial integration reuniting into EU, which implies strong interdependencies between countries.

Assuming that cross-sectional dependence is caused by the presence of common factors, which are unobserved they are uncorrelated with the included regressors, the standard fixed effects (FE) and random effects (RE) estimators are consistent, although not efficient, and the estimated standard errors are biased. One may chose to rely on standard FE/RE methods and correct the standard errors by following the approach proposed by Driskoll and Kraay (1998). Alternatively, one may attempt to obtain an

efficient estimator by using the methods put forward by Robertson and Symons (2000) and Coakley and Fuertes (2002) dealing with asymmetric dynamics in UK real interest rates. On the other hand, if the unobserved components that create interdependencies across countries are correlated with the included regressors, these approaches will not work and the FE and RE estimators will be biased and inconsistent.

One may follow the approach proposed by Pesaran et. al. (2004), Chudik and Pesaran (2007, 2009, 2010) to deal with cross-sectional dependence in both cross-section and time series. They have introduced the so-called "stacked vector autoregressive model (VAR)" which is different from a simple VAR.

Simple VAR is a model for two or more time series where each variable is modelled as a linear function of past values of all variables, plus disturbances that have zero means given all past values of the observed variables. VAR models will have at least one lag of each variable. All variables in VAR model are normally assumed to be endogenous, however it does not mean there could not be an exogenous variable in the VAR. In practice there would often be more than two endogenous variables, but not necessarily an exogenous variable. In case with N endogenous variables and *l* lags, we can write VAR model in a matrix notation such as:

$$x_t = \alpha + \Gamma_1 x_{t-1} + \cdots . + \Gamma_t x_{t-l} + \varepsilon_t \qquad (1.1)$$

where α vector of intercept term, x_t it's a lagged value, ε_t are N x 1 vectors, Γ_1,…. Γ_l are N x N matrices of constants to be estimated.

Although the approach has drawbacks, such as a lack of economic restrictions on the dynamics of the system (Cooley and Dwyer, 1998) and sensitivity to identifying

restrictions (Pagan and Robertson, 1998; Faust and Leeper, 1997), it has the advantage of being able to capture general dynamic relationships and identifying economic interactions without the imposition of too much structure. However, one of the weak points of this approach in practice is that the need for a limited number of endogenous and exogenous variables which could lead to omitted bias. As the number of parameters, to be estimated grows at a quadratic rate, the number of variables is limited by the size of typical country datasets. For macroeconomic and international economics empirical applications this is not enough. As the number of cross-sectional units' increases we face the so-called "curse of dimensionality", and certain restrictions must be imposed for the analysis.

Two different approaches have been suggested in the literature: (i) shrinkage of the parameter space and (ii) shrinkage of the data. They consider a parameter space can be shrunk by imposing a set of restrictions, which could be for instance obtained from a theoretical structural model, directly on the parameters.

The second approach to deal with "curse of dimensionality" is to shrink the data, along the lines of index models. Chudik and Pesaran (2007, 2009 and 2010) techniques model proposes to deal with the curse of dimensionality by shrinking the data as the number of endogenous variables (N) increases to a large number. Under this set up their Infinite VAR (IVAR) could be approximated by a set of finite-dimensional small-scale models that can be consistently estimated separately in the spirit of Global VAR (GVAR) models initially proposed in Chudik and Pesaran (2007).

Later on, Chudik and Pesaran (2010) extend the analysis of infinite dimensional vector autoregressive models (IVAR) proposed to the case where one of the variables or the cross section units in the IVAR model is dominant or pervasive. This extension is not straightforward and involves several technical difficulties. The dominant unit influences the rest of the variables in the IVAR model both directly and indirectly, and its effects do

not vanish even as the dimension of the model (N) tends to infinity. The dominant unit acts as a dynamic factor in the regressions of the non-dominant units and yields an infinite order distributed lag relationship between the two types of units. Despite this it is shown that the effects of the dominant unit as well as those of the neighbourhood units can be consistently estimated by running augmented least squares regressions that include distributed lag functions of the dominant unit.

A successful attempt to extend Chudik and Pesaran's logic on modelling the transition economies of Belarus, Ukraine and Russia was made by Charemza et. al. (2009). Technically their the modelling idea has been grounded within the concept of the infinite dimensional vector autoregressive models by Chudik and Pesaran (2007). The main developments are such that the model is 1) interdependent rather than vector autoregressive, 2) estimated by the generalised method of moments and 3) forward-looking. The primary linkage of the country models is provided through the real effective exchange rates of particular countries, while the secondary linkages are through the Chudik and Pesaran cross-sectional augmentations. Cross section augmentations (CSA) i.e. cross section averages of each endogenous variable calculated for the rest the countries. CSA itself is an exogenous variable which captures the effect of cross-sectional dependence across the countries caused by the presence of common factors, which are unobserved. An Infinite VAR along with a simple VAR method enable to measure the impact of external and domestic shocks on output of one country taking into account an unobserved impact of the rest of the countries pooled together in one vector autoregressive model. Both VAR and IVAR models may have the number of lags starting from one and more. In case with N endogenous variables and l lags, the Infinite VAR model can be represented as follows.

Let x_{it} denote the realisation of a random endogenous variable belonging to cross section unit *i* in period *t*, and assume that $x_{it} = (x_{1t}, x_{2t} \dot{\ldots\ldots}, x_{Nt})$ is generated according to the following reduced VAR (*l*) model:

$$x_{it} = \alpha + \sum_{l=1}^{p} \Gamma_{pi}\, x_{i,t-l} + \sum_{l=0}^{q} \theta_{q_i}\, x^{*}_{t-l} + \mu_{it} \qquad (1.2)$$

where, α vector of intercept terms, Γ_p is N x N dimensional matrix of unknown coefficients of the endogenous variables, θ_q is N x N dimensional matrix of unknown coefficients of cross- section augmentations (CSA), significant in a group cross- section augmented regressions, $\mu_t = (\mu_{1t}, \mu_{2t}, \dot{\ldots\ldots\ldots}, \mu_{Nt})$ are white noise innovation terms, that is E*(* μ_{it} *)=0,* and , μ_{it} and , μ_{it+h} are independent for , h= 0. The matrix $\sum_{\mu}(\mu\acute{\mu})$ is non-diagonal.

Country specific cross section averages accounting for cross-sectional effects, are constructed as

$$x^{*}_{it} = \sum_{J=1}^{N} x_{jt} \qquad (1.3)$$

CSAs (1.8) are included in a VARs model as exogenous should the value of θ_{qi} be more than zero for $l \in \{0, \ldots., q\}$.[4]

IVAR now includes the following variables: US corporate bond yield spread, *BAA-AAA*, domestic interest rate spread on national currency-denominated assets and

[4] On the previous version of the paper distances between the capitals of country *j* and country *i* used for to implement unobserved effects correction. We reconsidered this approach and we agree with the anonymous referee that such an approach is not suitable for financial market analysis as the markets are becoming or are already global. Therefore distances as weights were removed from cross sectional augmentations.

liabilities, *DS*, real lending rate, *LR*, and measure of output gap, *GAP*, i.e. economic performance of the country: deviations of current output from its trend level, $((y_{real} - y_{pot}) / y_{pot})$. The trend component $y_{pot}$is obtained by applying the moving average[5] instead of Hodrick–Prescott filter frequently used in economic literature[6].

In order to justify the inclusion of CSA in IVAR (p) model cross-sectional dependence test (CD test) by Pesaran (2004) was implemented and those CSAs to be included in a model were identified (see Table 1.1 below). US corporate bond yield spread was not tested for CD dependence as this variable is exogenous and does not vary across the countries being analysed. No CSA were calculated for US corporate bond yield spread.

Pesaran CD test strongly rejects the null hypothesis of no cross-sectional dependence at least at the 1% level of significance. Although it is not the case here, a possible drawback of the CD test is that by adding up positive and negative correlations it might undermine the cross-sectional dependence present in the data.

Table 1.1: Pesaran CD test of cross-sectional dependence*

Model: Fixed effects (within) regression	Pesaran's test of cross sectional independence	Pr.	Average absolute value of the off-diagonal elements
GAP as dependent variable	57.880	0.000	0.680
LR as dependent variable	4.445	0.000	0.095
DS as dependent variable	5.329	0.000	0.135

*Note: According to the results, once we account for State fixed effects LR and DS have no effect upon country output fluctuations. An assumption implicit in estimating equation (1.2) is that the cross-sectional units are independent. *Ho*: *Cross-sectional Independence.* To test this hypothesis Pesaran's (2004) CD test was employed.

Source: Author's calculations.

[5] Simple moving average (one sided) was used in its unweighted mean of the previous 7 data points. For example, a 7-months simple moving average of output is the mean of the previous 7 months' output.

[6] The filter has misleading predictive outcome when used dynamically since the algorithm changes (during iteration for minimisation) the past state (unlike a moving average) of the time series to adjust for the current state regardless of the size of lambda used.

The average absolute correlations are calculated between the cross-sectional units. In this case the average absolute correlations are 0.680, 0.095 and 0.135 respectively. The value of GAP is very high. Hence there is enough evidence suggesting the presence of cross-sectional dependence in model (1.2) under a fixed effects assumption.

To justify the choice of four variables in a model two correlation matrices were introduced (see Table 1.2 and Table 1.3). Table 1.2 and 1.3 provide the evidence of existing correlation between the model variables. Particular attention is given to proxies for shocks and a dependent variable output gap. As one could expect the correlation is statistically significant and the value of the pair-wise correlation coefficient is lower for US corporate bond spread. The pair-wise correlation coefficient between US corporate bond spread and output gap increases three times during the time of crises which helps us to explain better fluctuations in output gap of those economies of international lender's interest. Both coefficients are statistically significant at 1% significance level; however correlation does not mean causation.

The pair-wise correlation coefficient of real lending rate and output gap has also increased significantly during the time of crises and became negative. This signifies a higher impact of lending rates hit by endogenous shocks and its effect on output of the countries being analysed.

Table 1.2: Correlation matrix of model variables (Feb. 2007- Sept. 2009)

	Interest rate spread	BAA-AAA	Output gap	Real lending rate
Interest rate spread	1.0000	-	-	-
BAA-AAA	-0.1108* (0.001)	1.0000	-	-
Output gap	0.0234 (0.361)	-0.0603** (0.018)	1.0000	-
Real lending rate	0.0834* (0.001)	-0.0165 (0.520)	0.1217* (0.000)	1.0000

(*), (**), (***)-significant at 1, 5 and 10% level accordingly, p-values are in parenthesis. Number of observations 105.
Source: Author's calculations.

We refer in what follows to the model without CSA as Model A, and the one with CSA as Model B. Both models are estimated with monthly data from January 2001 through September 2009. External shocks being exogenous to both domestic factors (such as changes in output and domestic credit conditions) and external factors (such as changes in market sentiment) are therefore placed last in the Cholesky ordering of the IVAR model. This allows to "clear" it of its possible domestic component. In doing so, we are capturing primarily the exogenous shock. Changes in a real lending rate could happen mostly due to endogenous shocks, such as changes in government bond rates, monetary policy and other domestic credit conditions. Therefore that variable is placed first in the ordering of the IVAR model as it will include the domestic component.

Table 1.3: Correlation matrix of model variables in crises (Feb. 2007- Sept. 2009)

	Interest rate spread	BAA-AAA	Output gap	Real lending rate
Interest rate spread	1.0000	-	-	-
BAA-AAA	-0.0664 (0.146)	1.0000	-	-
Output gap	0.1614* (0.004)	-0.1978* (0.000)	1.0000	-
Real lending rate	-0.6345* (0.000)	0.1723* (0.001)	-0.2921* (0.000)	1.0000

(*), (**), (***)-significant at 1, 5 and 10% level accordingly, p-values are in parenthesis. Number of observations 33.
Source: Author's calculations.

1.4. Variance Decompositions

The variance is used as a measure of how far a set of numbers are spread out from each other. It is one of several descriptors of a probability distribution, describing how far the numbers lie from the mean (expected value). In particular, the variance is one of the moments of a distribution.

Variance Decomposition or Forecast error variance decomposition indicates the amount of information each variable contributes to the other variables in VAR models. To analyse variance decomposition is important because it determines how much of the

forecast error variance of output gap can be explained by exogenous shocks to the other variables and the output gap itself.

Table 1.4 presents for Model A and Model B the variance decompositions for *GAP*. Following the discussion of the results below, the table shows the share of the variance associated with shocks to *GAP*, and the sum of the shares of the variance associated with shocks to the other variables in the models[7].

The share of the variances in Model A and Model B are different. At face value these results suggest that on average between January 2001 and October 2009, movements in *GAP* for the countries being analysed were associated with shocks originating from both outside and inside the country. This was not true for Lithuania, Croatia, Czech Republic and Estonia.

The bulk of the variance of *GAP* is associated with external shocks proxied by *BAA-AAA* spread for Latvia, Slovenia, Romania and Russia. This signifies that the external lenders and international credit markets, US in particular play an important role for the above countries. This effect is true for both short and long horizons, where the external shocks are associated with more than 30 percent of the *GAP* variance for Latvia, 21 percent for Slovenia, more than 40 percent for Romania and about 20 percent for Russia. Although this share declines somewhat from 6 to 12 months.

The share of the variance of the cyclical component of output associated with domestic shocks proxied by *LR* is not as substantial as was expected. The variance of *GAP* for Latvia, Slovenia, Hungary and Ukraine is explained by shocks originating within the country such as real lending rate shock.

[7] The shocks are assumed to be orthogonal; therefore, the sum of the shares reflects the combined shares of the variance associated with shocks from BAA–AAA, DS, (*y* - *y*pot / *y*pot) and LR. Also, it avoids the thorny issue of identifying the individual shocks of these variables that are not of interest to this study.

Table 1.4: Variance decompositions of "Cyclical component of output" (Model A and Model B) over the period 2001:M1-2009:M9

Country	Months	Percentage of variance associated with historical shocks from:							
		Model A (VAR)				Model B (IVAR)			
		GAP	LR	DS	BAA-AAA	GAP	LR	DS	BAA-AAA
Poland	1	99.94	0.00	0.04	0.00	99.75	0.03	0.20	0.00
	6	85.84	8.86	1.49	3.79	79.29	5.40	3.32	11.96
	20	82.77	9.21	3.34	4.66	73.36	5.70	6.16	14.47
Czech Republic	1	99.97	0.00	0.02	0.00	99.41	0.06	0.51	0.00
	6	81.81	1.31	3.59	13.27	87.94	0.49	5.11	6.45
	20	78.90	3.30	4.95	12.83	78.43	1.96	11.10	8.49
Slovakia	1	99.40	0.00	0.59	0.00	99.63	0.36	0.00	0.00
	6	93.43	0.97	4.16	1.42	95.05	0.44	3.50	1.00
	20	90.23	2.44	4.04	3.27	69.00	5.44	14.40	11.14
Hungary	1	97.05	2.88	0.06	0.00	98.37	1.47	0.14	0.00
	6	84.12	6.62	0.24	9.00	80.29	11.49	0.62	7.58
	20	82.00	8.26	1.00	8.72	48.18	39.45	1.48	10.87
Lithuania	1	99.95	0.04	0.00	0.00	92.53	0.95	6.50	0.00
	6	65.68	17.25	8.43	8.63	75.03	1.74	18.92	4.29
	20	69.09	15.78	7.41	7.70	70.11	4.96	19.85	5.06
Latvia	1	99.97	0.01	0.00	0.00	98.13	1.74	0.11	0.00
	6	74.46	0.66	2.39	22.47	55.21	12.25	1.57	30.95
	20	74.40	1.35	2.30	21.93	45.75	24.58	2.88	26.77
Estonia	1	95.28	3.56	1.15	0.00	98.21	1.42	0.36	0.00
	6	70.55	3.34	3.78	22.30	90.32	3.38	0.54	5.74
	20	63.86	4.19	8.36	23.57	87.45	3.72	1.63	7.18
Slovenia	1	96.84	0.09	3.06	0.00	94.00	5.53	0.45	0.00
	6	72.82	7.70	5.74	13.72	46.93	28.97	6.95	17.12
	20	63.77	6.73	10.82	18.66	40.47	25.18	12.97	21.36
Romania	1	99.65	0.11	0.23	0.00	97.66	1.03	1.30	0.00
	6	87.42	8.08	3.89	0.59	52.02	3.43	4.96	39.58
	20	86.53	7.02	4.35	2.08	42.30	9.95	4.15	43.57
Bulgaria	1	99.98	0.01	0.00	0.00	97.47	2.50	0.01	0.00
	6	88.49	2.65	4.56	4.28	84.60	9.39	5.40	0.58
	20	87.75	2.95	3.34	5.95	73.79	10.03	6.24	9.92
Croatia	1	92.51	7.20	0.27	0.00	95.93	4.05	0.00	0.00
	6	81.68	13.63	0.59	4.08	92.39	5.36	0.60	1.63
	20	83.08	10.48	0.79	5.63	90.97	5.70	1.39	1.92
Russia	1	94.88	0.00	5.11	0.00	95.59	3.71	0.69	0.00
	6	86.81	4.69	4.78	3.70	80.78	2.44	0.65	16.11
	20	85.73	5.85	4.07	4.34	75.01	4.10	1.11	19.77
Ukraine	1	94.59	0.91	4.49	0.00	97.96	1.46	0.56	0.00
	6	88.98	1.42	8.52	1.06	91.70	4.34	6.39	7.55
	20	86.30	3.06	7.13	3.49	72.74	13.31	5.64	8.28

Notes: These decompositions in the Table 1.4 are based on the unrestricted VAR and Infinite VAR analysis described above following Chudik and Pesaran (2007, 2009, 2010). Variance decompositions are assumed to add up to 100 percent and historical shocks are considered to be orthogonal, which is different from the decompositions based on the generalized VAR analysis following Koop, Pesaran and Potter (1996). Variance decompositions are obtained from IVAR models with cross-sectional averages for *DS, LR, GAP* with cross section dependence in Model B. Standard -error in each series are based on 1000 Monte Carlo repetitions. The model is estimated with four lags using monthly data from 2001:M1 through 2009:M9; see Appendix A for details. Source: Author's calculations.

Although the specifics depend on the choice of *GAP* measure, the share of the variance of *GAP* associated with *LR* increases within 6-20 month horizon for Hungary, Ukraine, Latvia, Lithuania, Slovakia and Romania; increases within 1-6 months for

Poland, Estonia, Slovenia, Bulgaria, Croatia. In fact the first group of countries are seemed to be the most effected by Global financial crises in 2007-2009.

1.5. Impulse response analyses

Figure A.1 in Appendix A (left column) shows the impulse responses of *GAP* to a positive shock from *BAA-AAA,* when (right column) shows the impulse responses of *GAP* to a positive shock from *LR*. Impulse response functions describe how the *GAP* reacts over time to exogenous impulses, which economists usually call 'shocks'. These impulse responses have been computed by placing *BAA-AAA* last in the ordering and by placing *LR* first in the ordering in case of calculating the effect of a shock from *LR*. Placing *LR* first in the ordering does not purge the identified *LR* shock from the impact of other shocks in the model that are more likely to reflect domestic factors. As discussed in the introduction, the experiment of placing the variable last in Cholesky ordering can be viewed as reflecting a "pure" contagion effect, triggered by events taking place elsewhere. A shock from *BAA-AAA* was identified, but not for a shock from *LR.*

The shock from LR cannot be now viewed as reflecting an adverse external financial shock—related or not to contagion[8]. The figure displays one-standard-error bands of percentage change for *GAP* and one standard deviation for *BAA-AAA* or *LR* variable[9].

[8] In the context of transition countries, the shock from *LR* that is considered may well also represent an increase in devaluation risk. In fact, accounting for the transmission process of a change in devaluation expectations would require taking into account the fact that major part of the firms could have large foreign-currency-denominated liabilities. But to the extent that adverse balance sheets effects translate into downward movements in the cyclical component of output—because, for instance, the risk premium depends on firms' net worth, Bernanke, Gertler and Gilchrist (2000) —empirical framework would implicitly capture it.

[9] In all figures the dotted lines for the impulse responses (IRs) show one-standard-error band in each direction and are based on 1000 Monte Carlo replications. The upper dotted line shows the upper border of possible response of *GAP* to a shock from *BAA-AAA* or *LR*. The bottom dotted line shows the lowest border of possible response of GAP to a shock from *BAA-AAA* or *LR*. The reaction to shock may vary within the

First, the impulse responses of *GAP* to a positive shock from *BAA-AAA* are discussed and later the impulse responses of *GAP* to a shock from *LR.* A shock from BAA-AAA corporate bond yield spread is modelled which supports the thesis that risk appetite has decreased, and investors do not intend to put money to work but rather park it in low risk reservoirs. If this happens, movements of *GAP* for most of the countries become significantly negative supporting the definition 2 of the paper. This holds true for Czech Republic, Estonia, Hungary, Latvia, Lithuania, Slovenia, Slovakia, Poland and Russia. The fall in the *GAP* is very significant for the economies dependent on international lending such as Hungary, Slovenia Latvia, Poland and Russia. This signifies that lenders stay away from adding high-risk stocks or investments to their portfolio linked to the economies with increased default risks.

On the contrary, *GAP* becomes significantly positive in case of Romania and Bulgaria which joined the European Union during its last enlargement in 2007. This positive response could be explained by low level of dependence on US investments, rather than EU investments. These two countries have recently become centres of outsourcing for European multinationals as well as the centres of emigration. Impulse response displays higher degree of persistence for those countries less dependent on US credit and financial markets such as Russia, where the fall has happened 4 months aftershock. At the same time there was a lower persistence to shock by Czech Republic, Estonia, Hungary and Slovenia (3 months). *GAP* falls instantly after the shock for Poland and Latvia[10]. Movements in *GAP* for Slovakia and Ukraine are ambiguous, because of the

upper and bottom dotted lines which are also called 95% confidence intervals, i.e. with 95% confidence it's possible to say the response of *GAP* will fit to the estimated dotted corridor. Should upper or bottom dotted line cross zero line we conclude on zero response of *GAP* to an exogenous shock. In each replication we sampled the VAR coefficients and the covariance matrix from their posterior distribution. From these repetitions we calculated the square root of the mean squared deviation from the impulse response in each direction. By construction, these bands contain the impulse-response function but are not necessarily symmetric. Number of observations are 117.

[10] Note that there are no perverse blips in the output response at any times. It is clear why the measurement of cyclical output in this case does not make such a blip. It is possible if the HP filter is used in the Model

large one-standard-error bands. The instant aftershock possibly reflects other external shocks or a low share of stocks in the investor's portfolios from these two countries.

For seven of the thirteen countries the shock from *LR* does not result in any significant changes in *GAP*. The 95% confidence intervals include zero, which means there is no significant effect of a shock from *LR* on *GAP*. Moreover, for four countries such as Hungary, Latvia, Russia and Ukraine, *GAP* become significantly positive which is counterintuitive to the definition 2 made in the paper. The possible explanation for this is that firms do not lend in national currency due to high inflationary expectation and constant depreciation shocks. These shocks might affect business which starts borrowing money in more stable currencies such as Euro or US dollar. In this case there is nothing surprising in the positive response of *GAP* to a shock from LR, should there be an international credit channel open. It may also reflect, financial speculation happening behind the scenes, recalling that *LR* is calculated as the nominal lending rate on national currency-denominated loans at a monthly rate minus current monthly inflation. Nevertheless, definition 2 holds true for Croatia, Slovakia and Hungary in the short horizons. This could be explained by borrowing primarily in national currency and absence of any form of financial tightening or constraints from the Central banks (e.g. a good example of financial market liberalisation is Hungary were no financial constraints exist). Movements in *GAP* for Bulgaria, Czech Republic, Estonia, Slovakia, Lithuania, Poland, and Romania are ambiguous, possibly because the finding of large one-standard-error bands for the instant aftershock that is a reflection of external shocks.

It's possible to conclude on heterogeneity in countries' responses to endogenous shocks. What is obvious is the size of the economy and monetary policy could explicitly affect the movements in *GAP* in favour of exogenous vs. endogenous shocks. The

which may create a spurious cycle, as discussed by Cogley and Nason (1995). In our Model moving average of seven lags has been used which prevents any unexplained blips and spurious cycles.

economies being analysed are small open economies except for the economy of Russia which is more subject to endogenous rather than exogenous shocks. Ambiguous impulse responses of *GAP* to a positive shock from *LR* for seven of the thirteen countries enable to conclude on high level of borrowing in foreign currency, economic openness, high inflationary expectations and depreciation shocks. The business does not seem to borrow in national currency to buy the inputs of production, so that the production cycle is not very much dependent on the national currency which often play a secondary role in transition economies of Central and Eastern Europe.

1.6. The Aftermath of Crisis: Variance Decomposition

A useful application of VAR models estimated above is to assess how much each variable contributes to the movements in output gap in VAR models. Variance Decompositions in the immediate aftermath of crisis (2007-2009) show how much of the forecast error variance of output gap can be explained by exogenous shocks during the crises, rather than during the entire period analysed. This can be done by using the historical variance decompositions of these variables for the period immediately following the collapse of world financial system, specifically, from September 2007 to September 2009. Table 1.5 presents these results on a monthly basis.

First Cogley and Nason (1995) and later A , Aizenman and Hoffmaister (2008) proposed to use similar approach to estimate the effect of shocks for *GAP* in the aftermath of Peso crises, when the historical decompositions obtained by averaging over the monthly decompositions for unrestricted vector autoregressive models. The fact that the monthly data is already available in the model guarantees the outputs from Table 1.5 are consistent to those in Table 1.4. Above provides a clear interpretation of the results accounting for financial crises within the economies analysed.

Results for IVAR model in Table 1.5 indicate that the share of the variance of *GAP* associated with *BAA-AAA* shocks in the aftermath of crises (2007-2008) compared to the period of 2001-2009 has increased for the majority of countries. This is in line with the economic intuition. The more is the dependence of small open economies on international fundraising, foreign economic policy, foreign direct investment and export-import transactions, the higher is the risk of exogenous shocks. For the same period there is a fall in the share of the variance of *GAP* associated with *BAA-AAA* shocks in the aftermath of crises for Slovenia, Romania and Russia.

The above could be explained by specific economic structures of these countries. Slovenia is one of the most developed economies in the New EU member states. Its sustainable growth before the crises increased the level of country resistance to various exogenous shocks almost outside the EU. Like Romania and other New EU member states the country is being gradually integrated with European financial and credit institutions and is more dependent on shocks originating from inside the EU than from outside. The situation with Romania is different, however a stream of financial resources in a form of direct investments and outsourcing policy of multinationals, sustainable production and services growth, common trade zone within the EU made the country less dependent on FDI originating from outside the EU and the perception of a country's default by foreign investors.

Russia being a large open economy with its large home market and its special stabilisation funds established in 2006 from the monopolistic revenues of gas and oil export in Europe could support itself during the recessions and mobilise its reserves to support production and services in the aftermath of crises. This could bring down the share of variance of *GAP* associated with *BAA-AAA* shocks instead of increasing the variance of *GAP* associated with endogenous shocks. In particular there was a significant

increase in the share of variance of *GAP* associated with interest rate spread shock as a proxy for banking sector efficiency and competitiveness.

Now let's move to the analysis of endogenous shocks. Interestingly, Table 1.5 shows an increase in the share of the variance of *GAP* associated with *LR* shocks in the aftermath of crises for eleven of the thirteen countries analysed. This is what we could expect from definition 1. In the aftermath of crises the external cost of credit, r_i^* increases as a result of a liquidity crunch and other country shocks generated endogenously. This increased a risk premium that could raise the price of money and therefore have a greater affect on the demand for inputs and economic activity than say in equilibrium.

The fall in the share of the variance of *GAP* associated with *LR* shocks for Hungary and Latvia signifies a secondary role of endogenous shocks compared to shocks originated from international financial markets during crises. These countries have suffered most amongst the New EU member states during the Global financial crises appealing to IMF and other financial institutions. It's still disputable whether any financial tightening was applied in these countries as the real lending rate during the crises was very low and sometimes negative. At the same time we can clearly observe an increased share of variance of *GAP* associated with *BAA-AAA* shocks and *GAP* shocks itself for Hungary and Latvia in the aftermath of shock.

Therefore, the channels of exogenous and endogenous shocks to *GAP* within the period of 2007-2009 were different across the countries. This could be explained by heterogeneous structure of Eastern and Central European economies being analysed, as well their reliance on internal or external financial resources and the activity of multinationals.

It remains true that during the fourth part of 2007 and first half of 2008 (that is, in the immediate aftermath of the financial crisis), exogenous shocks rather than

endogenous shocks had important impacts on business activity for such countries as Poland, Czech Republic, Slovakia, Hungary, Latvia and Estonia. Transition countries are successfully integrating into the EU and reforming its legal institutions. Those countries, where the institutional reforms have been weak experienced a higher share of variance of the *GAP* associated with a shock from *LR*.

The results contrast between the models described in Table 1.4 and Table 1.5, particularly in a dramatic decrease in the share of variance of *GAP* associated with its own shocks in the aftermath of crises when the business activity seems to be more affected by financial and credit risks.

Table 1.5: Generalised variance decompositions of "Cyclical component of output" in the aftermath of crises

Country	Months	Model B (VAR) 2007:M9- 2009:M9					
		Percentage of variance associated with historical shocks from:				Δ, BAA-AAA*, %	Δ, LR **, %
		GAP	LR	DS	BAA-AAA		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Poland	1	74.99	5.57	19.42	0.00	0.00	5.54
	6	21.43	24.82	9.55	44.18	32.22	19.42
	20	16.33	30.00	10.40	43.25	28.78	24.30
Czech Republic	1	84.75	0.73	14.40	0.00	0.00	0.67
	6	53.51	2.77	20.02	23.69	17.24	2.28
	20	48.13	3.19	18.85	29.81	21.32	1.23
Slovakia	1	80.58	19.11	0.29	0.00	0.00	18.75
	6	17.44	20.05	27.75	34.75	33.75	19.61
	20	11.93	14.10	26.07	47.89	36.75	8.66
Hungary	1	78.00	5.81	16.18	0.00	0.00	4.34
	6	66.82	4.86	18.10	10.20	2.62	-6.63
	20	54.94	5.45	12.60	27.69	16.82	-34.00
Lithuania	1	43.41	53.93	2.66	0.00	0.00	52.98
	6	18.46	48.90	22.26	10.36	6.07	47.16
	20	11.53	79.19	7.43	1.84	-3.22	74.23
Latvia	1	80.29	0.00	19.70	0.00	0.00	-1.74
	6	57.23	2.68	7.28	32.79	1.84	-9.57
	20	55.15	3.14	5.58	36.11	9.34	-21.44
Estonia	1	59.14	0.92	39.93	0.00	0.00	-0.5
	6	51.51	3.71	40.29	4.47	-1.27	0.33
	20	32.78	15.53	35.14	16.53	9.35	11.81
Slovenia	1	34.72	12.24	53.03	0.00	0.00	6.71
	6	8.96	54.98	30.70	5.34	-11.78	26.01
	20	8.77	55.00	30.64	5.57	-15.79	29.82
Romania	1	97.11	2.72	0.15	0.00	0.00	1.69
	6	74.63	10.43	12.83	2.10	-37.48	7.00
	20	65.98	16.51	12.54	4.96	-38.61	6.56

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bulgaria	1	81.68	6.33	11.98	0.00	0.00	3.83
	6	46.99	17.46	30.92	4.61	4.03	8.07
	20	36.44	25.71	32.56	5.26	-4.66	15.68
Croatia	1	32.49	32.88	34.62	0.00	0.00	28.83
	6	11.82	54.94	25.95	7.28	5.65	49.58
	20	4.35	76.72	11.39	7.52	5.60	71.02
Russia	1	45.69	4.07	50.22	0.00	0.00	0.36
	6	27.11	7.66	60.69	4.52	-11.59	5.22
	20	26.97	8.12	60.39	4.50	-15.27	4.02
Ukraine	1	98.56	1.38	0.05	0.00	0.00	-0.08
	6	45.84	35.88	9.56	8.70	1.15	31.54
	20	42.50	39.98	8.78	8.71	0.43	26.67

Notes: These decompositions are based on the same assumptions as Table 1.4. However, variance decompositions in the Model IVAR 2007-2009 are obtained for the period of financial crises from September 2007 to September 2009. Standard -error in each series are based on 1000 Monte Carlo repetitions. The models are estimated with two lags instead of 4 lags in Table 1.4 using monthly data from 2001:M1 through 2009:M9 for the period of time from 2007:M9 through 2009:M9 respectively.

*Column (7) is calculated as the difference in the share of variance of GAP associated to a shock to BAA-AAA in the Model B (IVAR) for 2001-2007 (Table 1.4) and column (6) in Table 1.5.

**Column (8) is calculated as the difference in the share of variance of GAP associated to a shock to LR in the Model B (IVAR) for 2001-2007 (Table 1.4) and column (4) in Table 1.5. Source: Author's calculations.

1.7. Conclusion

Due to a rather new methodology and relatively unresearched area of applications, findings of this paper are twofold: methodological and empirical. On the methodological side, it is possible to formulate effective algorithms for solving large models with cross-section augmentations, generating results which might add more to the knowledge of the modelled systems and markets than the traditional vector autoregressive algorithms.

The paper shows that, for multi-country modelling, the links through the real lending rates, intermediation spread, US corporate bond yield spread and output gap are feasible and lead to interesting empirical results. In this context, the Chudik and Pesaran (2007, 2009 and 2010) cross-country augmentations seem to behave well even if the principal limit assumptions (large cross-country dimension and lack of dominance) are violated. The cointegration relationships was not modelled here, as for the newly established countries like Croatia, Latvia, Lithuania, Estonia, Ukraine and other, or

substantially transformed Russia, the long-run relationships have time to develop (Charamza et al. 2009).

Regarding the empirical findings of the impact of external and domestic shocks on output fluctuations in transition economies of Central Eastern Europe and Russia, output sustainability to exogenous and endogenous shocks was estimated and the length of the period was identified when a country's economic activity is more likely affected.

Variance decompositions and impulse responses corrected for cross-country interdependence demonstrated that output gap associated both with *BAA-AAA* and *LR* shocks is growing faster in short horizons, which signifies an immediate impact of a shock to business activity in the economies analysed. Furthermore, the impact of external shock as an indicator of external investor's risk-aversion in the aftermath of crises was clearly higher in 2007-2009 compared to 2001-2009 for the majority of the countries. The exceptions are Slovenia, Romania and Russia. This could be explained by the existence of internal financial reserves and large domestic market for borrowing and lending for Russia and deeper integration into EU markets with following up foreign direct investment in Slovenia and Romania.

It's worth noting that exogenous shocks associated with a decrease of a risk appetite to a greater extent than the endogenous shocks were a threat to economic sustainability causing the reduction in *GAP* in a short run for such countries as Czech Republic, Hungary, Latvia, Lithuania, Russia and Slovenia; in a long run for Estonia, Poland and Slovakia. For Romania and Bulgaria, countries which recently joined the EU the effect of exogenous shock on *GAP* was positive flagging it's higher integration with the European rather than world financial and credit markets.

There are two trends to be investigated further. At face value the results suggest that on average between September 2007 and October 2009, movements in *GAP* (its

cycle component) for New EU Members were mostly associated with shocks originating from outside the country. For the non-EU countries, where the institutional and market reforms have been weak, and that dependant on output fluctuations in the Russian market, movements in *GAP* were mostly associated with endogenous shocks. I joined to the voices questioning the effectiveness of financial constraints in countries where financial market and banking sector reforms have been week. These countries appear which is more sensitive to endogenous shocks with higher reliance on internal funds.

Heterogeneity in the effect of domestic shocks on output fluctuations could be also explained by the existing differences in credit channels, dependence on international funding, country's initial conditions, economic structure, degree of market openness, economic competitiveness and resources, political regime and others institutional factors that affect capital mobility.

Finally, the experience of transition economies in the 2000s and in the aftermath of crises provides new challenges, requiring policy-makers to reassess the understanding of the transmission mechanism and the size of exogenous and endogenous shocks from financial markets to real economic activity. Further research might be focused on the policy implications of the results obtained as well as bickering over whether further rescue packages for transition economies proposed by IMF and the European Central Bank (ECB) in recession make sense.

Chapter 2. Self-employment across European cities[11]

2.1. Introduction

The importance of entrepreneurship as a driving force in economic development has been widely recognised. Entrepreneurs substantially contribute to job creation, generate and disseminate innovative ideas, increase competition and enhance economic efficiency and productivity (Acs and Armington, 2004a, 2004b; Cohen and Klepper, 1992; Audretsch and Thurik, 2004). 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. The 2003 Green Paper outlined the need and the strategy of building up an entrepreneurial society[12]. The Europe 2020 strategy has further re-emphasized this, viewing knowledge, innovation and entrepreneurship as the key drivers for smart, sustainable and inclusive growth[13].

In the identification of entrepreneurial activity as an important driver of economic growth, a growing number of empirical studies have focused on explaining variation in entrepreneurial activity at various spatial levels with the majority of them taking either a cross-country perspective or looking at the inter-regional differences. More recent studies

[11] This essay is the result of collaboration with Dr. Julia Korosteleva from SSEES, UCL (UK) during my part-time work at SSEES, UCL (2009-2010). In this essay I attempted to introduce my own contribution to the joint paper Belitski, M., and Korosteleva, J., 2011. Entrepreneurial activity across European cities. *Frontiers of Entrepreneurship Research, 2010* "Babson College Entrepreneurship Research Conference 2010".

[12] Additional materials are available at http://ec.europa.eu/services_general_interest/green_en.htm

[13] Additional materials are available at http://ec.europa.eu/europe2020/index_en.htm

on entrepreneurship have shifted their focus to examining cross-city variation in entrepreneurship (Acs et al. 2008; Glaeser and Saiz, 2003; Grilo and Thurik, 2005; Glaeser, 2007), attributing urban success to a more abundant supply of entrepreneurship (Chinitz, 1961; Porter, 1990; Saxenian, 1994; Glaeser, 2007).

However, given limited city-level data availability, scarce work has been undertaken so far on cross-city entrepreneurship within the spatially oriented entrepreneurship research in the context of Europe. Some scholars, notably, Acs et al. (2008), Bosma and Schutjens (2007, 2009) have attempted to bridge this spatial level gap. Acs et al. 2008 explore differences in entrepreneurial perceptions and entrepreneurial behaviour across 34 world cities, including a number of European cities, using Global Entrepreneurship Monitor data. Their work demonstrates that the gap between the prevalence of individuals who have positive perceptions to opportunities and to their own capabilities of setting up a business and involvement in entrepreneurial activity is larger for European cities than for Anglo-Saxon ones. The authors associate this gap with higher opportunity costs for entrepreneurship in these cities. They offer two possible explanations for this: (1) entrepreneurial intentions in European cities are lower comparing to cities of Anglo-Saxon countries; (2) European cities offer a plenty of good job opportunities. While their paper provides a rich comparison of the characteristics of new entrepreneurial activity (nascent entrepreneurs and entrepreneurs in young businesses) across world cities, it falls short of providing testable implications for variation in entrepreneurship across these cities. Grilo and Thurik (2005) explore the determinants of entrepreneurial activity in the US; later Bosma and Schutjens (2009) explore the determinants of entrepreneurial activity at a larger level of regional aggregation in Europe, also using the Global Entrepreneurship Monitor (GEM) data[14].

[14] They largely use the NUTS1 spatial level data.

Based on the same dataset, they also draw important distinctions between low and high ambition entrepreneurship, finding little regional variation in the latter as compared to the former paper of Bosma and Schutjens (2007). Given the fact that not all entrepreneurial activities equally contribute to economic growth, distinguishing between low and high ambition entrepreneurs has important policy implications, in particular in the light of the Europe 2020 strategy aimed at targeting economic growth and productivity improvements via promoting creativity, innovation and entrepreneurship.

Altogether, despite a growing number of spatial-oriented studies of entrepreneurial activity in Europe, to our best knowledge no empirical studies testing the importance of various city characteristics, business / institutional environment for entrepreneurial entry have yet been undertaken at the level of European cities using the European Urban Audit Survey fairly unique dataset. Our paper aims to fill this gap.

This paper investigates variation in entrepreneurial activity across European cities. More specifically, by harmonizing city indicators for 31 European countries, based on Urban Audit Survey data, we undertake a panel data study of how various demographic, educational, socio-economic, business / institutional and industrial characteristics affect self-employment in 374 European cities during the period of 1989-2010[15].

We use the rate of self-employment as a proxy for entrepreneurial entry. In enormous number of empirical studies self-employment is often interchangeably used with entrepreneurship (e.g., Parker 2004; 2009). Self-employment is seen as an operative concept which for the first time has allowed more direct integration of entrepreneurship into economic theory (Congregado, 2008). More specifically, numerous studies have looked at the determinants of self-employment to examine supply of entrepreneurship,

[15] Within this time span the reference years for data collection were 1991, 1996, 2001, 2004 and 2009.

using occupational choice models (Blachflower and Oswald, 1998; Blanchflower, 2000; Blanchflower, Oswald and Stutzer, 2001; Giannetti and Simonov, 2004).

In developed Western economies self-employment has been generally viewed as a desired outcome eventually resulting in business growth and success (Mandelman and Montes-Rojas, 2009). On the contrary according to the dualistic view advocated by Harris and Todaro (1970) the self-employment sector may be seen as stagnant and unproductive and associated with disguised unemployment. Furthermore, with the globalisation and labour deregulation trends self-employment also tends to increasingly capture subordinate employment, making the distinction between employment and self-employment, as traditionally defined, blurred. Respectively, the concept of self-employment has become too broad to capture genuine entrepreneurial activity that further questions whether interchangeability of the both concepts in empirical studies should be taken for granted.

We test the importance of business and institutional environment, agglomeration economies, higher and lower education for entrepreneurial entry, U-shaped relationship between GDP per resident in PPP and self-employment rate as an indicator of both necessity- and opportunity-driven entrepreneurship in the cities as opposed to widely perceived belief of the predominance of the "necessity-push at start-up" self-employment phenomenon. We also look at the role of a city typology and city industrial structure, with a special focus on the knowledge intensive business sectors prevailing in a city proxied by a 'knowledge hub' type, employment in ICT manufacturing and services and other industrial sectors which altogether help further clarify possible entrepreneurial patterns emerging in Europe. Based on our findings and the results of the impact of institutional and we further develop a discussion of whether self-employment in the context of European cities can serve as an adequate measure for genuine entrepreneurship,

associated with recognition of new market opportunities and innovation. This is crucial for policy making.

By using cities as a unit of analysis this study does not only attempt to bridge the city-level gap in empirical research, but it also gives some other advantages such as allowing to focus purely on heterogeneity across urban regions unlike country or regional level studies which analyse both urban and rural regions where entrepreneurship has different characteristics. Furthermore, cities as unit of study are also interesting from the point of economic development, given that about 60%[16] of the global population lives in urban areas. Higher concentration of human capital and spatial proximity of knowledge owners and its potential users, a high degree of cultural, industrial, ethnic and economic diversity in urban areas all suggest that cities play an important role in facilitating economic growth (Florida, 2004; Saxenian, 1994; Acs et al., 2008). Finally, in accordance with urban incubator hypothesis the incidence of entrepreneurship is higher in urban agglomerations (Tödtling and Wanzenböck, 2003). This makes cities a particularly interesting and important unit of analysis for studying variations in entrepreneurial activity.

Above characteristics draw some important conclusions for the possible patterns of entrepreneurship emerging across different types of cities and industries in Europe with further implications for the potential role of entrepreneurship in regional growth patterns.

The paper proceeds as follows. The next section discusses some issues regarding appropriateness of utilising self-employment for capturing entrepreneurial activity. Section 2.3 overviews the literature pertaining to the determinants of entrepreneurship. Section 2.4 describes the data availability, imputation issues and the methodology.

[16] Population Division of the United Nations Secretariat, World Urbanization Prospects: The 2003 Revision, Data Tables and Highlights. Available at: http://www.un.org/esa/population/publications/wup2003/2003WUPHighlights.pdf [27 September 2010].

Empirical results and discussion follow in Section 2.5. Finally, Section 2.6 presents conclusions.

2.2. Self-Employment as a Measure of Entrepreneurship: Some Controversies

A number of scholars associate entrepreneurs with residual claimants such as self-employed or small-business owners (Parker 2009). The category of self-employment has traditionally fallen outside the boundaries of paid employment. The definition of self-employment assumes autonomy in the labour market and income generation via exercising profession or business on individuals' own account[17].

As a measure of entrepreneurial activity self-employment has been extensively used in numerous empirical studies, both at the individual and national levels (Blachflower and Oswald, 1998; Blanchflower, 2000; Blanchflower, Oswald and Stutzer, 2001; Giannetti and Simonov, 2004; Bosma et al., 2005; Clark and Drinkwater, 2010; Doh and Zolnik, 2010; Tervo and Haapanen, 2010). This list goes far beyond the studies listed here. Self-employment is regarded as one of the easiest measures of entrepreneurship to operationalise in empirical research given the widespread availability of data on self-employment worldwide allowing for international comparisons to be undertaken (Parker 2009).

In some instances scholars explicitly acknowledge limitations of self-employment as a measure for entrepreneurship. For example, in his study of cross-city variation of entrepreneurship in the US, Glaeser (2007) shows that in high-skilled manufacturing self-employed account for less than one percent of its labour force that clearly points out to some 'mismatch between the number who are self-employed and the importance of

[17] For further discussion of national contexts and legal differences of the definitions of self-employment see Pedersini and Coletto (2010).

entrepreneurship within an industry'. He claims that this should serve as warning against using the self-employment rate as any kind of definitive measure of entrepreneurship. However, in their majority empirical studies which use self-employment as an operational concept of entrepreneurial activity do not even acknowledge the limitations of the former in terms of its ability to capture genuine entrepreneurship, associated with opportunity recognition and innovation, effectively taking interchangeability between the two concepts for granted.

On the one hand side, in developed Western economies self-employed are often regarded as highly skilled talented individuals who abandon their employment to realize their innovative ideas to introduce new products or make substantial improvements to production processes (Mandelman and Montes-Rojas, 2009). So, in this instance self-employment is viewed as a desired outcome eventually resulting in business growth (ibid.), as evidenced by outstanding success of Ebay, an Internet giant with the current market capitalisation of USD 39.5bln., founded as a sole proprietorship by Pierre M. Omidyar in 1995. As Mandelman and Montes-Rojas (2009) put it further,

The self-employed sector is presumed to be dynamic and populated by 'superstars' who obtain outstanding profits and social influences'...and 'are thought to bring vitality to the economy and decisively contribute to economic expansion' (Mandelman and Montes-Rojas, 2009:1914)[18].

This conceptualization of self-employment associates individual entrepreneurs with innovators and agents of transformative change (Schumpeter, 1939). This view is also compatible with Baumol's definition of productive entrepreneurship which involves the creation of value through realization of innovative ideas in the process of starting and

[18] Their view originates from Rosen's (1981) 'superstar' theory.

growing a profit-making business with a positive net contribution to the economic output (Baumol, 1990)[19].

On the other hand side, according to the dualistic view advocated by Harris and Todaro (1970) the self-employment sector may be seen as stagnant and unproductive. They distinguish between urban employment in the highly productive modern sector, and a stagnant and unproductive informal sector which is largely comprised of the urban unemployed and rural migrants. Here, self-employment may be associated with 'disguised unemployment' (Mandelman and Montes-Rojas, 2009:1914) and it can be regarded unproductive according to Baumol' typology of entrepreneurship (Baumol, 1990).

Mandelman and Montes-Rojas (2009) test both approaches in studying transition patterns from employment and unemployment in the context of developing countries, focusing on the case study of Argentina. They find clear sector segmentation with own-account workers accounting for the majority of self-employed in their sample resembling characteristics associated with dualist approach, while self-employed with employees emerge to be associated with more productive entrepreneurship conforming to the industrialised countries view.

According to Parker (2009) self-employment is a too broad concept and to a greater extent it tends to include individuals who are unlikely to be entrepreneurs by other than risk-bearing criteria. It not only tends to capture unproductive entrepreneurship or low-value-adding business activity, but also to a great extent subordinate employment. Globalisation, technological and structural changes have enabled new forms of self-employment associated with subordinate employment that made the distinction between

[19] Baumol's (1990) major contribution to the development of the theory of entrepreneurship was placing entrepreneurship into the institutional context, arguing that allocation of individual efforts between productive, unproductive and destructive entrepreneurship is largely influenced by an existing system of payoffs.

self-employed and employees blurred. Although industrial reorganisations towards much learner organisational structures have become quite common starting from 1970s, new forms of self-employment have gained more popularity with the recent trends in labour market deregulation, linked to introduction of flexible work and a number of enterprises shifting away from centralisation of their activities to outsourcing and subcontracting certain activities to micro-firms or self-employed workers (Pedersini and Coletto, 2010).

In a number of developed countries these changes have been supported via legislation amendments. For example, in Austria along with the traditional form of self-employment the labour law recently introduced two additional statutory employment relationships where the first one -'free service contract', - is seen as hybrid between standard employment and self-employment and the second one - 'new self-employment' - covers contract workers without a trade licence and freelance workers in some liberal professions (e.g., psychologists, translators etc.).

These more flexible contractual relationships have allowed firms to achieve substantial cost reduction, including in part of eliminating the need to pay employee benefits such as insurance, pension, vacation and sick pay. In periods of economic disturbances such flexible contractual relationships are particularly valuable for firms as they give them some room to respond to external shocks faster and in a more efficient way.

Pedersini and Coletto (2010) report that the incidence of independent work[20] in Europe as of 2007 was higher in Southern or Eastern European countries, including Greece (35%), Romania (34%), Italy (26%), Portugal (25%) or Poland (24%) and lower in Luxembourg (7%), Norway (8%), Denmark (9%)[21]. In all cases they report that self-employment represents at least 50% of all independent work, reaching about 70% in a

[20] Pedersini and Coletto (2010:7) define independent work as the one in which 'all professional situations apart from dependent employment can be grouped'.
[21] The EU average was reported 17% (Pedersini and Coletto, 2010).

number of countries, including the United Kingdom, Czech Republic, Lithuania, Portugal and Slovakia. They define self-employed as 'persons who work in their own business, professional practice or farm for the purpose of earning a profit, and who employ no other persons' (ibid.:7).

Our data also reveals a similar geographical pattern of distribution of the rate of self-employment across European cities (see Figures 1-2). More specifically, cities across Scandinavian countries, UK and France, known for their relatively higher levels of entrepreneurship[22] with a high number of patent applications and income generated by innovative products and services, have one of Europe's lowest self-employment rates, whereas the incidence of self-employment is higher in cities scattered across the Mediterranean European countries, including Greece, Italy and Spain. The fact that self-employment rates in Northern Europe are lower than in Mediterranean countries does not necessarily imply that London, Stockholm, Copenhagen and Oslo are less entrepreneurial than their counterparts in South of Europe, as evidenced by the Global Entrepreneurship Monitor data. It may be the case that ambitious start-ups with high-tech potential and high-growth orientation bypass the stage of sole proprietorship which lacks continuity as a legal form of business and does not give name protection, preferring to incorporate from the early start. Simplification of incorporation procedures and reduction in its cost across European countries can have contributed to this trend. It should be noted that easiness of starting up a business varies across Europe, with Northern European countries in their majority having more favourable starting-up conditions compared to their counterparts in Southern Europe.

[22] See Global Entrepreneurship Reports (GEM), various issues, for some evidence on this. GEM equates entrepreneurship with opportunity recognition and new venture creation (Parker, 2009) which is believed to better capture genuine nature of entrepreneurial activity (Glaeser, 2007), although not without its criticism (Parker 2009). For example, as at 2004 – the last reference year for the UAS data – France, UK and Norway had marginally higher index of total entrepreneurial activity (TEA) (respectively, 6, 6.3 and 7 % of the total adult population than its counterparts in Southern Europe, including Italy, Greece and Spain with respective values for TEA index equal to 4.3, 5.8, 5.2 % of the total adult population.

For example, as at 2004 Norway and Denmark had just five procedures that entrepreneurs had to go through to register a firm with the cost as little as 3.5 and zero percent of income per capita respectively. For Greece and Italy the number of procedures reached 15 and 9 respectively, whereas the cost was as high as 32.7% and 22.1% of income per capita respectively. Furthermore, the formation of company as a form to launch a start-up may also be driven by the recent growth of university spin-offs. Although this trend is more typical for the USA, it has been gaining momentum in some European countries, including United Kingdom, Netherlands, Belgium, Sweden (Sætre et al., 2009). These provisional observations clearly signal out some North-South divide in geographical distribution of self-employment and new venture formation (based on GEM), as well as point out to some divergence between the two concepts, if placed in the perspective of geographical location of cities. In section 2.5 we further test the North-South divide hypothesis.

In the next section we turn to the discussion of the determinants of entrepreneurial activity drawing on extensive literature in the field of urban economics and entrepreneurship, primarily focusing on studies which use the rate of self-employment as a proxy for entrepreneurship, although not limited to these.

2.3. Entrepreneurial Entry: Theoretical Considerations and Hypotheses Tested

Earlier empirical studies on urban economics and entrepreneurship show that a number of factors can be identified as to likely shape cross-city variation. These can be broadly grouped as follows: (1) socio-economic characteristics and city welfare; (2) institutional / business environment; (3) urbanisation economies; (4) geographical characteristics and industrial structure

2.3.1 Socio-economic characteristics and city welfare

This group of factors focuses on the differences in socio-economic and welfare characteristics of cities, including education levels, income per capita, and unemployment.

Drawing on earlier studies (De Wit and van Winden, 1998; Uhlaner, Thurik and Hutjes, 2002; Blanchflower, 2004; Glaeser, 2007; Rosenthal and Strange, 2008) we expect educational attainment to significantly affect entry in entrepreneurship. On average entrepreneurs tend to be more educated than non-entrepreneurs (e.g., Parker 2004; 2009). The positive relationship seems to hold more for studies using other measures of entrepreneurship than the rate of self-employment. Turning to the evidence on the relationship of educational attainment and self-employment, a number of studies find that a higher level of education is associated with lower rates of self-employment (Audretsch et al., 2002; Uhlaner, Thurik and Hutjes, 2002; Doh and Zolnik, 2010). Uhlaner, Thurik and Hutjes (2002) explain this by the fact that individuals with higher education are likely to succeed more in employment. Doh and Zolnik (2010) believe that this reverse relationship may be attributed to a higher risk aversion of individuals with higher education attainment. However, they also offer an alternative explanation arguing that self-employment as a measure of entrepreneurial activity may capture more unproductive entrepreneurship.

Other research also suggests that higher educational attainment is negatively linked to unemployment which is often seen as a push factor behind self-employment, implying that highly educated people are unlikely to become unemployed and therefore to become self-employed in the instance when the latter is driven by unemployment (e.g.,

Audretsch et al., 2002). At the same time, some research shows the positive impact of higher levels of education and entrepreneurial entry, proxied by the rate of self-employment. Glaeser (2007) in his study of cross-city variation of entrepreneurship in the US shows that individuals with the level of school education are 6.9 percent less likely to be self-employed than college graduates, suggesting that 'better educated people could easily have more skills to succeed as entrepreneurs' (Glaeser, 2007). There is also some evidence on education having a cross-regional differential impact on self-employment. For example, De Wit and van Winden (1998) and Blanchflower (2004) find that education is positively correlated with self-employment in the US but it is negatively correlated in Europe. Based on this literature and some controversies regarding the use of self-employment as a proxy for entrepreneurship we postulate our first hypothesis.

Hypothesis 1a: Higher levels of education are more likely to be associated with lower levels of self-employment.

The rate of unemployment is another city socio-economic characteristic that may influence cross-city variation in self-employment. The effect of the rate of unemployment is ambiguous. On the one hand side, it may have a push effect with entrepreneurship being seen as the only available occupational alternative. In this case entrepreneurship is most likely to be necessity-driven and associated with basic low-scale business activities (Mandelman and Montes-Rojas, 2009). On the other hand side, unemployment is a cyclical phenomenon and may simply mirror economic recession and demand deficiency, making entrepreneurial entry unlikely.

Audretsch et. al. (2005) estimated two-equation vector autoregression model for data of 23 OECD countries over a period of 1974-2002 to shed light on the dynamic

interrelationship between self-employment and unemployment rates. They emphasized that, on the one hand, unemployment rates may stimulate start-up activity of self-employed; on the other hand, higher rates of self-employment may indicate increased entrepreneurial activity reducing unemployment in subsequent periods. These two effects have resulted in considerable ambiguities about the interrelationship between unemployment and entrepreneurial activity. Based on this we postulate our next hypothesis.

Hypothesis 1b: Higher rate of unemployment is likely to have a push effect on self-employment.

Following the discussion above, the self-employment could be both necessity-driven, that reflects the scarcity of income earning alternatives and opportunity driven, that reflects self-expression, innovation and readiness to take risk (Baumol, 1990; Scase, 2003; Glaeser, 2007; Mandelman and Montes-Rojas, 2009). At the macro level entrepreneurship literature suggests that entrepreneurial activity varies in countries at different stages of their economic development (Carree et al., 2002, Wennekers et al., 2005). Wennekers et al. (2005) find a U-shaped relationship between the two variables, suggesting that nascent entrepreneurship is high in low-income countries where entrepreneurship is often seen as an alternative for employment. As per capita GDP increases, the rate of entrepreneurial activity falls that may be explained by the emergence of economies of scale. Following the considerations of income stability that can be provided by large domestic firms, many individuals prefer employment to self-employment at this stage.

However, entrepreneurial activity surges again after passing a certain threshold in high-income countries, indicating the accumulation of individual savings which can be used to start a business and economic environment favourable to exploitation of new opportunities. So, unlike the conventional view of predominance of "necessity-push at start-up" (Welter and Smallbone, 2011: 108) following Wennekers et al. (2005) we expect to find the presence of both necessity-driven and opportunity-driven entrepreneurs across European cities:

Hypothesis 1c: The level of income per capita has a U-shaped form with respect to self-employment rate.

2.3.2. Institutional / business environment

The second group of the determinants of entrepreneurship at a regional level establishes the importance of institutional / business environment (Glaeser and Kerr, 2010; Estrin et. al. 2011). Scarce empirical research exists on the effects of various institutional arrangements on entrepreneurship across cities. A well-functioning institutional / business environment is likely to provide incentives to entrepreneurs in pursuing market opportunities (North, 1994). The quality of institutions affects the allocation of entrepreneurial efforts among its various uses such as, for example productive or unproductive (Baumol 1990, 1993). First we look at the institutional quality in a city is from the perspective of the levels of criminality. According to Glaeser et. al. (2010) and Rosenthal and Ross (2010) entrepreneurs will choose the safest location for doing their business. Central to their analysis is the idea that different sectors of the economy will sort into high- and low-crime areas depending on their relative sensitivity

to crime. We expect a negative effect of city criminality on entrepreneurial entry regardless which measure is used to capture it.

Hypothesis 2a: Higher self-employment rates are associated with lower levels of criminality.

Extensive evidence suggests that start-ups typically exhibit a moderately low level of formal external financing, largely relying on self-funding and informal finance, primarily family and friends' funds and investment of other individuals comprising business angels (Korosteleva and Mickiewicz, 2011). Although to a smaller extent, entrepreneurs also tend to use bank loans in financing their ventures. The relationship between financial depth and financial constraints has been widely studied. Developed financial institutions are found to be particularly beneficial for small firms compared to large ones (Barth et al. 2006; Beck et al. 2006; 2008). Accordingly, the size of the formal financial system is expected to be positively related to the use of external financing by start-ups, as a better functioning financial system should ease up borrowing constraints.

Hypothesis 2b: The larger size of the financial sector is positively associated with self-employment.

As far as property rights protection is concerned strong property rights are important not only for high-tech and high-growth entrepreneurship with a strong intellectual property position but also for other forms of entrepreneurship to the extent that in the first place property rights guarantee the status quo via providing crucial security of private property against an arbitrary action of the executive branch of the

government (e.g., Estrin et. al. 2009, 2011). In their study of entrepreneurs' ambitions Estrin et al. (2011) show that property rights protection, proxied by constraints on executives (Polity IV), is found to have positive effect on start-ups with employment expectations between 5 and 10 jobs (at the 5% level of significance), although, as the authors claim, following the Chi^2 test results this effect is not statistically different from the effect of property rights on lower-scale entrepreneurship, including self-employed.

Hypothesis 2c: Strong property protection is associated with higher self-employment.

Hypothesis 2a and 2c are related to risk of expropriation that is created by private parties, therefore those two hypotheses are connected closely.

2.3.3 Urbanisation economies

Local interactions that give rise to agglomeration spillover for entrepreneurship were extensively discussed in Duranton and Puga (2004), Rosenthal and Strange (2003, 2004) and Glaeser et. al, (2010). The proposition that agglomeration economies have a positive effect on productivity and innovation goes back to Marshall (1890). The scale of the urban environment may impact productivity through availability of a larger pool of workers and their skill diversity, co-location of firms across diverse industries, the proximity of customers and suppliers. In agglomeration economies a larger home market essentially increases the returns to innovation and business entry (Agrawal et al., 2008; Gerlach et al., 2009; Simonen and McCann, 2008). So, the incidence of entrepreneurship is likely to be higher in urban agglomerations where entrepreneurs' payoffs are governed by higher technology, knowledge and consumer demand.

Although all these factors are expected to be more important to driving opportunity-based entrepreneurship, we expect urbanisation economies to matter self-employment from the perspective of the proximity of customers and suppliers. The savings benefit of reduced shipping costs to distant consumers is seen as the core agglomerative force of the new economic geography (Fujita et al., 1999). Where customers and suppliers are geographically separate, firms must trade-off distances. In addition to shipment costs, Porter (1990) emphasizes that proximity to higher concentration of customers and suppliers can enhance innovation by increasing knowledge flows about which products are working and what new products are desired, driving more ambitious self-employment. More specifically, our next hypothesis can be formulated as follows:

Hypothesis 3: Urbanisation economies are expected to have a positive impact on self-employment.

2.3.4. Geographical characteristics and industrial structure of cities

City location along with industrial specialisation may significantly influence entrepreneurial entry. Some regions may be better endowed in natural resources which are conducive for the development of certain industries (Glaeser and Kerr, 2010). For example, coastal access is important for fishing industry, ship building or transportation of heavy cargo. Exposition to better natural environments like sea or border proximity, or access to international highways may imply reduction of transaction costs for entrepreneurs, leading to higher entrepreneurial entry (Ellison et al. 2010). Coastal areas and cities with a richer historical background may be better of in terms of tourism with higher share of employment in trade, hotels and restaurants. Closeness to natural

resources, like mines and energy may imply higher employment in mining, manufacturing and energy, rather than high-tech services, leading to larger businesses entry. Business activity and financial intermediation is likely to be concentrated in regional centres of trade and capital cities.

Along with industrial specialisation of a city and its type we expect to see some differences in the rates of self-employment across European regions. More specifically, drawing on Pedersini and Coletto (2010) and some preliminary investigation of our data discussed above, we expect to find some support for the South-North divide control, saying that the rate of self-employment is higher in the South and is lower in the North which can be also seen from the Figures B1-B2.

Furthermore, to test existing theories advocating the importance of cultural differences for explaining spatial heterogeneity in entrepreneurship (Saxenian, 1994) we use special econometric technique called 'Fixed' effect estimation. These cultural differences concern equal gender opportunities to job market, the right to elect and be elected, entrepreneurial culture and established networks. It is particular important to control for time-invariant factors pooling together the data on North and South of Europe. Some Mediterranean countries, including Greece, Italy and Spain still continue exhibiting some features of a patriarchal society, implying the dominance of male rule in some aspects of societal life, such as, for example, political or social ones.

2.4. Data and Methodology

2.4.1 Sample Description

To investigate variation of self-employment across European cities the present study uses fairly new database that the Eurostat and Urban Audit have constructed

together: the European Urban Audit Surveys (UAS)[23] over the period of 1989-2010. The sample covers 374 European cities from 31 European countries[24]. These cities, though varying in size[25], are generally considered to be the most appropriate spatial units for modelling and analysis purposes (Fingleton, 2001, Fisher, 2009). The sample data cover cities located in Western Europe as well as in Eastern Europe.

The UAS data covers cities located in Western Europe as well as in Eastern Europe. Western Europe is represented by 254 cities covering Austria (5 cities), Belgium (7 cities), Cyprus (1 city) Denmark (5 cities), Finland (6 cities), France (33 cities), Germany (40 cities), Greece (10 cities), Ireland (6 cities), Italy (32 cities), Luxembourg (1 city), Malta (2 cities), the Netherlands (15 cities), Norway (6 cities), Portugal (10 cities), Spain (26 cities), Sweden (8 cities), Switzerland (10 cities) and the United Kingdom (31 cities). *Eastern Europe* is covered by 121 cities including Turkey (26 cities) the Baltic states such as Lithuania (3 cities), Latvia (2 cities), Estonia (2 cities), Bulgaria (8 cities), the Czech Republic (14 cities), Hungary (9 cities), Poland (28 cities), Slovakia (8 cities), Romania (14 cities), Slovenia (2 cities), Croatia (5 cities).

The European Urban Audit dataset contains urban audit indicators across various domains specific to our study. These include economic and social aspects, education, demographic characteristics of cities and other indicators used to test our main hypotheses pertaining to entrepreneurial entry at city level. We merge these statistics with institutional country-level data and geographical characteristics of cities to shed some light on the effect of institutional settings on entrepreneurial activity and some spatial

[23] The UAS data were obtained from the Eurostat New Cronos dataset. Available at: http://www.esds.ac.uk [6 June 2011].
[24] In this study we use NUTS3 city level data for Europe.
[25] The population size of cities included in the sample varies from a minimum of 21,277 in Gozo (Malta) to 6,828,168 people in Istanbul (Turkey).

effects of cities. The institutional indicators are derived from the Polity IV data[26] and the data on size of the financial sector is taken from WDI World Bank database. These indicators as well as geographical controls are discussed further in section 2.4.3.

2.4.2 Addressing the Problem of Missing Values: Multiple Imputation Technique

One of the limitations of our dataset is a number of missing values for two of explanatory variables, describing the level of education: proportion of working population qualified 3 and 4 ISCED (Education medium); proportion of working population qualified 5 and 6 ISCED (Education high). We address this problem by using the multiple imputation technique for these two variables only, which originated in early 1970, but has been increasingly used in recent empirical regional research (Blien et al., 2009; Penn, 2009). The core of multiple imputation is that missing values are replaced with multiple sets of simulated values to complete the data. In order to impute data we use a chained equation to be able to use a predictive mean-matching method which cannot be applied if missing values are not monotone missing that is the case here.

We undertake a validity check varying the number of imputations from 50 through 500 to 1000. Most literature suggests that the number of imputations equal to 5 should be sufficient in order to obtain a valid inference (e.g., Rubin, 1987; Stata, 2009). The analysis of imputed datasets reveals that a dataset based on 100 imputations has the most parsimonious fitted MI model with the average relative variance increase due to nonresponse being closer to zero and the reported relative efficiencies being high for all

[26] See Marshall, M., 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 [6 June 2011].

coefficient estimates[27]. Respectively, we proceed our further analysis based on the imputed dataset pooled on the basis of 100 imputations.

Further, we undertake data analysis through the multiplication of imputed data and the pooling of individual analyses using Rubin's combination rules (Rubin, 1987) which allows to correct for standard errors. For this we use the *mi* system for multiple imputation and the estimation of models with multiplied imputed data.[28]

Table 2.1 provides detailed descriptive statistics of the original and imputed samples which have very similar statistical characteristics (skewness, kurtosis, mean, variance, etc.), advocating that the statistical properties of the imputed variables have not changed. Furthermore to make the imputation process more trustworthy and put trust to the confidence levels reported for the coefficients controlling for the effect of education of self-employment, we report the results of Table B3 based on both existing data for education (no imputation) and imputed data which includes education variables been imputed. If the estimation results, signs and significance of the coefficients as well as confidence intervals are robust for two models based on imputed and original data, we can justify the use of imputed educational variables in a dynamic panel data model. Table B3 presents the estimation results (OLS, Fixed and random estimation, between and maximum likelihood estimation) for both imputed and original education variables; it advocates for results been consistent. Once again, only two explanatory variables have been imputed viz. proportion of working population qualified 3-6 ISCED to test the Hypothesis 1a.

[27] These imputation results can be obtained from the authors upon request. For further discussion see Stata (2009).
[28] Multiple imputation package is a major new feature of Stata 11 software.

Table 2.1: Descriptive statistics of existing and imputed data on education

Statistics	Education medium (3-4 ISCED)		Education high (5-6 ISCED)	
	original	imputed	original	Imputed
Smallest percentiles (1%)	15.3	15.3	6.8	6.8
Largest Percentiles (99%)	80.6	81.5	41.8	39.8
Mean	44.99	46.57	22.95	22.00
Std. Dev.	12.38	12.99	7.98	7.58
Median	45.20	46.70	21.8	20.70
Variance	153.45	168.80	63.81	57.51
Skewness	0.07	0.10	0.47	0.61
Kurtosis	3.51	3.52	3.01	3.13
Observations	467	1759	445	1759

Source: Author's calculations

2.4.3. Variable Definitions

Dependent variable

We use the rate of self-employment as our dependent variable to measure entrepreneurship which we extensively discussed in section 2.2. All but eight urban areas have self-employment rates between 32-39 percent during 1989-1993 (1991 is used as reference year here) and 32-36% percent during 2003-2006 (2004 is used as reference year here). In 1989-1993, the standard deviation of self-employment rates across urban areas was 7.71 percent and it was higher than the standard deviation in 2003-2006 – 6.56 percent. Over the same period the mean value of self-employment rate increased from 10.64% in 1991 to 11.10% in 2004.

There is a great variation in the rates of self-employment in our sample, with the rate varying from as low as 1 % in about 23 cities, including Vilnius (Lithuania), Zurich (Switzerland), Poznan (Poland), Bucharest (Romania) and Umea (Sweden) to as high as 44% in Vidin (Bulgaria). Figures 1-2 show distribution of the rate of self-employment across European cities for two periods: 1989-1993 and 2002-2006 reference years. As

discussed earlier in section 2.2 and 2.3, there emerges a clear pattern of North-South divide.

Explanatory variables

At a city level we use a proportion of working age population qualified at level 3-4 ISCED[29] to capture medium level of education and a proportion of working age population qualified at level 5-6 ISCED to capture high level of education. To measure the level of income we use GDP per capita in PPP and a square of GDP per capita in PPP suggesting support for the U-shape relationship between self-employment and per capita income. The rate of unemployment is defined as the ratio of the number of unemployed workers to total labour force. The level of criminality is proxied by a number of crimes per 1000 inhabitants in a city.

To capture agglomeration effects we use a number of cars per 1000 city inhabitants and a number of residents as a city size controls.

To be able to control for the type of industrial specialisation of a city and heterogeneity of business activities across them we include the proportion of employed in the NACE sector (AB, CE, GH, JK and LP). These five broad industry sectors facilitate our analysis of different industries' specialisation to factors affecting differences in self-employment rates across European cities. Industry codes are based on the most recently reported The NACE code system[30] (see Table 2.2).

[29] ISCED stands for International Standard Classification of Education of the UNESCO. For further details see http://www.fernuni-hagen.de/FTB/telemate/database/isced.htm.

[30] NACE stands for "Nomenclature Generale des Activites Economiques dans I`Union Europeenne" (General Name for Economic Activities in the European Union). It's the European standard for industry classifications introduced in 1970. The most recent version from 2008 is based on "International Standard Industrial Classification of all economic activities" (ISIC) of the United Nations.

Table 2.2: Industry classification

Sector	NACE
Agriculture and fishery (NACE A)	A. Agriculture, forestry and fishing
Mining, manufacturing and energy (NACE B-E)	B. Mining and quarrying C. Manufacturing D. Electricity, gas, steam and air conditioning supply E. Construction
Trade, hotels and restaurant (NACE G-I)	G. Wholesale and retail trade; repair of motor vehicles and motorcycles H. Transporting and storage I. Accommodation and food service activities
Financial intermediation and business activity (NACE J-K)	J. Information and communication K. Financial and insurance activities
Public administration, health and education (NACE L-P)	L. Real estate activities M. Professional, scientific and technical activities N. Administrative and support service activities O. Public administration and defence; compulsatory social security P. Education

Source: Author's calculations.

Among our institutional variables at a country level we use the Polity IV's constrains on executives as a proxy for property rights protection which is the most appropriate measure to capture protection of citizens against expropriation by the government and powerful elites (e.g., Acemoglu and Johnson, 2005). This element of property rights protection is broader than protection of intellectual property rights. To the extent that the latter gives protection from expropriation of intangible assets by rivals, it may be not be relevant for self-employed who are more likely to be involved in basic low-value adding or unproductive business activity.

We use domestic credit to private sector (% of GDP) to measure the availability of formal finance and a size of a financial sector in European countries. These data are obtained from the World Bank 'World Development' Indicators.

Finally, at a city level we introduce a "knowledge hub" city type dummy obtained from the State of European Cities Report. This variable originated on the basis of various city characteristics such as size, economic structure, economic performance and other drivers of competitiveness (EC, 2007) and together with proportion of employed in ICT

manufacturing and ICT services is used as a control for high-value added entrepreneurial activity. Among city types we also distinguish between Europe's International hubs, represented by knowledge hubs, established capitals and reinvented capitals, and specialised poles, including national service hubs, transformation poles, gateways, modern industrial centres, research centres and visitor centres, which were not included in a model[31]. Table B1 provides variable definitions and descriptive statistics, while Table B2 shows the correlation matrix between urban audit indicators, 'World Development' Indicators and institutional variables pertaining to this study.

2.4.4. Methodology

We use the following model to examine the determinants of entrepreneurial entry in a panel of 374 cities over 5-year averages (1989-1992; 1993-1996; 1997-2001; 2002-2006; 2007-2010) of the data:

$$S_{it=} \beta_1 S_{it-1} + \beta_2 X_{it} + \beta_3 Z_{it} + u_{it} \quad (2.1)$$

$$u_{it} = v_i + e_{it} \quad (2.2)$$

where i denotes a city (i=1, ….374) and t - the time period (t=1,..,5); S_{it} is our self-employment rate and S_{it-1} is its lagged value (predetermined variable). X_{it} is a vector of potentially endogenous variables, namely GDP per resident in PPP, GDP per resident in PPP squared, domestic credit to private sector (% of GDP) and the rate of unemployment. Z_{it} is a vector of strictly exogenous control variables listed in Table A1. The error term u_{it} consists of the unobserved city-specific effects, v_i and the observation-specific errors, e_{it}.

[31] For detailed description of each city type and city classification see EC 2007.

To estimate equation (2.1) we use the System Generalised Method of Moments (SYS GMM) estimator (Arellano and Bover, 1995; Blundell and Bond, 1998)[32]. The choice of this estimator is determined by the need to address some econometric problems which may arise from estimating equation (2.1). These include (1) the problem of potential endogeneity of some of our regressors, notably GDP per resident in PPP, rate of unemployment and domestic credit to private business to GDP (%); (2) the presence of predetermined variables - the lagged dependent variable S_{it-1} that gives rise to measurement error as it is correlated with past errors; (3) the presence of fixed effects which may be correlated with the repressors; (4) our finite sample of T=5. SYS GMM allows the predetermined and endogenous variables in levels to be instrumented with suitable lags of their own differences (Roodman, 2006). Tables B4 report the SYS GMM results and discuss a set of instruments used for levels and differences equations.

The System-GMM derived from the estimation of a system of two simultaneous equations, one in levels (with lagged first differences as instruments) and the other in first differences (with lagged levels as instruments). This is grounded within the panel data autocorrelation (unit root) concepts. In multivariate dynamic panel models, the System-GMM estimator is shown to perform better than the differenced-GMM when series are persistent (β_1 close to unity) and there is a dramatic reduction in the finite sample bias due to the exploitation of additional moment conditions (Blundell et al., 2000).

Results reported in column Table B4 allow us to conclude that the results obtained from the System GMM model 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 provides the lower bound) and OLS (which provides the upper bound); (b) there is gain in efficiency; (3) the instrument set is valid as evidenced from Hansen test of

[32] For the detailed discussion of System GMM estimator see Roodman (2006).

overidentified restrictions; (4) all variables of interest have expected signs viz. consistent on the estimated coefficients in Table B3.

Before estimating System–GMM type model we employ linear panel data techniques (such as Pooled OLS, Fixed, Random, Between effects estimators and Iterative MLE estimator) with sophisticated diagnostic tests on random effects, heterogeneity and endogeneity issues in a panel of 374 cities to examine the determinants of entrepreneurial entry and compare the results obtained on the imputed dataset (column 1-5 of Table B3) and on the original dataset (column 6-10 of Table B3). The comparison of regressions results based on imputed and original dataset (see Table B3) will enable us to speak about credibility of results and prove that the estimated coefficients and confidence interval are the best we could get. The self-employment (S) equation in Table B3 to be estimated is as follows:

$$S_{it=} \beta_0 + \beta_1 X_{it} + \beta_2 Z_{it} + u_{it} \quad (2.3)$$

where β_0 is a constant term; i denotes a city (i=1, ….374) and t - the time period (t=1,..,5); S_{it} is our self-employment rate. X_{it} is a vector of our potentially endogenous variables, namely GDP per resident in PPP, GDP per resident in PPP squared, domestic credit to private sector (% of GDP) and the rate of unemployment. Z_{it} is a vector of strictly exogenous control variables listed in Table B1. The error term is identical to equation (2.2).

2.5. Empirical Results and Discussion

2.5.1. Control sample findings

This section discusses our empirical findings using the imputed and a control (original) database. Table B3 reports estimation results based on both imputed (column 1-

5) and original datasets (column 6-10) for educational variables, while Table B4 reports the results of System GMM estimation based on imputed dataset only. Model specification in columns 1-5 of Table B3 and column 6-10 of the same table has provided us with the identical results on the sign, statistical significance and confidence intervals of the coefficients estimated with a few exceptions mentioned below.

Table B3 shows the Pooled OLS, Between, Within, Maximum Likelihood estimator for the slope coefficients along with their standard errors. The Between and Random effects estimates are different from the 'Within' estimates and a Hausman test based on their difference favoured Random effects (feasible GLS estimates). On beneath of the Table B4 feasible GLS and MLE estimates of the regression coefficients are reported along with the corresponding estimates of rho, σ_e and σ_v for two models. The values of rho, σ_e and σ_v between IMLE and feasible GLS estimates (RE) are not different. LR test that the variance of random effects component in the error term equals zero is strongly rejected in both models based on imputed and original dataset. Same is true for the F-test computed by 'Within' estimation with the same null (the variance of random effects component in the error term equals zero) which demonstrated the presence of random effects in the error term in both models (column 1-5 and column 6-10). A fraction of variance due to random effects (rho) is consistent across IMLE and RE estimators and varies between 0.75-0.78 for the imputed model (column 1-5); between 0.81-0.83 for the control model 2 (column 6-10).

Next, Breusch's (1987) iterative maximum likelihood estimation is performed (IMLE). This procedure converged to a global maximum in two to three iterations depending on whether one started from the 'Between' or 'Within' estimators. There is not much difference among the feasible GLS estimates or the iterative MLE and they are all close to the 'Within' estimates. This is understandable given that theta for these

estimators is close to 1 in both models (0.65 in imputed model and 0.69 in original model).

There are few notes to be made about two models: residents control, criminality and executive constraints and year dummy (year 4) are not significant in original model, but are significant in the imputed model, although the signs of the coefficients and the confidence intervals are overlapping. This could be explained by the lower number of observations in the original dataset model due to inclusion of the original educational variables. Once original educational variables are included the number of observations drops from 324 to 168. We conclude, that we can trust the results of a regression (column 1-5 of Table B3) and the confidence intervals of coefficients and, therefore, the conclusions related to hypothesis testing using more advanced panel data technique such as System GMM in a model that includes two imputed explanatory variables on educational attainment (described in details in the next section).

2.5.2. System GMM estimation

Table B4 reports estimation results based the three models used, notably pooled OLS estimation (column 1); fixed effects estimation (column 2) and System GMM (column 3) with lagged dependent variable. Neither the basic Hansen test of over-identifying restrictions nor the Difference Hansen test, which focus on the additional instruments validity, used by the System GMM estimator detect any problems with instrument validity, which allows us to consider that SYS GMM is the most efficient and robust estimation (Arellano and Bond 1991). Further particulars of SYS GMM estimation are provided on beneath of the Table B4. All variables of interest in the Table B4 (column 3) have expected signs viz. consistent on the estimated coefficients and

confidence intervals from Table B3 (columns 1-5). Given superiority of SYS GMM estimation (as discussed in the previous section) we proceed our further discussion primarily based on the results reported in column 3 of Table B4.

Although we find that higher-educated labour and percentage of employed in ICT services have a negative effect on self-employment (Hypothesis 1a) signalling the prevalence of low-value added self-employment, we also support our *Hypothesis 1c*, suggesting a U-shaped relationship between the self-employment rate and income level proxied by GDP per resident in PPP.

The percentage of residents with high level of education (5-6 ISCED) and self-employed are strongly and negatively related both in Table B4 and B3, that contradicts the conventional empirical findings viewing higher education as a strong predictor of entrepreneurial entry with some evidence of its positive effect on the rate of self-employment as its measure too (Glaeser, 2007). The results follow the hypothesis one with lower levels of self-employment are more likely to be associated with higher human capital and more advanced levels of education (Hypothesis 1a). However, this finding conforms to other studies which find a negative relationship between higher education attainment and the rate of self-employment (Doh and Zolnik, 2010).

At the same time, the U-shape GDP per capita in PPP relationship suggests the prevalence of both necessity- and opportunity-driven entrepreneurship in the region unlike commonly believed predominance of "necessity-push at start-up" (Welter and Smallbone, 2011). These results are also consistent with Wennekers et al., (2005). The coefficient are marginally significant (at 20% significance level) in Table B4 oppose to Table B3 significant at 1%, however they do have an expected sign. An inflicting point calculated on the basic of column 3 (Table B4) enables us to speak about a threshold of GDP per resident in PPP of NUTS3 viz. 21578 euros, when individuals switch from

necessity- to opportunity-driven entrepreneurship. As far as we can see, this number is higher than the medium GDP per capita in PPP viz. 19800 euros and is also higher the mean of GDP per resident in PPP viz. 21156 euros. There are few cities in the Central and Eastern Europe establishing opportunity driven start-ups with a mean value of GDP per resident in PPP 11183 euros. Amongst the cities with the GDP per resident in PPP viz. more than 21578 euros are Eastern European capitals: Bratislava, Bucharest, Budapest, Ljubljana, Prague, Riga, Tallinn, Vilnius, Warsaw and one city in the Western Poland viz. Poznan. Cities with the GDP per resident in PPP less than 21578.56 euros could be also found in the Western Europe with a major part of them in the South of Europe. Based on the geographical characteristics and as a follow-up of Pedersini and Coletto (2010) discussed in section 2.3 we found, as expected, support for the South-North divide, saying that the rate of self-employment is higher in the South and is lower in the North of Europe.

We find that unemployment is negatively related to self-employment, however is not statistically significant (see column 3 Table B4), suggesting that self-employment is likely to be associated with 'disguised unemployment' which does not support out Hypothesis 1b. Turning back to the results of Table B3 we can speculate that entrepreneurship is not necessity-driven and associated with basic low-scale business activities (Mandelman and Montes-Rojas, 2009) with the coefficients being positive and statistically significant. On the other hand side, we believe that unemployment is a cyclical phenomenon and may reflect economic recession and demand deficiency, making entrepreneurial entry unlikely; the effect could also be mitigated through tightening generous welfare protection. Furthermore both effects could cancel out with the coefficients being weakly significant what we get.

While controlling for the impact of urbanisation economies on self-employment rate across European cities we find that it is largely explained by the number of residents and a number of registered cars, used a proxies for economies of scale. Our findings provide some evidence for our agglomeration hypothesis where self-employment develops as the result of urbanisation economies (Table B4).

Analysing the causal impact of business and institutional environment on entrepreneurship as in Rosenthal and Ross (2010) we fail to support the Hypothesis 2a as we find that the coefficient of crimes is positive, but not significant. For the Eastern Europe this could be explained by a necessity driven character of self-employment irrespectively of the quality and safety of business environment. For the Western Europe this effect was expected to be negative as in Table B3, that provides an explicit evidence of the negative relationship between the number of crimes and self-employment rate and indicates that self-employed prefer safer location for doing business.

We investigate the effect of formal finance availability on self-employment. Bygrave (2003) argues that while informal financing is accessible to all entrepreneurs, formal finance plays a more significant role for 'star' firms, such as high-growth entrepreneurs, high-technology firms and export-oriented small firms, leaving no other choice for less-ambition and necessity driven entrepreneurs as to rely on self-financing or informal finance. We support the Hypothesis 2b of the negative effect of formal finance availability for self-employment (Korosteleva and Mickiewicz, 2011). The results are also consistent with the Table B3 and suggest that the size of formal financial system fails to play any significant role in driving self-employment, moreover it discourage low-value added start-ups. The latter may imply for Western Europe that bank finance is likely to crowd out informal finance in Europe, which is (1) better developed than in Eastern Europe; (2) and widely used by start-ups.

We also find that a property rights system strongly determinants the rate of self-employment as expected (Hypothesis 2c). The effect of property rights is strong in both Table B3 and B4. While the trend of self-employment becoming increasingly used as a form of subordinate employment is more typical of Western European cities, it more remains associated with individual entrepreneurship, as traditionally defined, in their Eastern counterparts, where in its majority it is necessity-driven with self-employment being seen as the only alternative of income earning (Korosteleva and Mickiewicz, 2011). Out findings are also in line with the crucial role of property rights providing security of private property against an arbitrary action of the executive branch of the government or criminality emphasized by Estrin et. al. (2011), which links our Hypothesis 2c and 2a.

The overview of industrial characteristics of cities enabled us to control for heterogeneity in self-employment rates with fishing and agriculture industry encouraging self-employment entry and mining, manufacturing and energy sector discouraging self-employment, where large business with positive returns to scale dominates. We also find positive effect of trade, restaurants and hotel industry on self-employment rates estimated in Table B3 with positive and marginally significant coefficient in Table B4. Employment in public administration, healthcare and education has no significant impact on self-employment, although the coefficients estimated are positive. Regarding a city typology, we fail to support the importance of knowledge intensive business sectors in a city captured by a city type dummy associated with knowledge hub on self-employment rates (Table B4). This advocates again for low-value added entrepreneurial activity across European cities (EC 2007) with a small share of self-employment in knowledge intensive industries. The period dummies implemented in Tables B3 and B4 do not make us suspect a structural break in the data over time.

2.6 Conclusion

Our key result in this study is that some specific city features emerging as significant determinants of self-employment, notably higher level of human capital and prevalence of self-employment in South Europe, along with insignificance of knowledge intensity, as proxied by a city type dummy 'knowledge hub', leads to perception of that self-employment in the context of European cities captures more a low-ambition, low-value added entrepreneurship. At the same time our key findings suggest that the relationship between self-employment and GDP per resident is U-shaped, with cities exhibiting higher rates of entrepreneurial activity when income level is low, advocating therefore the prevalence of necessity-driven entrepreneurship. However, as city income grows, the rate of self-employment falls suggesting the likely emergence of economies of scale and larger start-ups providing better returns and income stability. Finally, self-employment surges again hitting the 21578 euros GDP per resident in PPP inflicting point, being largely associated with the accumulation of individual savings that can be used for launching new businesses and economic environment favouring exploitation of new opportunities.

Our results also show the importance of entrepreneurial networking, business co-location and better institutional environment for self-employed with a positive effect of agglomeration economies leading to intensified exchange of knowledge and ideas between entrepreneurs. Furthermore, we find some marginal support for a formal finance availability disincentivising entrepreneurial entry, and better property rights protection including combating crimes, enhancing it.

One of the strong determinants of this study is that the Urban Audit Survey data allows to control for industrial characteristics of urban areas which sheds some light on

whether incidence of self-employment is higher in low-skilled industries or high-skilled high-value adding industries. We find that self-employment is mostly concentrated in trade, restaurants and hotels industry, fishery and agriculture with a low rate of self-employment in mining, manufacturing and energy, ICT manufacturing and service where the emergence of economies of scale provide better returns to investment.

For robustness check of our results the use of an alternative measure of entrepreneurship, such as, for example, proportion of new businesses registered, could have been beneficial to see if there is any differential effect of education, city type and business / institutional characteristics of cities on self-employment vis-a-vis new businesses registered. This will be a part of our future research.

Nevertheless, the key message from our study remains clear. In the light of more intensified trends of organisational downsizing and labour deregulations, the concept of self-employment has become too broad and it captures both genuine and necessity-driven entrepreneurship, and in the context of Europe it should be treated with caution rather than simply be taken for granted in studies on entrepreneurship. Additional controls should always be included in a model attempting to explain variation in self-employment rates viz. income per capita in PPP, education attainment, industrial characteristics of cities and city typology. Given that not all types of entrepreneurial activities equally contribute to economic growth, in the light of the Europe 2020 strategy the role of self-employment should not be overstressed in targeting economic growth in low income per capita cities, as higher rates of self-employment there are less likely to drive productivity improvements via promoting creativity and innovation.

Chapter 3: Entrepreneurship and cities: Evidence from Post-Communist World [33]

3.1. Introduction

Over the past three decades small firms have been credited with playing a much more important role in the economy than had been previously assumed (Acs and Audretsch 1990, Acs et. al. 2008). First, small businesses have become a driving force behind the technological change and innovation (Schumpeter 1939, Audretsch and Thurik, 2004). Through exploring new opportunities they are responsible for generating much of the market turbulence and creating the mechanism of regeneration (Marshall, 1920). Second, small firms increase competition and provide diversity among firms through newly created niches (Brock and Evans 1986, Storey and Johnson, 1987). Third, they emerge as an important engine behind job creation (Birch 1987, Acs and Armington, 2004).

Acknowledging the positive relationship between entrepreneurship and economic development, a growing number of empirical studies have focused on explaining variation in entrepreneurial activity at various spatial levels with the majority of them taking either a cross-country perspective or looking at the inter-regional differences. More recent studies on entrepreneurship have shifted their focus to examining cross-city variation in entrepreneurship, attributing urban success to more abundant supply of entrepreneurship (Acs et al., 2008, Glaeser 2007, Glaeser et. al 2010, Glaeser and Kerr 2009, Bosma and Schutjens 2007, 2009).

Acs et al., 2008 explore differences in entrepreneurial perceptions and entrepreneurial behaviour across 34 world cities using Global Entrepreneurship Monitor data. While their paper provides a rich comparison of the characteristics of new venture

[33] This essay is the result of collaboration with Dr. Julia Korosteleva from SSEES, UCL (UK) and is the final draft of our joint paper Belitski, M. and Korosteleva, J. (2011) Entrepreneurship and cities: Evidence from post-communist world, WIFO Working Papers, 2011. I attempted to introduce my own contribution.

creation across world cities, it falls short of providing testable implications for variation in entrepreneurship across these cities. Bosma and Schutjens (2009) explore the determinants of entrepreneurial activity at a larger level of regional aggregation in Europe, distinguishing also between low- and high-ambition entrepreneurs. Belitski and Korosteleva (2011) explore how various demographic, socio-economic and geographical characteristics of European cities and institutional country-level settings affect entrepreneurship, proxied by the rate of self-employment, in 377 European cities during the period of 1989-2006. They find that in the context of European cities self-employment captures low-value-adding business activity at best or simply reflects the emergence of new types of subordinate employment which have little to do with opportunity-driven entrepreneurship and knowledge intensive services. These results hold largely true for both East European cities and West European ones, although there is some weak evidence that knowledge-hub cities seem to exhibit positive relationship with self-employment in the latter.

Despite a growing number of spatial-oriented studies of entrepreneurial activity worldwide Belitski and Korosteleva (2011) are the first who attempted to explain variations of entrepreneurship across Western vs. East European cities by this providing some insights on whether cities of transition economies are any different from their Western counterparts in terms of factors driving their entrepreneurial activity. Their finding support the role of institutions, notably property rights protection, and the size of the financial sector, play less prominent role in Eastern European cities compared to its Western counterparts.

Estrin and Mickiewicz (2011) show that transition economies generally exhibit lower rates of entrepreneurship than observed in most developed and developing market economies. They argue that this difference is even more pronounced for the

Commonwealth of Independent States (CIS) compared to Central and Eastern Europe (CEE). Despite the fact that small businesses have steadily become to play a more important role in urban economics of transition, there is still an obvious scarcity or virtually no existence of research in this field in the context of transition economies. The scarcity of cross-city research in the context of the region can be attributed to a number of reasons, including lack of data; prevailing thinking and planning at a larger level of space aggregation such as municipality (rayon) and beyond; existence of different approaches to measuring entrepreneurial activity across transition countries.

This paper investigates variation in entrepreneurial activity, proxied by the logarithm of small businesses, across 98 cities located in seven CIS countries, namely Russia, Ukraine, Belarus, Moldova, Georgia, Armenia and Azerbaijan, during the period of 1995-2008. By using cities as a unit of analysis the aim of this study is twofold: to bridge the city-level gap in empirical research on entrepreneurship in the CIS; to focus on urban heterogeneity in entrepreneurship unlike the regional one. Regional level studies deal both with urban and rural areas, and in this setting entrepreneurial activity has different characteristics. Furthermore, in accordance with urban incubator hypothesis the incidence of entrepreneurship is higher in urban agglomerations (Tödtling and Wanzenböck, 2003). Small firms benefit the most from positive spatial, agglomeration and knowledge spillover effects (Saxenian, 1994). As evidence shows areas with a larger number of small- and medium-sized firms have always tended to do better. Some examples include Detroit, Boston and Silicon Valley businesses, and a recently emerged hub of high-tech start-ups in the New York City, which according to a study by market research firm CB Insights placed New York second to Silicon Valley in high-tech innovations[34]. This list also includes London with a 'Tech City' in its East part, dubbed

[34] Financial Times, Life and Arts, 2010. Lighting in a bottle. October 30/Sunday October 31, 2010.

Silicon Roundabout, which emerged in 2008 as a cluster of internet start-ups and which is expected to stretch from Shoreditch to the 2012 Olympic games site farther east, and which is expected to strongly contribute to city success and social cohesion (The Economist, 2010). Unsurprisingly, while looking for ways to boost employment and growth of their cities, local authorities among others focus on boosting private sector developments, and even more so entrepreneurship. A better understanding of the determinants of entrepreneurship in the context of cities can help guide a more efficient policy-making.

To investigate variation of entrepreneurship across CIS cities we utilise 1995-2008 dataset collected during 2009-2010 from the Offices of National Statistics in the aforementioned countries. We employ an advanced econometric technique, the System Generalised Method of Moments (SYS-GMM) technique, to estimate our model. This allows addressing a number of econometric problems, including potential endogeneity of some of our regressors; the presence of predetermined variables; and the presence of fixed effects which may be correlated with the regressors.

Our findings suggest that heterogeneity in entrepreneurial activity across CIS cities is largely explained by a U-shaped per resident income, advocating the prevalence of both necessity- and opportunity-driven entrepreneurship in the region as opposed to widely perceived belief of the predominance of the "necessity-push at start-up" phenomenon. For further overview of the literature see Welter and Smallbone (2011). Our results also show the importance of concentration of higher-education institutions in cities which may provide some indirect evidence for the importance of agglomeration economies in terms of higher concentration of knowledge which may lead to intensified exchange of ideas driving opportunity-based entrepreneurship. Finally, we find some

marginal support for larger size of local authorities disincentivising entrepreneurial entry, and for progress in banking reform enhancing it.

The paper proceeds as follows. The next section discusses the specifics of entrepreneurship development in transition economies. The following section focuses on the determinants of entrepreneurial activity and formulates hypotheses. The two subsequent sections discuss data and methodology, and empirical results, whereas the last section concludes.

3.2. Entrepreneurship developments in Transition economies

The fall of the Berlin Wall in late 1989 marked the beginning of transition of socialist countries to a market economy. The near simultaneity of regime changes often contributed to the perception that the former Soviet republics and the CEE countries by and large fit a common model of post-socialist transition, in which differences mainly lie in the degree or sequencing of market-oriented reforms. Stabilization and liberalization programmes accompanied by structural reforms appeared to shape transition in CEE and CIS countries from a planned economy to a market economy. The reality of transition has proven more complex than it was viewed at the beginning, revealing some differences in initial conditions and institutional developments that played substantial role in defining the success or failure of transition.

One of the issues facing transition countries at the early start was the need to develop a private business sector, which occurred through small-scale privatisation and the creation of new businesses from scratch (de novo firms). Despite a number of hardships, including economic instability, institutional deficiencies, lack of public support and hostile social attitudes towards entrepreneurship, de novo firms experienced

exponential growth in the early 1990s, driven by abundant market opportunities which were suppressed under the communist system, and the lack of governmental regulations. Along with this the transition experience offered some unique institutional opportunities for entrepreneurship to develop.

Institutions, viewed as norms and rules both formal and informal, may simultaneously enhance entrepreneurial activity and constrain it (North, 1990). The institutional context will also affect allocation of individual efforts between various types of entrepreneurial activities whether these are productive, unproductive or destructive (Baumol, 1990). While regulation may hinder prospects of one entrepreneur, it can open opportunity for another. In the early years of transition weak institutional environment benefited various organised criminal groups that following Baumol's typology (1991) could be regarded as destructive entrepreneurs. However, institutional loopholes have created opportunities not only for destructive or unproductive entrepreneurship to flourish, but they have also led to a surge in productive entrepreneurship, for example, formally registered business consultancy firms rendering some advice in acquisition of permits and licenses. Following Welter and Smallbone (2011) "the consultancy firms that developed to fill institutional gaps were not gray sector enterprises but some of the most innovative and successful firms in the business services sector"[35].

One of the peculiar features of transition economies in terms of private sector development is that entrepreneurship there has predominantly been viewed as necessity-driven at start with a large proportion of small business traders being seen as proprietors opting for satisfying their direct consumption needs rather than opportunity-based

[35] To illustrate this Welter and Smallbone (2010) discuss a case study the owner of a successful business involved in managing and letting advertising hoarding space in Minsk, Belarus, who was considering opening a coffee shop rather than expanding her key business. She explained this referring to business expansion strategy of 'being too risky because her successful enterprise was beginning to attract too much attention of the wrong sort".

entrepreneurs oriented towards business growth (Scase, 2003). Glinkina (2003) advocates that since the primary function of a proprietor is survival, proprietorship as unlikely to initiate dynamic growth in transition countries. At the same time Scase (2003) acknowledges that both proprietorship and entrepreneurship are dynamic categories and not rigidly defined, implying that it is possible for proprietors to turn into entrepreneurs and vice versa. Aidis et al., (2004) advocates a more dynamic view to be adopted which emphasizes the learning capacity of individuals over time, in particular where high levels of human capital are involved, as well as improvements in business environment as the two factors likely to enable changes in the aspirations of individuals and their ability to spot and exploit new entrepreneurial opportunities.

By the mid-late 1990s, after tremendous initial explosion in new business formation, the majority of transition economies experienced a declining trend (Kontorovich, 1999, Radaev, 2003) that was largely explained by more rigid regulatory environment, increasing levels of competition, scarcity of financial resources and weak institutional environment (Radaev, 2003; Aidis, 2005). According to Geroski (1995) this trend is consistent with stylised facts on firms' entry, where the entry rate peaks early in the life of a market, but declines later with the survival rate of most entrants being low. Furthermore, this can be explained by the natural cause of economic development where entrepreneurship declines with increase in the level of income reflecting the emergence of economies of scale with individuals preferring income stability, while being employed by larger firms, over risky business initiatives (Wennekers et al., 2005). It picks up again as the income level passes a certain threshold with the trend being normally driven by accumulation of financial resources which can be directed towards launching a business, and improvements in business environment, offering new opportunities for entrepreneurial development (ibid.).

On average transition economies exhibit lower rates of entrepreneurial activities compared to other developed and developing economies which is even more true for the CIS compared to Central and Eastern Europe (Aidis et al., 2008). Estrin and Mickiewicz (2011) attribute this to the negative effect of the legacy of communist planning, which needs to be replaced with formal market-supporting institutions. They further argue that along with the establishment of formal institutions, it is necessary to develop new informal institutions, in particular to rebuild the generalised trust. Estrin and Mickiewicz (2011) see the longer prevalence of the communist rule, leading to a lack of institutional memory, as one of the reasons why entrepreneurship rates vary between CIS states and their CEE counterparts. Following, Schwartz and Bardi (1997) they posit that "time spent under communism is associated with the prevalence of a system of norms and values not conducive to generalized trust which is a prerequisite to entrepreneurship". The prevailing conditions of surveillance and detailed monitoring of citizens triggered distrust that was often in contradiction to the official ideology promoting cooperation and trust (ibid.). The authors conclude that given slow pace of change in informal institutional environment creation rebuilding generalised trust may be delayed until after full generational change.

In this paper we go on to explore variation in entrepreneurship across CIS cities looking at the role of various socio-economic and demographic characteristics of cities, and structural reforms aimed at establishing market-oriented institutions. Our overarching ambition is to offer a better understanding of the determinants of entrepreneurship in the context of cities that can help guide a more efficient policy-making. In the next section we discuss some literature pertaining to the determinants of entrepreneurial entry and postulate our main hypotheses.

3.3. Entrepreneurial entry: theory, hypothesis and controls

Earlier empirical studies on urban economics and entrepreneurship show that a number of factors can be identified as to likely shape cross-city variation in entrepreneurial activity. These can be broadly grouped as follows: (1) socio-economic characteristics of cities; (2) institutional context; (3) availability of inputs including financial resources; (4) urbanisation economies; and (5) geographic characteristics (Glaeser, 2007, Glaeser and Kerr, 2009).

We first discuss the literature related to our key hypotheses and further proceed with the discussion of other factors (control variables) which are likely to affect entrepreneurial entry in the context of CIS cities, linking them to the groups of factors identified above.

City income level

Income level represents the first group of factors. A wealthier urban environment, associated with higher payoff and larger market potential, is expected to provide more incentives to entrepreneurs in pursuing market opportunities. In their theoretical extension of the New Economic Geography model Glaeser et al. (2010) propose that in an open city the level of (endogenous) entrepreneurship is increasing with demand. The higher levels of per capita income reflect a stronger customer base which in turn should be conducive to entrepreneurial entry.

At the macro level entrepreneurship literature suggests that entrepreneurial activity varies in countries at different stages of their economic development. Wennekers et al. (2005) find a U-shaped relationship between the two variables, suggesting that nascent entrepreneurship is high in low-income countries where entrepreneurship is often seen as

an alternative for employment. As per capita GDP increases, the rate of entrepreneurial activity falls that may be explained by the emergence of economies of scale. Following the considerations of income stability that can be provided by large domestic firms, many individuals prefer employment to business creation at this stage. However, entrepreneurial activity surges again after passing a certain threshold in high-income countries, indicating the accumulation of individual savings which can be used to start a business and economic environment favorable to exploitation of new opportunities.

Following our discussion in the previous section, in the aftermath of the collapse of the Soviet Union, start-ups in the region have been found to be predominantly necessity-driven that reflects the scarcity of income earning alternatives (Scase, 2003, Glinkina, 2003). More rigid regulations coupled with emergence of larger competitive firms have contributed to a decline in new business creation throughout the mid-end of 1990s. However, with market maturing and respective improvement in economic environment to the benefit of entrepreneurship development, new opportunities emerged incentifying individuals to launch growth-oriented businesses. So, unlike the conventional view of predominance of "necessity-push at start-up" (Welter and Smallbone, 2011: 108) we expect to find the presence of both necessity-driven and opportunity-driven entrepreneurs across CIS, with the latter prevailing in wealthier cities. Therefore, our first hypothesis is formulated as follows.

Hypothesis 1: The level of income per capita has a U-shaped form with respect to entrepreneurial entry.

Institutional context

Drawing on the work of North (1990) and Baumol (1991, 1993, 2005) institutions, viewed as norms and rules both formal and informal, may simultaneously enhance

entrepreneurial activity and constrain it. The former occurs via better functioning institutions reducing transaction costs such as, for example, linked to contract enforcement, and via reducing risk associated, for example, with expropriation of private assets either by the state or economic agents. Better functioning institutions consequently enable the economy to move from a 'relationship-based personalised transaction structure to a rule-based, impersonal exchange regime' (Peng, 2003). On opposite deficient institutions characterised by weak rule of law, higher levels of corruption, a lack of property rights enforcement may constrain entrepreneurship, as has been shown in the context of transition economies, including Russia (Aidis et al., 2008, 2010). Furthermore, the quality of the institutional environment affects the allocation of entrepreneurial efforts among its various uses (Baumol, 1990), and some specific entrepreneurial strategies discussed by Welter and Smallbone (2011).

In our analysis, we concentrate primarily on structural reforms enabling establishment of market-oriented institutions. For this we primarily use outcome measures of institutions as defined by Glaeser (2004). More specifically, we use EBRD transition indicators which measure the progress in transition. We look at the progress in banking reform and large-scale privatisation[36]. Along with progress in structural reforms we also look at a size of the state; business regulation, and property rights protection.

The banking sector reform aimed to advance the financial development through the establishment of a two-tier banking system, liberalisation of interest rates and credit

[36] While small-scale privatisation can be more relevant for small business creation, we fail to find any significant effect of it, given that our dataset starts only from 1995 whereas small-scale privatisation has been largely completed in the majority of transition economies by that time. Given nearly 90% correlation between small and large-scale privatisation we had to drop small-scale privatisation from our model. We also tested the significance of competition policy; enterprise restructuring and securities market establishment, failing to find any significant results. In the case of enterprise restructuring the sign of the coefficient with respect to entrepreneurial entry is positive (unlike in the case of large-scale privatisation) that would have provided some support for hypothesis 2b if this effect had been found significant. Given its high correlation with large-scale privatisation we tested its effect separately with the results available from the authors upon request.

allocation, full convergence of banking laws and regulations with Bank of International Settlements standards, and provision of full set of competitive banking services (EBRD, 2010). It is widely acknowledged that more developed financial markets are likely to alleviate borrowing constraints through the wider allocation of savings to potential investment projects and facilitation of the risk management in the presence of information asymmetries and transaction frictions (Levine, 1997). With wider supply of finance and competition, the financial institutions are pushed to choose more challenging financial options including entrepreneurial finance. This is particular topical for transition economies for which scarcity of financial resources is more pronounced than for market economies. Respectively, our next hypothesis postulates:

Hypothesis 2a: Progress in banking reform is positively associated with entrepreneurial entry.

The advancements in *large-scale privatisation* are expected to have an ambiguous effect on entrepreneurship. In many post-communist towns, dubbed "large enterprise-driven" there still prevails a vertically integrated industry which lacks independent suppliers. That makes it difficult for new businesses to sprout. The majority of the working-age population living in such towns are employed by such incumbents with only minimum share of city residents of a working age being engaged in services sector dominated by small firms. Such structural distortions are still typical of the majority of the CIS countries, but even more so for Belarus which is regarded as a laggard in transition. Thus, in Belarus industry, dominated by large-scale vertically integrated enterprises, remains the largest sector of the economy in terms of employment generation and the second largest (after services) in terms of contribution to GDP.

Porter's Five forces model (1979) suggests that among other things the degree of competition in the market depends on the threat of buyers or sellers to integrate backwards and forward. The higher the degree of vertical integration, the more discretion businesses have over exercising their monopoly power. New firms are unlikely to enter the market when either a supplier or distribution network is largely controlled by few incumbents. Bolton and Whinston (1993) develop a model showing (among other findings) that vertical integration increases supply assurance concerns for non-integrating downstream firms. Departing from Chinitz's (1961) study on large integrated firms depressing the external supplier development, Saxenian (1994) argues that the development of independent suppliers, while lowering the effective cost of entry, enhances entrepreneurship. Large-scale privatisation and enterprise restructuring may help facilitate the development of supplier linkages between large and small firms via large enterprises' downsizing and specialization, and so it is likely to enhance entry of new firms. At the same time, large-scale privatisation is expected to drive competition that may force entrepreneurs quit the market (Parker, 2009). In this paper we indirectly test Chinitz's (1961) hypothesis.

Hypothesis 2b: Large-scale privatisation facilitates entrepreneurship to the extent of enhancing independent supplier development

The size of the state has been argued to adversely influence entrepreneurial entry (Aidis et al., 2010). Higher tax income associated with a larger size of the state and higher marginal tax rates for higher earners reduces the expected returns to entrepreneurs and discourages entrepreneurial entry (Parker, 2009). Higher tax income can also be associated with a more generous welfare provision system, implying among other things

higher unemployment benefits. These generous benefits are likely to increase opportunity cost of going into entrepreneurship (Estrin et al. 2011). Accordingly we hypothesize:

Hypothesis 2c: A greater size of the government will discourage entrepreneurial entry

As far as *property rights protection* is concerned strong property rights are important not only for high-tech entrepreneurship with a strong intellectual property position, but well for other forms of entrepreneurship. In the first place property rights guarantee the status quo via providing crucial security of private property against an arbitrary action of the executive branch of the government (Estrin et. al. 2011). It has been shown that strong property rights have a fundamental positive effect on economic activity and entrepreneurship. Acemoglu and Johnson (2005) find that property rights institutions have pronounced effects on investment, financial development and long-run economic growth. Aidis's et al. (2008) empirical account reveals that among various institutional indicators, the property rights system plays the most pivotal role in determining entrepreneurial activity. Johnson et al. (2002) provide evidence that weak property rights discourage entrepreneurs to reinvest their retained profits into business. Based on this we postulate our next hypothesis.

Hypothesis 2d: Strong property rights protection is associated with increase in small businesses

According to the public interest theory, a stricter *business regulation*, requiring a proper screening of new firms will allow for the entry of only those firms which meet

minimum standards for providing a quality product or service that should benefit the society. On the other hand, the public choice theory views regulation as potentially inefficient with industry incumbents being likely to benefit the most. Once they are able to influence the regulation in their favour, incumbents increase their power to the extent that restraints entry of new firms and competition. In their study of the regulation of entry of start-ups in 85 countries Djankov et al. (2002) find that countries with overly regulated business environment have higher level of corruption and larger unofficial economies, providing some supporting evidence for the public choice theory argument. In their majority, empirical studies on business regulation conform to the proposition that overregulated environment inhibits entrepreneurial entry (Grilo and Thurik 2005; Vat Stel et al. 2007). Regulatory constraints are found to be of particular detriment to opportunity-driven entrepreneurship (Ardagna and Lusardi, 2008). On the contrary, lower entry barriers are positively associated with the rate of firm entry (Klapper et al. 2006, Demirguc-Kunt et al. 2006). Respectively, our next hypothesis is formulated as follows:

Hypothesis 2e: More flexible business regulations encourage entrepreneurship

Concentration of knowledge

Our next hypothesis is associated with urbanisation economies. Start-ups are inevitably about new ideas, and the ability of some agglomerated locations to foster new ideas is one of potential reasons why they become centres of entrepreneurship and self-employment. Ideas are often outcomes of 'knowledge intensive environments', i.e. groupings of large and small firms interacting with public research organisation and providers of knowledge intensive services. Spatial concentrations boost entrepreneurship

by supporting the transfer of old ideas and the creation of new ones. Saxenian (1994) argues how the flow of ideas helped to create the entrepreneurial cluster of Silicon Valley. Cities with higher concentration of higher education establishments are more likely to be incubators of new ideas. Furthermore, as part of Europe's agenda to promote sustainable growth via innovation and entrepreneurship, many EU neighbourhood countries, including the majority of the CIS states studied here, embark on promotion of clusters, enhancing also collaboration between small businesses and research institutions. Respectively, we hypothesize:

Hypothesis 3: Cities with higher concentration of higher education establishments are likely to have higher entrepreneurial entry.

Along with the key factors discussed above in this study we also control for other variables which are likely to affect entrepreneurial entry according to theoretical and empirical evidence.

Other controls

Along with the level of income we also consider unemployment as part of socio-economic characteristics of cities as a likely determinant of entrepreneurial entry. The effect of the rate of unemployment is ambiguous. On the one hand side, it may have a push effect with entrepreneurship being seen as the only available occupational alternative. In this case entrepreneurship is most likely to be necessity-driven and associated with basic low-scale business activities (Mandelman and Montes-Rojas, 2009). It is important to note here that necessity-driven entrepreneurship is more likely to take a form of self-employment, implying that the unemployment effect may not necessarily

show up or it may be inversely associated with entrepreneurship when proxied by small businesses. Furthermore, higher tax income can also be associated with a more generous welfare provision system, implying among other things higher unemployment benefits, which could reduce incentives to go into entrepreneurship. Furthermore, unemployment is a cyclical phenomenon and may simply mirror economic recession and demand deficiency, making entrepreneurial entry unlikely.

As part of 'inputs availability' group we control for capital investment to GDP ratio in cities. Although, generally expected to have a positive effect on entrepreneurial entry, the role of capital investment in the context of the CIS may be ambiguous, and 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.

Along with knowledge concentration we also control for other variables associated with urbanisation economies. Local interactions that give rise to agglomeration spillover for entrepreneurship were extensively discussed by Duranton and Puga (2004) and Rosenthal and Strange (2004). The proposition that agglomeration economies have a positive effect on productivity goes back to Marshall (1920). The scale of the urban environment may impact productivity through availability of a larger pool of workers and their skill diversity, co-location of firms across diverse industries, the proximity of customers and suppliers. In agglomeration economies a larger home market essentially increases the returns to business entry (Agrawal et al. 2008; Gerlach et al. 2009; Simonen and McCann, 2008). So, the incidence of entrepreneurship is likely to be higher in urban agglomerations where entrepreneurs' payoffs are governed by higher technology, knowledge and consumer demand. So, respectively urbanisation economies are expected to have a positive impact on entrepreneurial entry.

We also add city geographical controls, including location proxied by latitude and longitude, the size of the market, proxied by the natural logarithm of population density, and distance from Moscow in km. However, given dataset constraints we are now unable to control for industry effects across the cities. This will be incorporated in the future research.

3.4. Data and Methodology

3.4.1. Sample Description

To investigate variation of entrepreneurship across CIS cities we utilise the 1995-2008 data collected from the Offices of National Statistics in Russia, Ukraine, Belarus, Moldova, Georgia, Armenia and Azerbaijan as part of a larger project entitled "Cities: An Analysis of the Post-Communist Experience". Our dataset contains urban audit indicators across various domains specific to our study. These include economic and social characteristics of cities and other indicators used to test our main hypotheses pertaining to entrepreneurial entry at city level. We match city level data with institutional country-level data, derived from the Polity IV data[37] , Heritage Foundation[38] and EBRD transition indicators (EBRD Transition Reports, various issues), and geographical characteristics of cities to shed some light on the effect of institutional settings and city spatial effects on entrepreneurial entry. More specifically, the dataset is represented by 98 cities[39] covering Russia (54 cities), Belarus (6 cities), Ukraine (26 cities), Moldova (1 city-capital), Georgia (5 cities), Armenia (5 cities), Azerbaijan (1 city-capital). These cities, though

[37] See Marshall, M., 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.
[38] For discussion see Beach et. al (2008).
[39] We use city level data similarly to NUTS3 classification.

varying in size[40], are generally considered to be the most appropriate spatial units for modelling and analysis purposes.

3.4.2. Variable Definition

We use a number of small businesses taken in logarithms to measure entrepreneurship. According to national statistical offices small businesses are defined as firms with 50 employees or less (100 employees respectively in manufacturing sector). A number of small businesses as a measure of entrepreneurial activity have been widely used in a number of empirical studies (Parker, 2009). There is a huge variation in the number of small businesses across our sample. The number of registered small businesses is extremely low in Naryan-Mar, Russia, varying from 60 to 165 over the period of 1995-2008, and Nazran, Russia, varying from 128 to 1857 respectively. In 6 out of 98 cities the number of registered small businesses over the 1995-2008 is below a thousand. These cities include Chernigov, Ternopil, Uzhgorod in Ukraine and Elista, Naryan-Mar and Nazran in Russia. At other extreme are Kiev, Moscow and Saint-Petersburg showing high rates of entrepreneurial activity with the number of small businesses reaching more than 40,000 on average over the period of our analysis[41].

To test our *Hypothesis 1* we use city GDP[42] per resident in constant 2005 USD prices obtained from our CIS Urban Audit dataset. To measure the effect of banking reform and large-scale privatisation (*Hypotheses 2a and 2b* respectively) we employ

[40] In our sample city size varies from less than 50,000 such as Gori in Georgia, Naryan-Mar and Nazran in Russia to 10,500,000 residents in Moscow, Russia.

[41] The table showing distribution of the number of small businesses by cities is available from authors upon request.

[42] City GDP is calculated using the proportionate distribution of city population in respective years and applying these as weights to obtain relevant city GDP. To minimise a measurement error, the start and end points of the series have been taken as the means for the first and last 3 years following the approach described at Cheshire and Magrini (2009).

EBRD transition indicators, scored from 1 denoting "little progress" to 4 - "significant progress". To measure the size of the local government we use a city-level indicator, defined as local government expenditure to GDP ratio (*Hypothesis 2c*). For the strength of property rights (*Hypothesis 2d*), we imply the Polity IV measure of efficient constraints on the arbitrary power of the executive branch of the government, named "constrains on executive". It has been argued as the most appropriate measure for protection of citizens against expropriation by the government and powerful elites (Acemoglu and Johnson, 2005). To test *Hypothesis 2e* we use the Heritage Foundation business freedom index (BFI) which measures the rigidity of business regulation. It reflects various barriers to start up, operate and exit business, and it scores from 0 to 100 with 100 denoting the highest degree of business freedom (Beach and Kane, 2008). Finally, we use the number of universities per city obtained from the "Universities in CIS" and "Universities worldwide information resources" databases[43] to test our *Hypothesis 3.* Table C1 reports variable definitions and descriptive statistics, including our control variables. Table C2 shows the correlation matrix between variables used in this study.

3.4.3. Methodology

We use the following model to examine the determinants of entrepreneurial activity in a panel of 98 cities over the period of 1995-2008.

$$S_{it=} \beta_1 S_{it-1} + \beta_2 X_{it} + \beta_3 Z_{it} + u_{it}, \qquad i=1,..., N;\ t=1,...,T \tag{3.1}$$

$$u_{it} = v_i + e_{it} \tag{3.2}$$

[43] For more detailed information please see http://univer.in and http://univ.cc.

where S_{it} is our natural logarithm of the number of small businesses and S_{it-1} is its lagged value (predetermined variable); X_{it} is a vector of our two potentially endogenous variables, namely GDP per resident, the rate of unemployment, and the ratio of capital expenditure to GDP; Z_{it} is a vector of strictly exogenous control variables listed in Table C1. The error term u_{it} consists of the unobserved city-specific effects, v_i and the observation-specific errors, e_{it}.

The dynamic structure of equation (3.1) makes both the OLS and fixed effects estimators upwards and downwards biased respectively, and inconsistent, since the predetermined variable and endogenous variables are correlated with the error term. Therefore, to estimate equation (3.1) we use the System Generalised Method of Moments (SYS GMM) estimator (Arellano and Bond, 1991; Arellano and Bover, 1995; Blundell and Bond, 1998). System GMM derived from the estimation of a system of two simultaneous equations, one in levels (with lagged first differences as instruments) and the other in first differences (with lagged levels as instruments). This is grounded within the panel data autocorrelation (unit root) concepts. In multivariate dynamic panel models, the System-GMM estimator is shown to perform better than the differenced-GMM when series are persistent (β_1 close to unity) and there is a dramatic reduction in the finite sample bias due to the exploitation of additional moment conditions (Blundell et al. 2000).

The use of this estimator allows addressing econometric problems which may arise from estimation. These include (a) the problem of potential endogeneity of some of our regressors, notably GDP per resident, the rate of unemployment and the ratio of capital investment to GDP; (b) the presence of predetermined variables - the lagged dependent variable S_{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) our finite

sample. SYS GMM allows the predetermined and endogenous variables in levels to be instrumented with suitable lags of their own differences (Roodman, 2006).

Therefore, Blundell and Bond (1998) propose another estimator – the System-GMM– derived from the estimation of a system of two simultaneous equations, one in levels (with lagged first differences as instruments) and the other in first differences (with lagged levels as instruments). This is grounded within the panel data autocorrelation (unit root) concepts. In multivariate dynamic panel models, the System-GMM estimator is shown to perform better than the differenced-GMM when series are persistent (β_1 close to unity) and there is a dramatic reduction in the finite sample bias due to the exploitation of additional moment conditions (Blundell et al. 2000).

Furthermore, in system GMM, we include time-invariant regressors (distance, latitude and longitude, dummy for a capital city), which would disappear in difference GMM. Asymptotically, this does not affect the coefficients estimates for other regressors. This is because all instruments for the levels equation are assumed to be orthogonal to fixed effects, thus to all time-invariant variables; in expectation, removing them from the error term therefore does not affect the moments that are the basis for identification (e.g., Roodman, 2006 for further details).

In particular, there is evidence that using results obtained with the System GMM confirm that: the system-GMM lies between the upper and lower bound represented by OLS and 'Fixed' effects estimators; there is a gain in efficiency; and the instrument set is valid.

Whether these three conditions are met, the two-step system-GMM results can be taken as a benchmark for dynamic panel data models (Bond, 2002). Results reported in Table C3 allow us to conclude that the results obtained from the System GMM model 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 provides the lower bound) and OLS (which provides the upper bound); (b) there is gain in efficiency; (3) the instrument set is valid as evidenced from Hansen test of overidentified restrictions; (4) all variables of interest have expected signs.

3.5. Empirical results and discussion

Table C3 reports estimation results based the three models used, notably pooled OLS estimation (column 1); fixed effects estimation (column 2) and System GMM (column 3). Neither the basic Hansen test of over-identifying restrictions nor the Difference Hansen test, which focus on the additional instruments validity, used by the System GMM estimator detect any problems with instrument validity, which allows us to consider that SYS GMM is the most efficient and robust estimation (Arellano and Bond, 1991). Further particulars of SYS GMM estimation are provided on beneath of the Table C3. Given superiority of SYS GMM estimation (as discussed in the previous section) we proceed our further discussion primarily based on the results reported in column 3.

We find strong support for our *Hypothesis 1*, suggesting a U-shaped relationship between the logarithm of a number of small businesses and income level proxied by GDP per resident. These results suggest the prevalence of both necessity- and opportunity-driven entrepreneurship in the region unlike commonly believed predominance of "necessity-push at start-up" (Welter and Smallbone, 2011). These results are also consistent with Wennekers et al. (2005).

Our results also suggest that entrepreneurial entry is positively associated with the progress in banking reform (H2a). To the extent that the banking reform promotes financial development via elimination of financial market frictions, reduction in

transaction costs and risks associated with financing start-ups, it eases borrowing constraints which can be particularly severe for small businesses. Developed financial institutions are found to be particularly beneficial for small firms compared to large ones (Beck et al. 2005). We also confirm our *Hypothesis 2c*, suggesting a disincentifying effect of a larger size of the state on entrepreneurial activity. These results are consistent with earlier empirical studies (Aidis et al. 2010; Estrin et al. 2011).

At the same time we fail to find any support for our property rights hypothesis (H2d). This, perhaps, can be explained by the fact that entrepreneurs choose to respond to institutional deficiencies, in our instance weak property rights protection, via employing various adaptive strategies such as, for example, a strategy of diversification: they choose to invest in unrelated businesses instead of growing their core businesses before "beginning to attract too much attention of the wrong sort" (Welter and Smallbone, 2011). Such strategies impose growth constraints on existing businesses, preventing many of them to exploit economies of scale. We also do not confirm our *Hypotheses 2b,* related to the effect of large-scale privatisation, and *Hypothesis 2e*, related to the rigidity of business regulations. In fact, Aidis et al. (2008) also failed to find any significant effects of start-up entry barriers on entrepreneurial entry.

The find that heterogeneity in entrepreneurial activity across CIS cities is largely explained by higher concentration of higher education establishments (*Hypothesis 3*) that we interpret as some evidence of the importance of agglomeration economies in terms of higher concentration of knowledge which may lead to intensified exchange of ideas via collaboration between small businesses and research institutions and make the human capital to grow. This is an important advancement given some centralisation of research and development activities in the past. Even nowadays the research and development system in some CIS countries (e.g. Belarus, Moldova) still largely reflects the Soviet

legacy with extra-mural R&D organizations not business enterprises remaining the main and often only source of R&D (UNECE 2010). These results also reinforce our findings related to a U-shaped relationship between income level and entrepreneurial entry, altogether suggesting that CIS cities are being more opportunity oriented.

Among our control variables we fail to find some evidence of the significance of market size, proxied by the logarithm of population density, although it fails fairly narrowly to pass the 10%-significance level and it is positively related to entrepreneurial entry. Population density here was also used as a city size control. For robustness check we also experimented with the level of GDP at constant prices as a proxy for market size (while excluding per resident income from this specification). Similarly, with per resident income we introduced a squared term of GDP to capture likely U-shaped relationship between the market size and the logarithm of small businesses. We obtained broadly similar results with all our key hypotheses being confirmed (these results are available from authors upon request). Air pollution, used as another proxy for agglomeration economies proved to be significant and positive related to entrepreneurship. We fail though to find any significant effect of capital investment, distance from Moscow, geographical controls and capital city. Finally, a negative and significant effect of the rate of unemployment is likely to be explained by unemployment mirroring adverse economic conditions or unemployment pushing individuals more into self-employment rather than in business registration, given a burdensome regulation and relatively higher cost of the latter.

3.6. Conclusion

Our key findings suggest that heterogeneity in entrepreneurial activity across CIS cities is largely explained by a U-shaped per resident income, with cities exhibiting

higher rates of entrepreneurial activity when income level is low, advocating therefore the prevalence of necessity-driven entrepreneurship. However, as city income grows, the rate of entrepreneurial activity falls suggesting the likely emergence of economies of scale and larger firms providing better returns and income stability. Finally, entrepreneurial activity surges again after passing a certain threshold, being largely associated with the accumulation of individual savings that can be used for launching new businesses and economic environment favouring exploitation of new opportunities.

Our results also show the importance of concentration of higher-education institutions in cities which may provide some indirect evidence for the importance of agglomeration economies in terms of higher concentration of knowledge and human capital which may lead to intensified exchange of knowledge and ideas driving knowledge-based entrepreneurship. Furthermore, we find some marginal support for a larger size of local government disincentivising entrepreneurial entry, and a banking reform, on the contrary, enhancing it. Our findings have important policy implications. Apart from emphasizing the importance of further advancements in a banking reform crucial for promoting financial development and reduction in borrowing constraints for small businesses, the authorities should also adopt a complex approach in further reforming a taxation system (as part of addressing the larger state size problem) where reduction in tax rates should be coupled with minimising tax inspections and corruptive practices embedded in the "grabbing hand" model of government intervention (Shleifer and Vishny, 1999), which are found to forcing entrepreneurs to adopt strategies constraining business growth of their core businesses. Finally, to promote knowledge-based entrepreneurship the local authorities should concentrate on encouragement of cluster development between universities and local businesses.

Appendix A: Output Sustainability to Exogenous and Endogenous Shocks: Evidence from Emerging Economies

Data Sources and VAR Estimation and Analysis

Data

The data used in this study are at a monthly frequency and cover the period 2001:M1–2009:M9. The variables are measured as follows:

BAA-AAA is the US corporate bond yield spread calculated as the difference between BAA and AAA Moody's corporate bond yields; *LR* is calculated as the nominal lending rate on national currency-denominated loans at a monthly rate minus current monthly inflation, measured by the consumer price index; *DS* is calculated as the difference between the nominal lending rate on national currency denominated loans and the deposit rate on national currency denominated deposits. Same measures of one year nominal lending rate on national currency denominated loans and one year deposit rates on national currency denominated deposits were taken within the countries analysed to ensure cross country consistency; *GAP* measures deviations of output, y, from trend, y_T. y_T is estimated with one sided moving average, using seven lags. Data were obtained from Datastream, International Monetary Fund (International Financial Statistics), National Bank of Ukraine for Ukraine wired http://www.bank.gov.ua/Statist/sfs.htm and Deutsche Bundesbank for Germany wired http://www.bundesbank.de/statistik/statistik_zeitreihen.en.php; Croatian Central Bureau of Statistics for Croatia available at: http://www.dzs.hr/default_e.htm Federal Reserve bank of St. Louis (Economic Research).

IVAR Estimation

Number of Lags: To determine the number of lags we started by using standard lag-length tests, i.e. Akaike information criteria (AIC), Hannan–Quinn (HQ), and Schwarz. We controlled for residuals autocorrelation functions (cross-correlograms) across the lagged variables looking at the behaviour of residuals within the two standard error bans (taken for 24 lags). The choice of a lag length and the test results are likely to be robust, because of an assumption of covariance stationarity of the considered variables. The number of lags chosen is three.

Panel Unit root test

Table A1. Panel Unit root tests (Summary)*

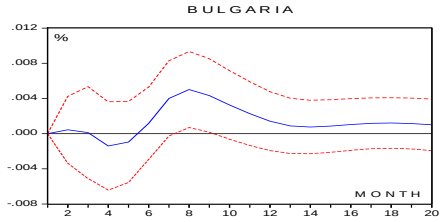
Method	Statistic	Prob.**	Cross-sections***	Number of observations
Levin, Lin & Chu t*	-3.214	0.0007	40	4480
Im, Pesaran and Shin W-stat	-16.516	0.0000	40	4480
ADF - Fisher Chi-square	588.655	0.0000	40	4480
PP - Fisher Chi-square	262.596	0.0000	40	4640

*Automatic lag length selection based on SIC: 0 to 12

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality

*** Number of cross-sections explains 13 countries and 4 variables included in the model. One variable which is US corporate bond yields spread does not vary across the countries, therefore 3*13+1=40. The output of four Panel Unit root tests in Table A1 allows us to reject the null of a unit root in a panel of 13 transition countries. The process is I(0).

Source: Author's calculations.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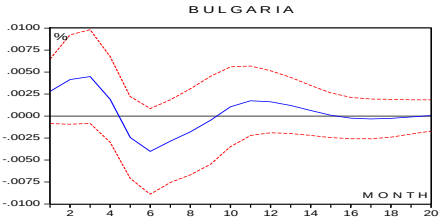
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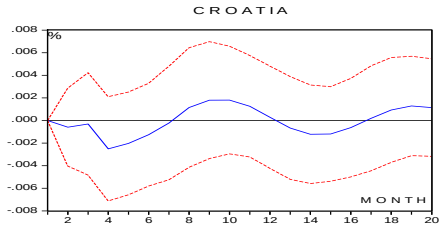
CROATIA
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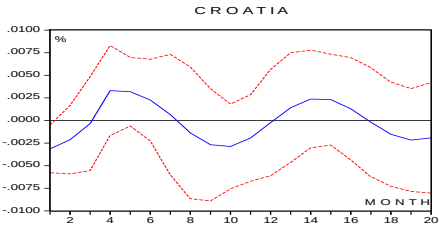
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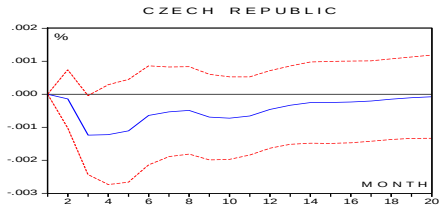
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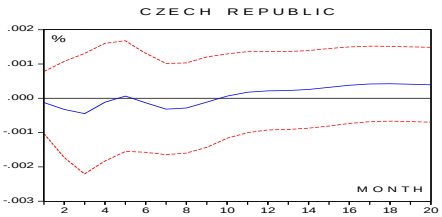
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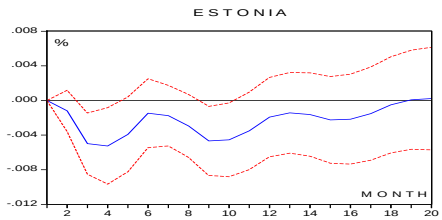
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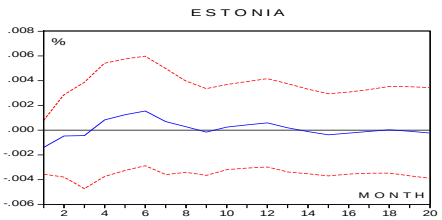
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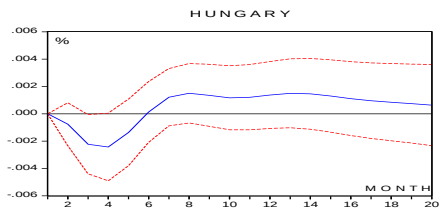
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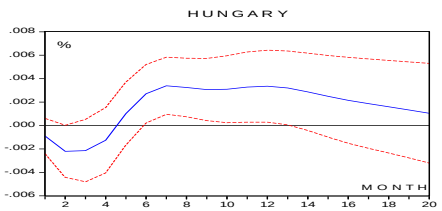
MONTH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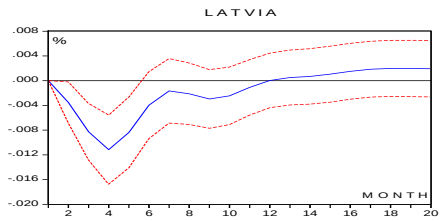
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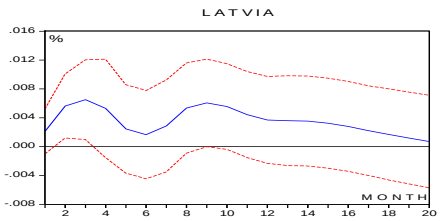
MONTH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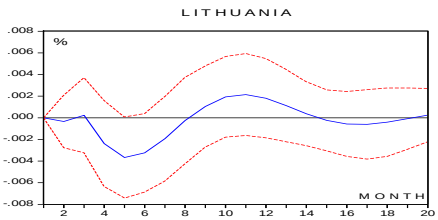
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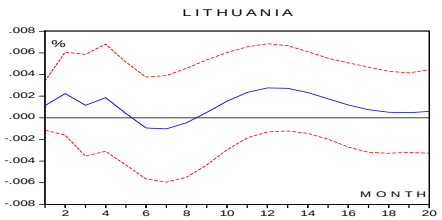
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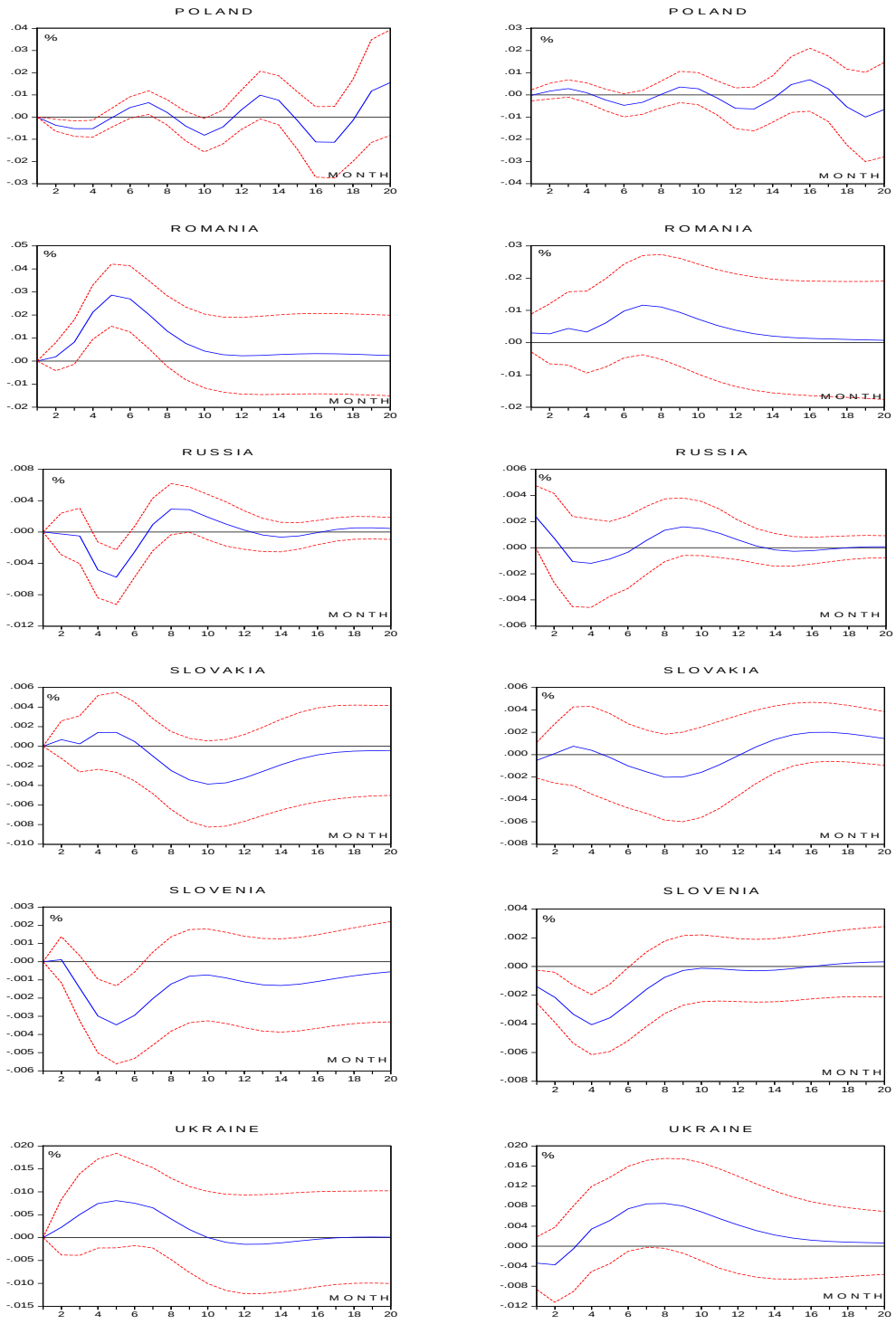


Figure A.1 Generalised Impulse Responses, Output response to historical shock to BAA-AAA (left column) and LR (right column).

Note: The impulse graphs include one-standard-error bands.
Source: Author's calculations.

Appendix B: Self-employment across European cities

Table B1: Descriptive statistics and definitions of the variables

Variable	Definition	Obs	Mean	Std. Dev.	Min	Max
Self-employment	Self employment rate, %	967	11.30	6.13	1.00	44.00
Unemployment	Unemployment rate, %	933	11.17	6.49	1.00	47.40
GDP per capita	GDP per capita in PPP (log)	1268	9.82	0.56	8.01	11.24
GDP per capita^2	GDP per capita in PPP squared (log)	1268	96.73	10.76	64.10	126.36
ICT manufacturing	% Employed in ICT manufacturing	1408	1.07	1.75	0.00	19.90
ICT services	% Employed in ICT services	1288	3.66	3.26	0.00	68.80
Residents	Number of residents (log)	1454	12.37	0.91	10.34	15.99
Education medium (imputed)	Prop. of high school graduates	1759	46.58	12.99	9.40	84.70
Education high (imputed)	Prop. of university / college graduates	1759	22.01	7.58	5.60	53.70
Education medium (original)	Prop. of high school graduates	467	45.00	12.39	9.40	84.70
Education high (original)	Prop. of university / college graduates	445	22.96	7.99	5.60	53.70
Crimes	Number of crimes per 1000 inhabitants	855	79.36	52.25	0.80	364.40
Private credit	Domestic credit to private sector as % of country GDP' obtained from WDI World Bank	1810	79.18	43.67	7.17	213.74
Executive constraints	Polity project. 'Executive constraints' "1=unlimited authority to 7=executive parity"; higher value denotes lower administrative barrier	1853	6.84	0.46	3.00	7.00
Cars	Number of cars per 1000 inhabitants	1011	391.80	124.85	1.40	726.70
NACE A-B	% Employment in NACE A-B	1351	0.01	0.01	0.00	0.18
NACE C-E	% Employment in NACE C-E	1536	0.12	0.06	0.02	0.41
NACE G-H	% Employment in NACE G-H	1541	0.14	0.05	0.03	0.31
NACE L-P	% Employment in NACE L-P	1541	0.22	0.11	0.01	0.73
Knowledge city	1= city type is knowledge hub, 0 otherwise	1868	0.35	0.48	0.00	1.00

Source: European Urban Audit Survey 1989-2010 unless specified otherwise

Table B2: Correlation matrix for urban audit variables

	Self-employment	Unemployment	GDP per capita	GDP per capita^2	ICT manufacturing	ICT services	Residents	Education medium	Education high	Crimes	Private credit	Executive constraints	Cars	NACE A-B	NACE C-E	NACE G-H	NACE L-P	Knowledge city
Self-employment	1																	
Unemployment	0.15*	1																
GDP per capita	-0.04	-0.43*	1															
GDP per capita^2	-0.04	-0.43*	0.99*	1														
ICT manufacturing	0.03	-0.06	0.04	0.04	1													
ICT services	0.14*	0.11*	0.19*	0.19*	0.02	1												
Residents	-0.05	0.00	0.36*	0.36*	0.01	0.28*	1											
Education medium	-0.28	0.34*	-0.38*	-0.38*	0.05*	-0.19*	-0.12*	1										
Education high	-0.25*	-0.30*	0.34*	0.34*	-0.04	0.00	0.15*	-0.07*	1									
Crimes	-0.32*	-0.21*	0.55*	0.55*	0.01	0.03	0.11*	-0.11*	0.29*	1								
Private credit	-0.14*	-0.39*	0.67*	0.66*	-0.04*	0.05*	0.06*	-0.41*	0.22*	0.46*	1							
Executive constraints	0.29*	-0.01	0.10*	0.10*	0.07*	0.06*	-0.05*	-0.11*	-0.16*	-0.01	0.09*	1						
Cars	0.33*	-0.20*	0.30*	0.29*	-0.02	0.19*	-0.09*	-0.45*	-0.05*	0.20*	0.22*	-0.01	1					
NACE A-B	0.08*	0.03	-0.10*	-0.10*	0.08*	0.39*	-0.16*	0.02	-0.16*	-0.11*	0.02	0.05*	0.12*	1				
NACE C-E	-0.11*	-0.25*	-0.18*	-0.17*	0.32*	-0.10*	-0.11*	0.31*	-0.16*	-0.12*	-0.25*	-0.01	-0.13*	0.08*	1			
NACE G-H	0.07*	-0.49*	0.51*	0.51*	0.06*	0.05*	0.11*	-0.38*	0.06*	0.23*	0.52*	0.28*	0.09*	0.02	0.11*	1		
NACE L-P	-0.38*	-0.36*	0.47*	0.48*	-0.03	-0.13*	0.01	-0.11*	0.44*	0.49*	0.49*	0.00	-0.28*	-0.07*	-0.06*	0.51*	1	
Knowledge city	-0.05	-0.03	0.11*	0.11*	0.03	0.09*	0.07*	0.04	0.03*	0.06*	-0.08*	0.05*	-0.19*	0.04	0.01	0.17*	0.14*	1

Note: * - significant at 0.05 level. Source: UAS 1989-2010.

Table B3: Self-employment panel data equation: one-way error component model

	Sample with education variables been imputed					Control sample with education variables been original				
	OLS	FE	RE	BE	MLE	OLS	FE	RE	BE	MLE
Unemployment	0.235***	-0.004	0.164***	0.195**	0.170***	0.170**	-0.043	0.084*	0.089	0.087*
	(0.06)	(0.05)	(0.04)	(0.08)	(0.04)	(0.08)	(0.09)	(0.05)	(0.07)	(0.05)
GDP per capita	-25.04	-13.75	-7.246	-55.79***	-8.798	-62.89**	-35.02	-57.90***	-68.19***	-58.62***
	(15.22)	(12.31)	(9.55)	(17.65)	(9.48)	(24.80)	(34.23)	(14.86)	(17.75)	(14.06)
GDP per capita^2	1.396*	0.536	0.482	2.928***	0.566	3.324***	1.713	3.058***	3.535***	3.096***
	(0.75)	(0.64)	(0.48)	(0.88)	(0.48)	(1.22)	(1.68)	(0.74)	(0.89)	(0.70)
ICT manufacturing	0.042	-0.009	0.013	0.042	0.011	0.069	0.011	0.053	0.041	0.055
	(0.07)	(0.06)	(0.06)	(0.13)	(0.06)	(0.09)	(0.07)	(0.06)	(0.13)	(0.06)
ICT services	-0.162***	-0.142**	-0.140***	-0.092	-0.143***	-0.258**	-0.009	-0.166***	-0.301***	-0.170***
	(0.06)	(0.06)	(0.04)	(0.09)	(0.04)	(0.10)	(0.08)	(0.06)	(0.11)	(0.06)
Residents	0.784*	-11.02***	0.525	0.663*	0.536*	0.490	10.40	0.389	0.350	0.396
	(0.41)	(3.05)	(0.33)	(0.36)	(0.31)	(0.54)	(11.15)	(0.40)	(0.40)	(0.37)
Education medium	-0.047***	-0.004	-0.030**	-0.046	-0.032**	-0.017	-0.009	-0.026	-0.019	-0.025
	(0.02)	(0.01)	(0.01)	(0.04)	(0.01)	(0.04)	(0.09)	(0.04)	(0.04)	(0.04)
Education high	-0.081***	-0.004	-0.038**	-0.170***	-0.041**	-0.148***	-0.063	-0.168***	-0.082*	-0.167***
	(0.03)	(0.02)	(0.02)	(0.05)	(0.02)	(0.04)	(0.10)	(0.04)	(0.05)	(0.03)
Crimes	-0.032***	-0.001	-0.028***	-0.029***	-0.029***	-0.012*	0.002	-0.009	-0.003	-0.010
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Private credit	-0.005	-0.052**	-0.020**	-0.006	-0.019**	-0.018*	-0.127***	-0.029***	-0.011	-0.028***
	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.01)	(0.01)	(0.01)
Executive constraints	1.933***	6.231***	3.112***	2.385***	2.991***	-0.736	--	-0.972	-0.830	-0.949
	(0.58)	(0.95)	(0.50)	(0.88)	(0.49)	(0.86)		(0.77)	(1.03)	(0.72)
Dummy (year 3)	1.418***	2.091***	1.059***	3.821**	1.054***	--	--	--	--	--
	(0.36)	(0.44)	(0.29)	(1.73)	(0.29)					
Dummy (year 4)	0.983**	3.187***	1.047***	2.303	1.008***	-0.236	0.996	0.199	-2.042	0.185
	(0.46)	(0.59)	(0.35)	(1.89)	(0.35)	(0.34)	(0.67)	(0.25)	(1.26)	(0.24)
Dummy (year 5)	0.134	2.709***	0.328	-0.630	0.274	-3.393***	0.785	-0.702	-8.760***	-0.768
	(0.61)	(0.76)	(0.47)	(2.44)	(0.46)	(0.90)	(1.35)	(0.64)	(2.05)	(0.64)
Cars	0.008**	-0.003	0.006**	0.013***	0.006***	0.004	-0.005	0.002	0.008**	0.002
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
NACE A-B	64.37***	55.58**	55.49***	51.59***	56.57***	90.54***	12.32	65.82***	109.3***	67.17***
	(13.73)	(23.99)	(15.90)	(19.30)	(15.19)	(34.45)	(29.12)	(22.41)	(37.24)	(21.63)
NACE C-E	-8.812**	-8.031	-10.47**	-11.70**	-10.20**	-14.91***	-1.378	-16.00***	-12.99**	-15.96***
	(3.78)	(10.32)	(4.92)	(5.63)	(4.63)	(4.88)	(14.93)	(5.54)	(6.26)	(5.16)

NACE G-H	13.45 (8.15)	33.54*** (11.18)	11.84* (6.72)	3.26 (9.21)	11.72* (6.41)	17.44* (10.43)	61.89*** (14.13)	21.86*** (7.26)	11.54 (9.31)	21.37*** (6.95)
NACE L-P	2.074 (2.9)	-5.455 (5.00)	-2.732 (3.41)	3.091 (4.71)	-2.490 (3.27)	-0.038 (4.84)	3.868 (13.86)	0.65 (4.83)	-3.469 (5.00)	0.625 (4.48)
Knowledge city	0.100 (0.46)	--	-0.209 (0.57)	0.194 (0.60)	-0.176 (0.53)	-0.297 (0.58)	--	-0.768 (0.62)	0.196 (0.62)	-0.755 (0.57)
Constant	96.83 (76.21)	192.7** (77.52)	8.620 (46.87)	249.7*** (88.90)	16.32 (46.59)	307.8** (124.97)	63.35 (246.06)	289.5*** (75.13)	340.9*** (87.33)	292.6*** (70.79)
No.obs	324	324	324	324	324	168	168	168	168	168
R-square	0.47	0.56		0.58		0.59	0.60		0.60	
F statistics	19.67	11.07		8.59		29.13	4.02		7.035	
chi2			232.16		184.66			131.51		106.47
Rho			0.78		0.75			0.83		0.81
σ_u			2.18		2.17			1.90		1.91
σ_e			1.13		1.25			0.84		0.89

Source: Authors' calculations based on European Urban Audit dataset 1989-2010, corrected for missing values of medium and high education via multiple imputation technique.

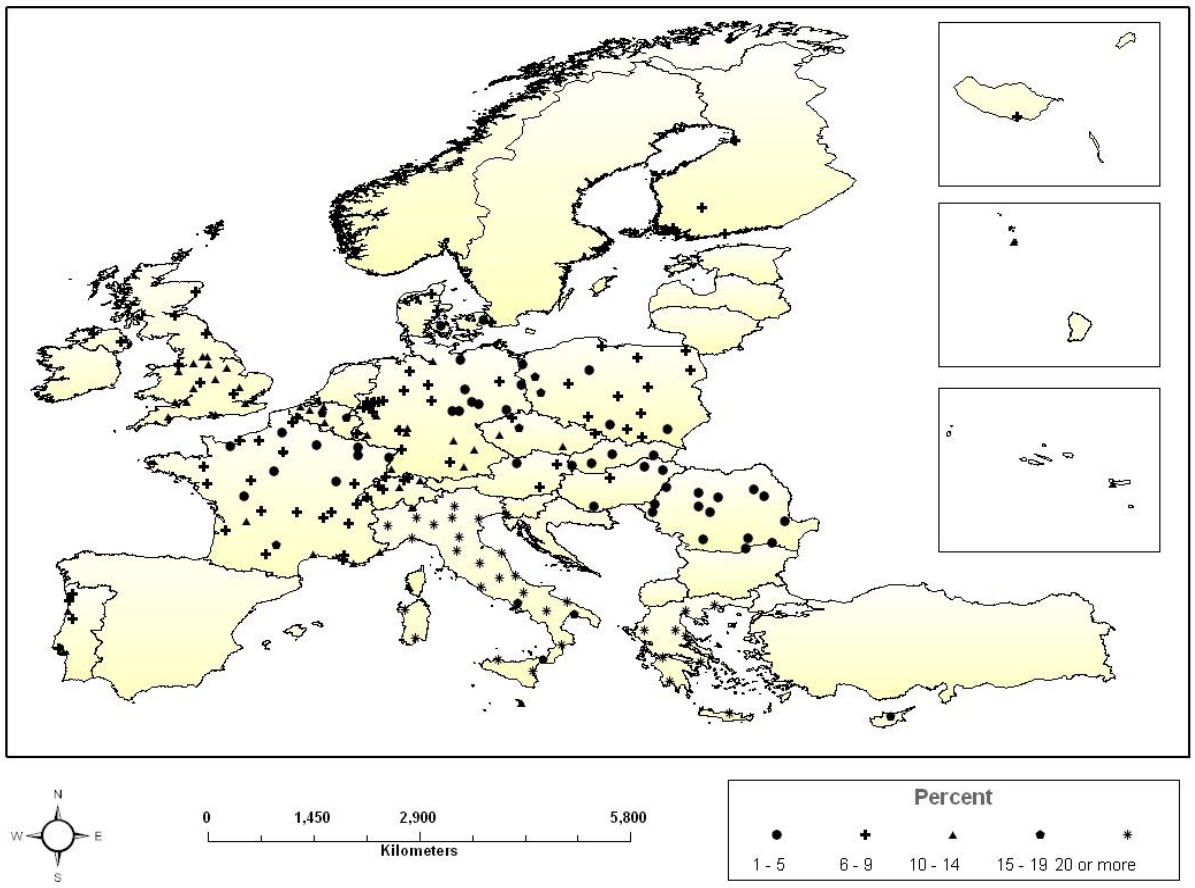
Table B4: System GMM estimation with Pooled OLS and FE control regressions

Dependent variable Sit (Self-employment)			
	OLS	FE	SYS-GMM
Self-employment (1st lag)	0.715*** (0.06)	0.183* (0.10)	0.594*** (0.12)
Unemployment	0.097** (0.05)	-0.039 (0.07)	-0.138 (0.19)
GDP per capita	-8.513 (15.80)	-8.727 (19.05)	-46.87 (35.40)
GDP per capita^2	0.449 (0.77)	0.170 (0.94)	2.34 (1.71)
ICT manufacturing	-0.023 (0.05)	-0.045 (0.06)	-0.008 (0.07)
ICT services	-0.116** (0.05)	-0.122* (0.07)	-0.116** (0.05)
Residents	0.488** (0.24)	-13.08*** (3.90)	0.675* (0.40)
Education medium	-0.017 (0.01)	0.004 (0.02)	-0.029 (0.02)
Education high	-0.037* (0.02)	0.017 (0.02)	-0.073** (0.03)
Crimes	-0.005 (0.00)	0.007 (0.01)	0.003 (0.01)
Private credit	-0.008 (0.01)	-0.070** (0.03)	-0.024* (0.14)
Executive constraints	0.915** (0.40)	5.058*** (1.28)	1.520** (0.64)
Dummy (year 3)	0.617** (0.29)	2.399*** (0.51)	223.168 (179.85)
Dummy (year 4)	-0.166 (0.31)	3.766*** (0.76)	224.402 (179.25)
Dummy (year 5)	-1.205*** (0.37)	3.380*** (0.93)	224.276 (180.06)
Cars	0.004* (0.00)	0.003 (0.00)	0.006* (0.00)
NACE A-B	48.40*** (13.10)	45.78 (28.00)	48.558*** (16.34)
NACE C-E	-4.271* (2.56)	-4.591 (11.68)	-10.415** (4.87)
NACE G-H	7.386 (5.79)	45.92*** (12.61)	-0.640 (8.87)
NACE L-P	1.091 (1.63)	-9.334* (5.32)	3.438 (3.31)
Knowledge city	-0.164 (0.31)	--	-1.132 (0.75)
Constant	30.77 (79.06)	208.2* (113.93)	
No.obs	266	266	266
R-square	0.75	0.67	
F statistics	65.04	11.85	
Number of instruments			35
AR(1)/ AR(2)			0.02 / 0.43
Hansen Test (Prob > chi2)			0.25
Hansen test excluding group			0.21
Difference (null H = exogenous)			0.40

Notes: ***- significant at 0.01; **- significant at 0.05; ** significant at 0.1 Standard errors are in parentheses robust to heteroskedasticity. The figures reported for the Hansen test and Difference Hansen test are the p-values for the null hypothesis, valid specification. Instruments for first differences equation GMM-type [L(2/.).(Self-employment, unemployment, GDP per resident in PPP, GDP per resident in PPP squared, credit to private business)] collapsed. Instruments for levels equation: GMM-type [DL.(Self-employment, unemployment, GDP per resident in PPP, GDP per resident in PPP squared, credit to private business) collapsed and all other regressors, including time controls, used as standard instruments here. Note: the autocorrelation test show that the residuals are an AR(1) process which is what is expected. The test statistic for second-order serial correlation based on residuals from the first-difference equation is not calculated as the time period is less than 5.

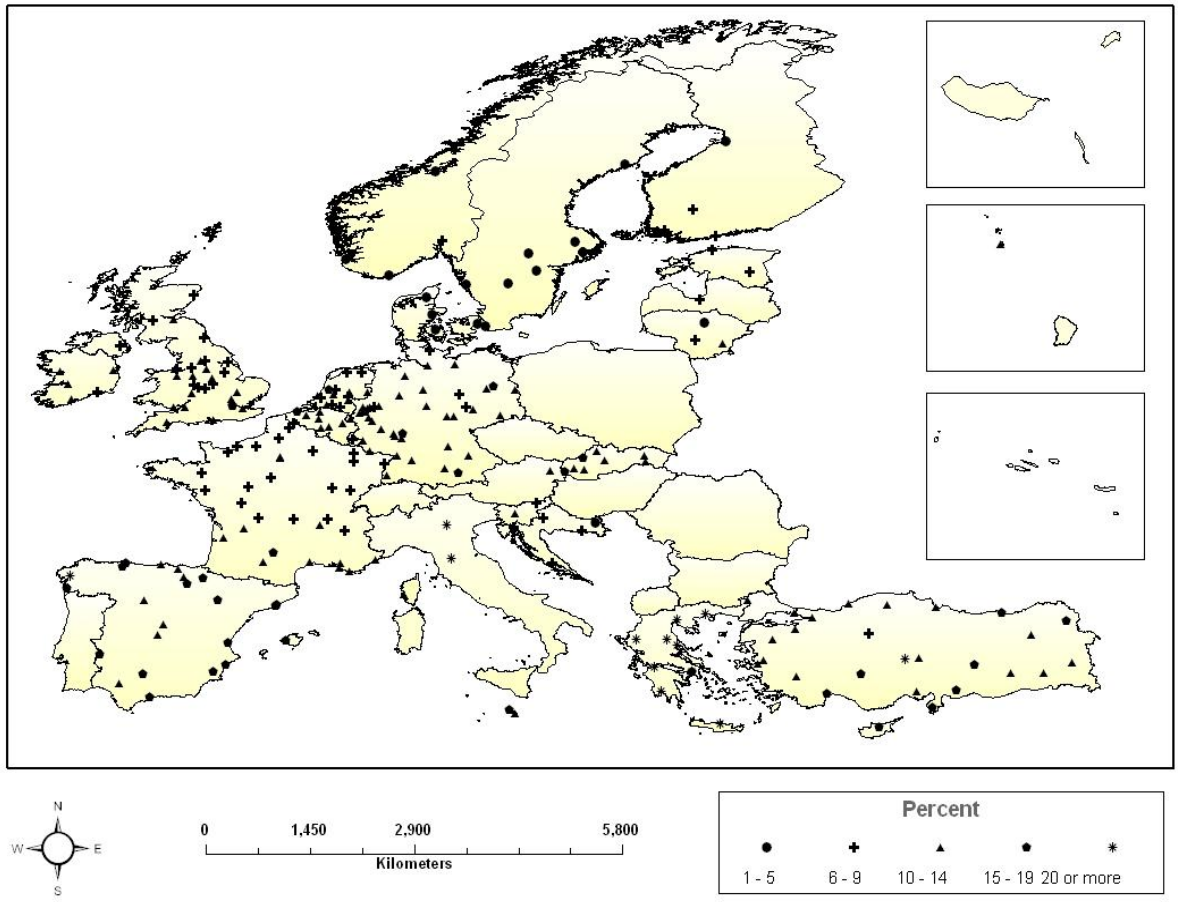
Source: Authors' calculations based on European Urban Audit dataset 1989-2010, corrected for missing values of medium and high education via multiple imputation technique.

Figure B1: Self-employment (% of total employment) across European cities, 1991 (based on original dataset)



Source: Authors' calculations based on UAS data and the spatial information obtained from http://epp.eurostat.ec.europa.eu/portal/page/portal/gisco/popups/references/administrative_units_statistical_units_1. Note: the legend shows range bands of variation of the rate of self-employment.

Figure B2: Self-employment (% of total employment) across European cities, 2004 (based on original dataset)



Source: Authors' calculations based on UAS data and the spatial information obtained from http://epp.eurostat.ec.europa.eu/portal/page/portal/gisco/popups/references/administrative_units_statistical_units_1. Note: the legend shows range bands of variation of the rate of self-employment.

Appendix C: Entrepreneurship and cities: Evidence from Post-Communist World

Table C1: Descriptive statistics and definitions of the variables

Variable	Definition	Obs.	Mean	St. dev.	Min	Max
Dependent variable						
LnSME	Number of small businesses registered, logarithm	1160	8.46	1.05	4.09	12.35
Explanatory variables relevant to hypotheses tested						
university	Number of universities in a city	1372	7.33	13.26	1.00	103.00
gdppr_city	City GDP per resident squared, constant 2005 USD	1157	2852.04	5023.64	245.75	93703.88
gdppr_city^2	City GDP per resident, constant 2005 USD	1157	$3.33x10^7$	$3.84x10^7$	60392.64	$8.78x10^9$
expenditure_ gdp	Ratio of expenditure to GDP	1077	0.59	0.47	0.06	5.73
banking	Banking reform and interest rate liberalisation from 4- to 4+	1372	2.17	0.41	1.00	3.00
large_pri	Large -scale privatisation; from minus 4 to 3+	1372	2.92	0.60	1.00	4.00
exconsrt	Polity project. 'Executive constraints' '1=unlimited authority to 7=executive parity'	1372	4.37	1.11	2.00	7.00
Explanatory variables: controls						
airpolution_res	Air pollution, 1000 tons per resident	1148	0.29	0.55	0.00	5.46
Ln_popdensity	Population density in the city per sq. km, logarithm	1307	7.75	0.58	5.82	9.18
capital_ invest_gdp	Ratio of capital investment to GDP	987	0.24	0.17	0.01	1.51
capitalcity	1= capital-city, 0 otherwise	1372	0.07	0.26	0.00	1.00
unemploym	Unemployment rate, %	1040	3.45	4.08	0.10	30.20
latitude	Latitude	1372	50.70	6.20	40.10	68.58
longitude	Longitude	1372	38.12	8.34	20.31	56.19
distance	Distance from Moscow, km	1358	1059.69	514.06	167.00	2230.00

Source: CIS Urban Audit 1995-2008.

Table C2: Correlation matrix for CIS urban audit variables

	LnSME	expenditure_ gdp	capital_ invest_gdp	university	Ln_ popdensity	airpolution _ res	unemploy m	latitude	distance	longitude	gdppr_city	gdppr_city ^2	capitalcity	banking	large_pri	exconsrt	hfbusfree
LnSME	1.00																
expenditure_ gdp	-0.30*	1.00															
capital_ invest_gdp	0.03	0.21*	1.00														
university	0.64*	-0.19*	0.00	1.00													
Ln_popdensity	0.19*	-0.35*	-0.09*	0.28*	1.00												
airpolution_res	-0.09*	-0.07*	-0.09*	-0.11*	-0.12*	1.00											
unemploym	-0.08*	-0.10*	-0.06*	-0.15*	0.10*	-0.09*	1.00										
latitude	0.04	-0.18*	-0.19*	0.11*	0.04	0.38*	-0.39*	1.00									
distance	-0.16*	0.27*	0.18*	-0.15*	-0.38*	0.12*	0.37*	-0.49*	1.00								
longitude	0.14*	0.13*	-0.03	-0.09*	-0.42*	0.16*	0.20*	-0.04	0.32*	1.00							
gdp_city	-0.07*	-0.13*	0.14*	0.13*	-0.10*	0.50*	-0.15*	0.30*	0.09*	0.08*	1.00						
gdp_city^2	-0.17*	-0.06*	0.14*	0.01	-0.13*	0.44*	-0.05*	0.15*	0.12*	0.09*	0.89*	1.00					
capitalcity	0.42*	-0.18*	0.05*	0.55*	0.19*	-0.11*	0.17*	-0.14*	0.12*	-0.02	0.05	0.00	1.00				
banking	0.05	-0.04	0.10*	-0.01	-0.03	0.00	0.13*	-0.21*	0.11*	0.04	0.17*	0.06*	0.02	1.00			
large_pri	0.11*	0.01	-0.31*	-0.04	-0.26*	0.04	0.17*	-0.02	0.12*	0.44*	-0.06*	-0.01	-0.13*	0.35*	1.00		
exconsrt	-0.04	-0.11*	-0.04	0.00	0.05*	-0.02	0.04	-0.22*	0.06*	-0.10*	-0.03	0.00	-0.02	0.45*	0.38*	1.00	
hfbusfree	0.04	0.02	-0.09*	-0.04	-0.07*	0.02	0.30*	-0.05*	0.12*	0.24*	0.00	0.01	0.07*	-0.04	0.23*	-0.12*	1.00

Note: * - significant at 0.05 level. Source: CIS Urban Audit 1995-2008.

Table C3: Estimation Results

Estimation of the model Dependent variable S_{it} (The natural logarithm of the number of small businesses registered)						
Variable	Pooled OLS	p-values	FE	p-values	SYS-GMM	p-values
	(1)		(2)		(3)	
L.LnSME	0.93 (0.02)	0.00	0.370 (0.02)	0.00	0.519 (0.15)	0.00
expenditure_gdp	-0.693 (0.03)	0.03	-0.032 (0.05)	0.57	-0.342 (0.20)	0.09
capital_investment_gdp	-0.403 (0.05)	0.43	-0.090 (0.08)	0.28	-0.052 (0.38)	0.89
university	0.005 (0.00)	0.01	-0.010 (0.02)	0.75	0.030 (0.01)	0.001
lnpopdensity	0.021 (0.02)	0.32	0.590 (0.07)	0.00	0.170 (0.12)	0.16
airpollution	0.004 (0.02)	0.78	0.020 (0.06)	0.73	0.161 (0.09)	0.07
unemploym	-0.001 (0.01)	0.75	0.001 (0.00)	0.98	-0.046 (0.02)	0.046
latitude	-0.002 (0.00)	0.08	-	-	-0.011 (0.01)	0.38
longitude	0.002 (0.00)	0.12	-	-	0.005 (0.01)	0.15
distance	-0.001 (0.00)	0.73	-	-	-0.001 (0.00)	0.87
gdppr_city $x10^{-05}$	-1.02 (0.88)	0.24	-1.13 (1.06)	0.28	-9.68 (3.26)	0.00
gdppr_city^2 $x10^{-10}$	1.20 (1.22)	0.32	1.11 (1.39)	0.80	9.75 (3.57)	0.00
capitalcity	0.009 (0.03)	0.78	-	-	-0.087 (0.31)	0.78
banking	0.006 (0.02)	0.84	0.280 (0.10)	0.00	0.476 (0.27)	0.08
large_pri	0.034 (0.05)	0.51	0.120 (0.06)	0.07	-0.111 (0.09)	0.18
exconsrt	0.010 (0.00)	0.58	-0.040 (0.02)	0.20	0.034 (0.04)	0.35
hfbusfree	-0.010 (0.01)	0.00	-0.001 (0.00)	0.69	-0.00 (0.002)	0.98
constant	0.650 (0.26)	0.01	0.19 (0.71)	0.78		
Country controls	No		No		Yes	
Year dummies	No		Yes		Yes	
R-square	0.95		0.47			
Pr>z AR(1) / Pr>z AR(2)					0.00 / 0.27	
Hansen test, Pr.>chi2					0.56	
Dif. Hansen test, Pr.>chi2					0.64	
Number of obs.	730		730		730	

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

Notes: 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. Instruments for first differences equation GMM-type [L(2/.).(LnSME unemploym capital_invest_gdp gdppr_city gdppr_city^2)] collapsed. Instruments for levels equation: GMM-type [DL.(LnSME unemploym capital_invest_gdp gdppr_city gdppr_city^2) collapsed and all other regressors, including time controls, used as standard instruments here. 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. Number of instruments 81. F(33, 83) = 3505.77

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