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BUSINESS DEMOGRAPHY AND ECONOMIC GROWTH: SIMILARITIES AND DISPARITIES IN 10 EUROPEAN UNION COUNTRIES

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Abstract. The main research aim is to investigate and test the long-term existence of a balanced relationship (cointegration) between business demographics and economic growth, expressed in terms of real GDP per capita, and to estimate the econometric models expressing relationships between analyzed variables in European economy. Our The study has focused on ten out of the eleven former communist countries, currently members of the European Union, during the 2006–2016 time period. Croatia was left out due to the shortness of the time series available for it, that the study would have required. These findings have significant implications in designing and shaping the future business models in European former communist countries, and increase convergence. The results obtained confirm the existence of long-term balanced relationships between the variables examined, the forms of which however vary from one cluster of states to another.

Keywords: business demography, business churn, convergence, econometric methods, economic growth, European economic model, GDP, Hierarchic Cluster methodology, SMEs.

JEL Classification: C51, D2, E32, M31, L26.

Introduction

The European Union (EU) concentrates an amalgamation of business patterns, economic systems and traditions, each of them mirroring the specifics, the transformations and mutations that have occurred in each particular member state due to the need for convergence

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with the common values. As, analyzing the fluctuation of employment form perspective of the level and type of the activities having entrepreneurship as a driver (Bednarzik, 2000) observe significant differences among geographic areas and between countries and between countries as well which explains a broad range of results for this variable. Shaping functional and highly efficient economic and businesses models on EU level requires numerous actions on developing key economic sectors by stimulating functional and highly efficient businesses' process, fostering of technological advance and the related elements of support. The analysis of business economic patterns through the spectrum of business demography and SMEs starts from the premise that the SMEs provide high quality services based on the read demand of the market, thereby fulfilling, as some studies suggest (Moeuf et al., 2018; Ingaldi & Ulewicz, 2020), a pioneering role in the market segment of emerging or related industries. They are highly resilient in times of crisis, and they are workable in any context precisely because they were designed to satisfy local cultural and economic specificities. The shift in the European business patterns and economic paradigm are an additional challenge for the SMEs. Such paradigm changes came with a continuously growing quality of labour, better capital resources, modern and adaptable industrial know-how, and press the need for a reform of the existing European distributive networks. From this perspective (Armeanu et al., 2018), pleads that, to satisfy the primary demands of this process requires the use competitive resources capable to blend education, research and innovation with new job opportunities.

The success and the efficiency of the European economic model derives from the ability to identify, channel, and make the best of the resources and specific features of each member state, in tune with their development priorities. Investigating the influence of democracy or dictatorship in determining the economic growth in some in developing countries (Sen et al., 2018) highlights that long-run growth is not often compatible with the stylized facts of economic growth and the inconsistence of the political regime determine fluctuant evolution of the business economics.

The aim of the paper is to contribute to the already existing research in the field of business demography, with a focus on the Small and Medium Enterprises (SMEs), and to fill the gap in the dedicated literature. For this purpose, it was explored the determining factors between business demography and economic growth, as expressed, in this case, in terms of real Gross Domestic Product (GDP) per capita at the level of European economy. More exactly, the aim of the research is to determine if business demography and real GDP per capita, as indicator of economic growth, are indeed connected through cointegration relationships, and if this can generate different dynamics or clusters which, in their turn, may shape the form and the course of the analyzed relationship. In this context, the study pursued two main targets, both of which carry weight in understanding the evolution of the business sector, particularly in the case of the former communist countries, described as the catching-up group. The first target was to identify the similarities and the disparities between the former communist countries, now members of the EU, with regard to their business demographics in the process of turning from a centralized economy to a market economy. The second target was to verify the existence of long-term connections (cointegration) between their business demographics and real GDP per capita in each of these states. From this perspective, it was assumed that a cointegration relationship does exist between two or more time series covering the analyzed variables, and that a disturbance (significant increase or decrease) affecting a variable will be corrected in a short span of time, so that a balanced relationship is regained.

The study of European economy by means of the business demography criteria specific for SMEs, from the angle of established economic models in the dedicated literature (Meyer & de Jongh, 2018; Gebauer, 2018; Radicic et al., 2020), is an intuitive attempt to analyze and understand the EU economic model, and no less the mechanism that leads to the concentration of the characteristics specific for a certain sustainable policy aimed at constant growth, gap filling, and spread of productive investment. Likewise, the competition for resources requires the compliance with certain conditions regarding their use, conservation and regeneration, so that the economy, and the society at large, could be given the space to develop, and progress harmoniously through resilience. Most of this research lay the stress on the analysis and distribution of the specific business indicators, and economic efficiency, giving less space to the business environment and, implicitly, to the SME demography, as also shown by (Flachenecker & Kornejew, 2019; Rotar et al., 2019; Cravo & Piza, 2019) or Sumiati (2020). Therefore, the main contributions to this paper are the analyses of the evolution, concentration and shaping up, and the affiliation of a country or group of countries to an economic model already well defined by economic writings, from the perspective of indicators specific for SMEs and business demography, and of their influence on the development of specific business models. It was also pursued to understand the long-term balance existing between business demography and economic growth, but also the clustering of the various levels of development of these types of businesses around a viable European economic model. Taking this into consideration, it was analyzed the possibility of business environments in lagging economies to catch up and converge with the EU average, taking a faster route of growth with the aid of the SMEs sector.

Keeping in view the two targets of this study, our paper has been structured as follows: a Literature Review Section, which analyses and presents, briefly, the theoretical background that formed the starting point of our research, with a special attention for the correlations, patterns, and findings revealed through an in-depth examination of the economic business models viewed from the perspective of business demography and SME. Then, follows a distinct Data and Research Methodology Section in which is described the methodology employed in our research, and the statistic variables considered. In this second section, it was used two methodologies that fit the targets of the research: the Hierarchic Cluster Methodology for the first target, and a methodology enabling the researcher to verify the existence of cointegration relationships, and estimate the VEC, namely the Augmented Dikey-Fuller Test and the Johansen Cointegration Test, for the second target. Further, in the section Results and Discussions, in line with the methodology used, it was devoted a first part to presenting and interpreting the results obtained from the research of the similarities and disparities between the analyzed state entities with respect to their business demography, and their positioning in three clusters. The second part is dedicated to testing the existence of cointegration relationships between real GDP per capita and the business demography indicators. The second part, also estimates the VEC and ECM models for each of the clusters identified as above.

The paper ends with the sections dealing with Conclusion, References, and points out to suggestions for future lines of research, starting from the limits identified during our research. The recommendations resulting from this research may provide useful help the SMEs understand the subtle mechanisms that govern their sustainable progress, and incorporate their sector in the larger economy, by identifying the determining factors in this process, and conceptualizing the need for long-term balance (cointegration) between business demography and economic growth of the European economy as a whole.

1. Literature review

The evolution of the European economy, and with it, of the business models and business demography that have been shaped up in the course of its existence, has been a long process of agglutination of practices, customs, and experience blended with the culture and social philosophy of each member state. The literature dedicated to this subject (Jenson, 2017; Jacques & Noël, 2018; Careja et al., 2020) hint to the fact that the number of economic and social models in the European space is on the rise, as a result of diversification and concentration of the European states around clusters of social models, all while retaining, each of them, certain statistic peculiarities. For example (Iyke, 2017) examining in some of the CEE countries the existing correlations between various measures adopted to increase the trade openness and growth conclude that there are particularly suitable convergence among their sectorial policies.

Describing the history of the European economic and business model (Palevičienė et al., 2014), are of the opinion that the EU member states, particularly those that were part of the last accession wave, forced to become convergent, are striving hard to change their own social models, including their own business models or their own business demography patterns, in the attempt to adopt economic measures and policies that have thus far proved to bring economic growth and wealth to citizens. In this view, (Bruns & Ioannidis, 2020) analyzing the a dataset containing 37 of the most determinant variables on growth, spread during 1960 to 2010, discovers instabilities in the inferences on growth determinants and find little support in arguing a determinant factor in prevailing such trend. In this context, Fagerberg and Verspagen (2015), noted that the world's capitalist economy is far from being uniform or homogeneous, and that, on the contrary, it consists of states placed at very different levels of economic and technical development, with each of them having forged its specific business models, which, in a world context, have no option other than converge with the others.

Similarly, as other studies point out (Juhász, 2006; Knogler & Lankes, 2012; Gonzálvez, 2016; Cappelen & Peters, 2018), the EU economic model is a mixture of economic patterns, all of them intermingling, as an expression of multiculturalism and functionality, bringing together old economic models recognized as traditional and new ones, prompted by the need for convergence and higher economic efficiency. Other authors (Bolea et al., 2018) also uphold the idea that the European Union architecture and the EU economic space were accomplished by promoting economic, social, and territorial cohesion, sustainable economic development, which have been the main pillars of economic progress and personal welfare. Most often a business's extinction from the market is the effect of the entrepreneur's own features and capabilities to adjust to the market and to overcome risks, and authors like (Delmar & Davidsson, 2000) argue that competitiveness is closely linked to the business founders' age, level of education, experience, and even family status (marital status, number of children) but, mostly, by the entrepreneur's gender. Other researchers (Compbell & Rogers, 2007) found that the characteristics of the business itself (such as revenues, or the average length of existence within the local business demography), or the government revenues would be decisive for a greater economic freedom, and that this would generate higher incomes for the residents, knowing that freedom of action gives broader space to business initiative (Compbell & Rogers, 2007).

Quite a large number of studies (Baute et al., 2018; Claassen et al., 2019; Rosetti, 2019; Burroni et al., 2020; Ferrera, 2020) have pointed out that the transformations of the European classical model, and the history of the European economy, demonstrate its capability to take on and adapt to significant structural changes, and to ensure comparable levels of productivity and sustainable economic growth, even when the economic paradigm suffered deep changes. In practice, the European economic and business model proved to be of utmost resilience: it was able to offer its consumers durable products and to provide finance for the welfare of their citizens, when affected by the transition to other, better, economic models. Speaking of these aspects (Holzinger & Schimmelfennig, 2012; Loth & Paun, 2014) claim that the differential integration of the states in the European economic and business model is possible precisely due to the high heterogeneous character of the EU member states, resulting not only from successive rounds of negotiation and accession, but also from the EU operation and decision-making construct.

The role played by business demography in the process of economic growth roused the researchers' interest to see how it contributes to resilience, due to its characteristics that are closely linked to the competitive resources a society as a whole needs to develop. Authors like (Santarelli & Vivarelli, 2007) observe that the emergence of new businesses on the market is both heterogeneous and innovative. The same study views business demography as an optimized vector, although (Van Praag, 2003) regards the dissolution of businesses as a broader symptom, arguing that only 50 out of 100 newly established business ventures survive the first three years of operation (Van Praag, 2003).

Other studies (Gürbüz & Aykol, 2009; Covin & Lumpkin, 2011) used entrepreneurial orientation as the specific indicator of a venture in order to understand the entrepreneur's capacity and involvement in ensuring the viability and performance of the venture. Previous studies used mediation variables, such as entrepreneurial orientation Pratono and Mahmood (2015), marketing capacity (Cacciolatti & Lee, 2016), knowledge stream (Sheng et al., 2013) or information technologies (Ball et al., 2008) in order to understand the relationship between a company's performance and its viability. From this point of view, a good instrument in business demography is the measurement of externalities, such as the rising employment opportunities in the e local markets. For example, in the manufacturing industry (Acs & Armington, 2004) found evidence of a highly positive relationship between growth rates and the diversity of geographically close industries, and the magnitude of human capital. Similarly, previous studies (Mead & Liedholm, 1998) demonstrated that the rate of employment followed the same curve as the emergence of new ventures or the expansion of the existing ones. Knowing these arguments, the variable employment as a share of enterprise births, considered for our research, brings to attention the evolution trends by state and group of states, similar to birth rate.

2. Model and methodology

The evaluation and testing the long-term existence of a balanced relationship between business demographics and economic growth of the European economy through understating the SMEs business patterns is the core issue of this applied research. The business demography variables has attracted and motivated numerous recent investigations in the field of SMEs business patterns development and convergence. For the research purposes, an extensive collection of datasets variables of European SMEs was employed. Having in mind the main aims established for this study, the countries considered for this purpose were chosen based on two criteria: (a) countries that prior to 1989 had a centralized economy, and (b) countries in which the transition, after 1990, from a centralized economy to a market economy evolved in different stages and patterns, which influenced their business demography. All this considered, it was selected 10 EU countries (Bulgaria, The Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia). Croatia, a former communist country and now member of the EU, could not be included in our study, due to the scarcity of comparative data available for the other 10 countries. In consideration of these two criteria, the analysis pursues to underline the similarities and dissimilarities between these countries in terms of business demography, on the one hand, and to discover the long-term balance, if any, between their evolutions along time and their GDP per capita, on the other. The analysis is based on a set of 1127 empirical values, which describe the evolution, in the time segment 2006–2016, of the business demography and real GDP per ca pita in the states analyzed. The dataset and the time frame availability of the employed variables harmonize the different business patterns evolution and allow a pertinent and accurate cross-country comparison analysis. The source of data collection and information was the Eurostat (2019a, 2019b, 2019c). The Eurostat datasets provides well-defined and detailed annual information on business demography of the SMEs operating in EU. This timeframe selection provides an encouraging trend for the sustainability and traceability of research findings. The size of the batch was limited by the data available at the date of the study. The data timeframe and sample employed in the research defines a representative and well-argued typologies as it substantiate a recognized taxonomy in understating the inner evolutions and characteristics of SMEs divergent trends across the EU. After a preliminary examination of the business demography, and having in view the targets of this study, 11 variables have been selected (Table 1).

To attain the first objective of this study, respectively to identify the similarities and dissimilarities between the former communist countries in terms of business demography developments, it wasapplied the Hierarchic Cluster methodology, by which it was grouped the states in clusters with the aid of the Squared Euclidian distance to generate Proximity Matrix $W = \left\| w_{ij} \right\|_{i=\overline{1,n},\, j=\overline{1,n}}$ (where n stands for the number of states included in the analysis, and m stands for the lengths of data series) as is described in (Rokach & Maimon, 2005; García-Escudero et al., 2010; Xanthopoulos, 2014):

$$W = \left\| w_{ij} \right\|_{i=\overline{1,n},\, j=\overline{1,n}}, \quad w_{ij} = \sqrt{\sum_{i=1}^{n} \left(z_{ik} - z_{ij} \right)^2}, \; j = \overline{1,m}, \; k = \overline{1,m}, \; j \neq i, \; k \neq i, \; w_{ii} = 0, \quad (1)$$

Table 1. List of variables used in the analysis (source: authors' selection based on Eurostat (2019a, 2019b, 2019c)

GDP	Gross Domestic Product – euro per inhabitant
BRT	Birth rate: number of enterprise births in the reference period (t) divided by the number of enterprises active in t
DTH	Death rate: number of enterprise death in the reference period (t) divided by the number of enterprises active in t
CHR	Business churn: birth rate + death rate
ESB	Employment share of enterprise births: number of persons employed in the reference period (t) among enterprises newly born in t divided by the number of persons employed in t among the stock of enterprises active in t
NBPG	Net business population growth – percentage
SVR1	Survival rate 1: number of enterprises in the reference period (t) newly born in t-1 having survived to t divided by the number of enterprise births in t-1 – percentage
SVR2	Survival rate 2: number of enterprises in the reference period (t) newly born in t-2 having survived to t divided by the number of enterprise births in t-2 percentage
YOE1	1 year old enterprises' share of the business population – percentage
YOE2	2 year old enterprises' share of the business population – percentage
DBRT	Density of birth rate: number of enterprise births in the reference period (t) divided by the population (in 10,000) in t – percentage
DAE	Density of active enterprises: number of active enterprises in the reference period (t) divided by the population (in 10,000) in t – percentage

as well as Ward's method to determine the distance between clusters as in (Gelbard et al., 2007; Murtagh & Legendre, 2014):

$$\Delta(A,B)=\sum_{i\in A\cup B}\left\|x_i-m_{A\cup B}\right\|^2-\sum_{i\in A}\left\|x_i-m_A\right\|^2-\sum_{i\in B}\left\|x_i-m_{\mathbf{B}}\right\|^2-\frac{n_{A\cap B}}{n_{A\cup B}}\left\|m_A-m_B\right\|^2. \quad (2)$$

For the testing of the significance of the variables belonging to clusters, it was applied ANOVA as in (Moore & McCabe, 2003; Cardinal & Aitken, 2013), where the null hypothesis H_0 (cluster belonging of the analyzed variable is not statistically significant) being given by:

$$F_{stat}=\frac{\sum_{i=1}^{r}(\overline{y}_i-\overline{y}_0)^2 n_i \Big/ df_1}{\sum_{i=1}^{r}\sum_{j=1}^{ni}(y_{ij}-\overline{y}_i)^2 \Big/ df_2}<F_{\alpha,r-1,n-r} \quad \text{equivalent to} \quad Sig\_F>\alpha. \quad (3)$$

To reach the second target of this study, i. e. identify the existence of cointegration relationships between time evolutions of demography and real GDP per capita, it was first verified the existence of the cointegration relationship, in order to see if the non-stationary time series at their level appear as stationary at first differentials, while displaying the same degree of integration. For this purpose, it was used the Augmented Dikey-Fuller Test (ADF). The variables whose time series did not fulfill these conditions were eliminated.

Further, each cluster was examined in the following two stages:

- For the variables that meet the cointegration condition, it was verified if there are significant correlations between the time series of the GDP and business demography, and also if between the time series of endogenous variables, the correlation coefficients are below |0.2|; endogenous variables must not/need not be correlated. Variables that do not meet these conditions have been eliminated.
- For the variables that meet the above conditions, it was verified the existence and estimated the VEC (Vector Error Correction) models. For this purpose, it was applied the Johansen Cointegration Test. Given three variables, Y_t, $X1_t$, and $X2_t$, whose time series meet the cointegration requirements (for example, they are stationary in the first differential), then the VEC model without a trend and without a constant, with 2 lags in the short-term balance components, will be expressed as in (Saghaian et al., 2002; Meerza, 2012):

$$d(y) = \alpha_0 \cdot \left(a \cdot y_{t-1} + b \cdot x_{1,t-1} + c \cdot x_{2,t-1}\right) + \alpha_{11} \cdot y_{t-1} + \alpha_{12} \cdot y_{t-2} + \beta_{11} \cdot x_{1,t-1} + \beta_{12} \cdot x_{1,t-2} + \beta_{21} \cdot x_{2,t-1} + \beta_{22} \cdot x_{2,t-2}. \quad (4)$$

If coefficient α_0 is negative and significantly different from zero (statistically significant), then variables Y_t, $X1_t$ and $X2_t$ have a long-term stability relationship expressed as:

$$y_t = -\left(b \cdot x_{1,t} + c \cdot x_{2,t}\right)/a\,. \quad (5)$$

This shows that a disturbance occurring in one of the time series reflects upon the others, but that the deviation (error) that comes with it will be gradually corrected until balance is reached again. To verify the statistic hypotheses, a 95% level of confidence was applied, which corresponds to a signification threshold $\alpha = 0.05$.

3. Results and discussion

Starting from the two objectives of this research – identify the similarities and dissimilarities between the former communist states, now members of the EU, in terms of their business demography, and verify the existence of long-term balance relationships between the diachronical evolution of their business demography and real GDP per capita – the results and discussions are centered on the methodologies and stages as described above.

3.1. Similarities and dissimilarities in terms of business demography

Analyzing the time evolutions of the variables chosen for this study (Table 1), in the time segment 2006–2016, reveals that all of them feature non-stationary data series (with trend) and that, the greatest majority of them feature a normal distribution. These features are reflected both in the values of the symmetry coefficient (Skewness), and the degree of tailing (Kurtosis). Knowing that all the Skewness values range (–1.96, +1.96), it means that the distributions of variables are relatively symmetrical. With regard to the tailing of distributions, the Kurtosis values corresponding to CHR (Business churn), DTH (Death rate), SVR1 (Survival rate 1) and SVR2 (Survival rate 2) show that they have a leptokurtic distribution.

The average values, the standard deviation values, and the values of the variation coefficient (V) show that they are relevant in the sense that they give a good image of the characteristics of the time series of variables NBPG and SVR1, and relatively relevant for variables BRT, DTH, SVR2 and YOE1. For the other variables, due to the large and very large spreads (variable NBPG) of the values recorded at various moments in time, the average values do no longer give a conclusive image of the diachronical evolution of the respective data sets. On the other hand, there are great differences between the minimal and the maximal values of some of the variables analyzed, among which GDP per capita, NBPG, DBRT or DAE, which, leveled through averaging, conceal certain peculiarities of the time evolutions of the analyzed variables, and of the states to which these values are attached. In Table 2 is presented the main characteristics (descriptive statistics) of the variables selected for this research.

Table 2. The variables main characteristics (source: authors' own computations based on Table 1)

	GDP	BRT	CHR	DTH	ESB	NBPG	SVR1	SVR2	YOE1	YOE2	DBRT	DAE
Mean	11061	12.99	24.38	11.40	3.68	2.61	79.79	65.31	10.14	7.93	71.30	558.89
Std. Deviation	3548	4.14	6.91	3.99	1.02	4.79	8.74	9.59	2.59	1.97	25.79	173.91
Minimum	4600	3.81	12.01	4.35	1.67	−13.64	41.82	29.47	2.62	2.24	19.32	221.82
Maximum	18400	25.99	49.09	29.05	6.67	17.61	91.81	84.21	16.35	14.54	160.03	973.93
Skewness	0.10	1.33	1.43	1.46	0.50	0.27	−1.59	−1.22	0.45	0.66	0.96	0.64
Kurtosis	−0.65	1.80	2.31	3.37	0.12	1.82	3.44	2.75	0.08	1.00	1.58	0.23
V	0.32	0.28	0.35	0.28	1.83	0.11	0.15	0.26	0.25	0.36	0.31	0.32
Observations	80	100	99	99	100	96	96	97	100	100	80	80

In order to ensure that the particulars of the time evolutions of the business demography indicators are no longer absconded, it was proceeded to a cluster analysis based on the data series corresponding to each of the 10 states chosen for the scrutiny. Using the methodology described above, and considering the data sets corresponding to the analyzed variables, the 10 states were grouped into three clusters (Figure 1).

From Figure 1 it could be remarked that: Cluster A includes Hungary, Poland, Romania and Bulgaria, Cluster B includes Latvia, Lithuania, Slovakia, and Cluster C includes The Czech Republic, Slovenia, and Estonia. After verifying the statistic relevance of the variables belonging to clusters, the null probability (relationship 3) was dismissed, therefore the average values so obtained (Table 3) are statistically relevant.

Knowing each cluster's structure, and depending on the main features of the explanatory variables (Table 3), a number of elements resulted, illustrating both the particulars of the states, and the characteristics that define the clusters. The curve of the Gross Domestic Prod-

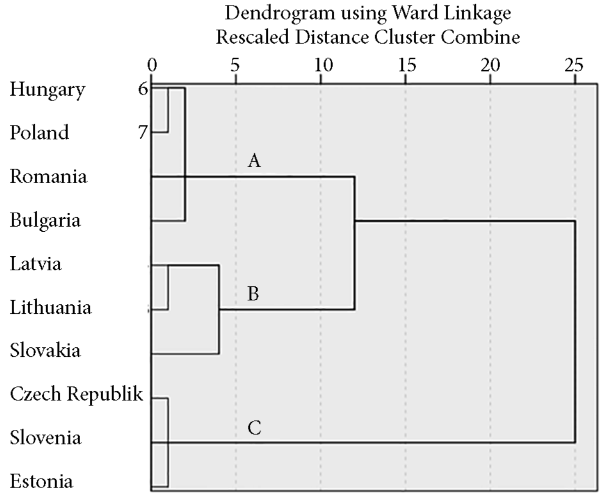

Figure 1. Cluster generation dendrogram by Ward Linkage (source: authors' own design)

Table 3. Average values of variables for clusters (source: authors 'own computations)

Clus-ter	GDP	BRT	CHR	DTH	ESB	NBPG	SVR1	SVR2	YOE1	YOE2	DBRT	DAE
A	8764	11.25	23.51	12.26	3.68	1.31	80.85	69.41	8.90	8.55	54.85	475.42
B	13505	15.95	23.03	7.08	4.04	5.26	75.56	62.37	13.96	8.17	104.39	671.83
C	15847	9.69	17.45	7.66	2.46	1.98	84.88	70.42	8.58	7.30	73.16	762.50

uct during the time span 2006–2016, by country and by cluster, ranks Cluster C first, with an average value of 15847 euro per capita, followed by Cluster B, with an average of 13505 euro per capita, and by Cluster A, with an average GDP of 8764 euro per capita. Bulgaria, with a GDP per capita of 5200 euro, is the country with the lowest value of this indicator, compared to the GDP of the other states, both in this Cluster A and in the other two clusters. Poland features the highest GDP: 10975 euro per capita. The other two countries that form Cluster A have a GDP that fluctuates around the average, with 5800 euro per capita in Romania, and 10500 euro per capita in Hungary. Cluster B has a GDP ranging between 8400 euro per capita in Lithuania, and 14729 euro per capita in Slovakia, while Latvia has a GDP varying from 8600 and 12857 euro per capita. In Cluster C, Slovenia has the highest GDP, (18400 euro per capita), among all the other 9 countries under study. Estonia recorded the lowest GDP in its cluster, while The Czech Republic boasted a GDP between 13600 and 14971 euro per capita.

Therefore, in terms of BRT, Hungary in Cluster A, The Czech Republic in Cluster C, and Slovakia in Cluster B, are the countries that, in the reference time segment 2006–2016, were each positioned under the average value of 11.25% for Cluster A, 15.95% for Cluster B, and 9.69% for Cluster C. The other countries, irrespective of the cluster they were grouped into, have year-on-year low average variation rates, as a whole: by 2.5 (Cluster A), 2 (Cluster B) percentage points below, and by 10.93 (Cluster A), 8.93 (Cluster B), and 8.51(Cluster C) percentage points above the average. Lithuania is the country that, for the entire study period, recorded the highest birth rate of business ventures: between 14.72% in 2009 and 24.88% in 2012. This tendency could be the result of entrepreneurship intertwined with an efficient government policy, which created the favorable ground for the emergence of new business ventures.

It is also worth noting that The Czech Republic and Slovenia, both members of Cluster C, had businesses death rates (DTH) by maximum 1.02 percentage points below the average value of 7.66%, but also by 2.05% above the average, for the entire reference period of the study. For example, in The Czech Republic, the business death rate in percentage points ranged between 7.5% in 2015 and 9.71% in 2012, while in Slovenia, this indicator scored the lowest rates: between 6.64% in 2008 and 9.07% in 2012. Lithuania, at the other extreme, is the country with the highest death rate among business entities in 2008 (29.05%), which leaves us to understand that, there, entrepreneurship is inferior to that of other countries. After the financial crisis of 2008, Lithuania has undertaken a great effort to surpass the economic lag, and this is reflected in the year on year decrease of its business death rate, which, in 2015, was brought down to only 5.42%.

In the first cluster, Hungary and Poland scored a business death rate that fluctuated between roughly 9% and 13% in the reference period. The other two states had greater variations, with a peak of approximately 20% in 2010 for Romania, and in 2008 for Bulgaria. Compared to the average death rate of 12.26% businesses in Cluster A, Poland recorded a minimum of 9%, and Romania a maximum of 20.23%. The business death rate in the other two countries of Cluster B fluctuated by approximately 9 percentage points: in Latvia between 6.27% and 14.92% and in Slovakia between 7.19% and 14.16%, the average death rate being 7.8%. Fluctuations like in Slovakia occurred in Estonia (the third member of Cluster C), where the business death rate oscillated between 7.73% and 14.6%.

If it is considered the fluctuations of the birth and death rates (BRT and DTH) by country and per year, but also by cluster, in their evolution, it can be observed the transformation in time and space of the indicator that sums up the two of them: the business churn (CHR). To illustrate, at an average ratio of 23.51% in Cluster A, and 17.45% in Cluster C, countries like Hungary in Cluster A, The Czech Republic and Slovenia in Cluster C, have low percentage rates, and the fluctuations recorded are smaller by maximum 4.69 percentage points for Hungary, by 5.44 percentage points for The Czech Republic and by 2.9 percentage points for Slovenia. Poland's year on year business churn is lower, revolving around an average value of 23.51%, with a minimum of 22.15% recorded in 2008, and a maximum of 25% in 2015. Romania and Bulgaria (members of Cluster A), and Estonia (member of Cluster C) have business churn rates vary from a minimum of some 18–19% to a maximum of 31%. The business churn rates for all the three members of Cluster B, the average of which is 23.03%, vary between the lowest rates of 19.83% for Slovakia in 2012, 23.5% for Latvia, and 23.97% for Lithuania in 2015, and the highest rates of 31.43% and 31.77% for Latvia (2009) and Slovakia (2014), and 49.09% for Lithuania, in 2008.

The analysis of the indicator Employment Share of Enterprise Births (ESB) is rather sensitive, considering the issue of job availabilities. Persons in employment have a job both in newly founded ventures, and in already established business entities. Entrepreneurship is a matter that must be viewed in terms of the process and length of the jobs on the market. It is the entrepreneurs' choice if they open new businesses in other geographical areas or expand the existing ones. The moment of expansion is another aspect to be kept in view: within the same year of opening the business, or at different dates? If it is bring into this equation the length of time required for one or for both of these options, then the employment share of enterprise births will be modified.

With all these elements considered, the, employment share of enterprise births (ESB) for the countries in Cluster C is below the average value of de 2.46%, with a maximum of 0.79 percentage points for The Czech Republic (2008), 1.46 percentage points for Slovenia (2010), and only 0.13 percentage points for Estonia, in 2015. All the countries in Cluster A had an employment share of enterprise births greater than the calculated average of 3.68%. As such, the maximum percentage differentials from the average employment share of enterprise births are 1.78 percentage points, in 2009, for Bulgaria, 0.96 percentage points, in 2013, for Romania, and 0.52 percentage points, respectively 0.45 percentage points for Poland (2008) and Hungary (2015). In Cluster B, the maximum differentials from the average value of 4.04% of the employment share of enterprise births are almost double than the differentials in the previous Cluster A. To illustrate, the differentials of 2.63 percentage points for Slovakia, and 2.63 percentage points for Lithuania, were recorded in 2014, and the differential of only 1.15 percentage points for Latvia was recorded in 2011.

Turnover of labour is influenced by the entrepreneurs' decisions, and no less by the macroeconomic level of development of each country's economy, and by the political implications of the government and entrepreneurial strategies. This explains the different values of the net business population growth (NBPG) indicator, which scores a significant net reduction, expressed in negative values. As such, the significant net reduction of the business venture population in most of the countries under this study is estimated to reach a minimum of 13.64% in Lithuania (2009). Cluster B, where the most significant drop was found, includes one other minimum of net reduction of the business venture population, in Slovakia: 4.16% in 2012, Latvia being the only member of Cluster B with a net business population growth for the entire reference time period of this study. In Cluster A, in which the NBPG average is 1.31%, it was only Poland that scored a net business population growth, at rates between 0% in 2008 and 4.11% in 2009. As for the other states in Cluster A, the indicator dropped to 9.63% in Romania (2010), to 5.94% in Hungary (2012), respectively to 1.21% in Bulgaria (2011). Estonia and The Czech Republic are the members of Cluster C (with an average of this indicator of 5.26%) which recorded business venture net reductions at negative levels of 3.34% (2010), respectively 1.92% (2013). Slovenia, the third member of Cluster C, recorded, in the reference time span, a net business population growth over the average percentage value in most of the years (with the exception of 2011, when the score was by 0.12 percentage points below the average), with a maximum of 5.6% reached in 2009.

The quality of entrepreneurship in each country, the peculiarities of their economic and social development, the regional development patterns of each of them, their historical evolution, have all played an important role in the survival rate of their business population. The significance of these business survival rates have a great import on a comparative scale with the neighboring countries or the organizations to which the businesses are affiliated. All the elements above considered, the average value of the Survival Rate 1 (SVR1) by country was 80.85% in Cluster A, 75.56% in Cluster B, and 84.88% in Cluster C.

This explains why the ratio between the entirety of companies created priory and active at that moment, and the companies created and incorporated in a past moment, if compared to the average recorded at the given moment of the analysis, varies broadly between 72.86% and 89.31 in Cluster A, 41.82% and 86.66 in Cluster B, and between 69.39% and 91.81% in Cluster C.

The environments in which the new business entities conduct their operations have an important say on their life and survival rate. A Survival Rate1 analysis of the Cluster A countries shows low fluctuation rates from the average value in Hungary, Romania and Bulgaria, more exactly between minimums of 72.86% (2012), 75.07% (2013), and 76.47% (2008), and maximums of 82.91%, 88.87% in 2014, and 81.92% in 2013. The only country in this cluster where trade exchanges, the market dynamics and competition had a positive influence on the newly established companies was Poland, where the Survival Rate1 was higher than the average, with a minimum of 3.63 percentage points, and a maximum of 8.46 percentage points. Lithuania is the country noted for the poorest entrepreneurship. As against the other members of Cluster B, and of all the other countries in the other two clusters, Lithuania is the only one with a low Survival Rate1, placed below the average value for the entire reference period. The year-on-year percentage range of the Survival Rate1 in Lithuania is between 41.82% (2009) and 65.56% (2012). For the other two members of Cluster B, the Survival Rate1 oscillates from a minus of 1.61 percentage points, and a plus 7.62 percentage points in Latvia, respectively 10.38 and 11.10 percentage points in Slovakia. In Cluster C, Slovenia is the champion of Survival Rate1 in 2009. The other two members of Cluster C had an upward trend of this indicator, beginning with a 76.18% rate for The Czech Republic in 2009, and a rate of 69.39% for Estonia, in 2008. The highest values were recorded in 2015, for The Czech Republic, with a rate of 82.89%, and in 2009 for Estonia, with a maximum rate of 87.6%.

However, entrepreneurship in the analyzed countries is called into question when it has been proceed to the analysis of the Survival Rate2 (SVR2), if we look at the data showing more thorough changes among the ventures incorporated two years before the moment of analysis. The percentage gap between the total number of ventures recorded to have been founded two years prior to the moment and still active at the date of the study, and the ventures incorporated and recorded two years after the moment, is 54.01%, therefore wider than that of the Survival Rate1 of 49.99 percentage points. The curve of the Survival Rate2 by cluster and by country has a tendency similar to that of the Survival Rate1. Compared to the Survival rate1, the average value is lower by 11.44 percentage points for Cluster A, by 13.19 percentage points for Cluster B, and by 14.46 percentage points for Cluster C. The variation limits are also lower, ranging from 56.74% to 77.23% in Cluster A, from 29.47% to 74.46% in Cluster B, and from 55.87% to 83.48% in Cluster C.

In terms of entrepreneurship, survival rates may also mirror the churning process of the new ventures on the market, as an effect of the owner's risk management skills, individual characteristics, and business environment, in close connection with each country's level of development. Business survival is the outcome of a variety of intertwined factors. This is the reason why it is hard to identify the clear-cut elements of prime importance enabling entrepreneurs to help the newly established companies to survive on the market. An example of this fluidity comes from the indicators 1 and 2 year old enterprises' share of the business population (YOE1 and YOE2). Looking at the two variables by country and by year, it was noticed that they had a similar evolution. Hungary and The Czech Republic are the countries in Clusters A and C which, for the entire length of the reference period, recorded shares below the average share (8.90% in Cluster A and 8.55% in Cluster C for YOE1, and 8.58% in Cluster A and 7.30% in Cluster C for YOE2). The indicator 1 year old enterprises' share of the business population varies from the average share by 2.11% (2014) to 3.54% (2013) for Hungary, and the indicator 2 year old enterprises' share of the business population varies from 1.4% (2014) to 2.66% (2015). Compared to all the countries in this analysis, The Czech Republic recorded, in 2009, the lowest percentage (2.62%) for the 1 year old enterprises' share of the business population, and a percentage of 2.24%, in 2010, for the second indicator. All the other countries, irrespective of the cluster to which they were assigned, recorded shares fluctuating below and above the average value, at a year-on-year analysis. More exactly, the variation is below the average by a maximum of 0.78 percentage points (Estonia, 2008), for the first variable, and by 1.37 percentage points (Latvia, 2008), for the 2 year old enterprises' share of the business population indicator. The biggest difference above the average share was recorded in Bulgaria, in 2008, with 6.74 percentage points for the 1 year old enterprises' share of the business population, and in 2009, with 3.41 percentage points for the 2 year old enterprises' share of the business population.

Density of birth rate (DBRT) is, in its turn, an indicator of significance in the description of the entrepreneurial landscape. Its importance is reflected in the changes of the percentage ratios determined in each country during 2006–2016. All the countries in Cluster A (Hungary, Poland, Romania, Bulgaria) had a density of birth rate that oscillated from the average density of 54.85%. Bulgaria made an exception from the rule in 2009, when the density of birth rate exceeded the average percentage value by 22.48 percentage points. Romania is the country with the lowest density of birth rate, not only by comparison to the countries in its own cluster, but also compared to all the other countries under study, through the DBRT value of 19.32%. Among all the countries under study, Slovakia, a member of Cluster B, boasts the highest density of birth rate, high above the average ratio by 55.64 percentage points. The percentage rates of the other countries are below the average by 55.18 percentage points in Cluster B (Latvia, 2008) and by 42.17 percentage points in Cluster C for The Czech Republic in 2008. This last country of Cluster C was going to score, two years later, a density of birth rate by 32.82 percentage points higher than the average percentage, a value that was the highest in its cluster, compared to that of the other countries, in the same time period.

A rather similar evolution to that of the density of birth rate had another variable, the density of active enterprises (DAE). In the first cluster, the exception for this indicator is Hungary, where the density of active enterprises rose above the average of 475.42% by 85.14 percentage points, in 2010. In the period 2006–2016, Poland, Bulgaria and Romania scored a density of active enterprises under the average, by a minimum of 66.60 percentage points in Poland (2008), and a maximum of 253.60 percentage points in Romania, in 2010 (which was the lowest density of active enterprises on record among all the countries under study). In Cluster B, Latvia scored a rather low density of active enterprises from the average value of 671.83%, namely between 352.67% (2008) and 555.41% (2015). In the other countries of Cluster B entrepreneurship fared better if it is considered the shares fluctuating between 381.31% for Lithuania, in 2009, and 823.54% for Slovakia, in 2015. The Czech Republic

(Cluster C) is the country with the highest density of active enterprises among all the other 9 countries, exceeding by 50.06 percentage points the average of 762.50%, as determined. The density of active enterprises was a modest indicator both in Slovenia and in Estonia, where its values between 563.67% and 684.08% in Slovenia, and between 527.28% and 629.48% in Estonia, were below the average.

3.2. Cointegration analysis

The second stage of this research was meant to identify cointegration relationships capable to detect the existence or non-existence of long-term correlations between the historical evolution of business demography and real GDP per capita. For this purpose, the first step was to verify the stationarity of the time data specific for each of the three clusters, as well as to identify their level of integration. To this end, it was used the Augmented Dikey-Fuller Test (ADF). A synthetic display of the results so obtained appears in Table 4.

Table 4. The results of Unit Root Test (1st difference) for data series included in the analysis (source: authors ‘own computations)

Panel unit root test							
Exogenous variables: Individual effects							
Method: ADF – Fisher Chi-square							
Null: Unit root_(assumes individual unit root process)							
Variables	Prob**						
	D(GDP)	D(BRT)	D(DTH)	D(ESB)	D(NBPG)	D(CHR)	
Cluster A (Cross-sections 4)	0.0000	0.0050	0.0015	0.0222	0.0000	0.0380	
Cluster B (Cross-sections 3)	0.0000	0.0366	0.0081	0.0424	0.0364	0.0024	
Cluster C (Cross-sections 3)	0.0003	0.0000	0.0376	0.0577	0.0041	0.0063	
Variables	Prob**						
	D(SVR1)	D(SVR2)	D(YOE1)	D(YOE2)	D(DBRT)	D(DAE)	
Cluster A (Cross-sections 4)	0.0007	0.0119	0.0023	0.0247	0.0006	0.0004	
Cluster B (Cross-sections 3)	0.0019	0.0218	0.1438	0.1112	0.0244	0.0933	
Cluster C (Cross-sections 3)	0.0000	0.0025	0.0001	0.0698	0.0000	0.1122	

Note: ** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution.

In view of the results obtained, it can be concluded that in Cluster A (Hungary, Poland, Romania and Bulgaria), all values of Prob** are strictly smaller that the value of the significance threshold α = 0.05 (95% Confidence level). Therefore, the null hypothesis is rejected and the alternative hypothesis is accepted, which means that the data series of Cluster A are order I integrated stationaries (1).

In Cluster B (Latvia, Lithuania, Slovakia), between the time series of variables YOE1 (1 year old enterprises' share of the business population), YOE2 (2 year old enterprises' share of the business population), and DAE (Density of active enterprises), for Prob** values that are strictly greater than the value of the threshold of significance, and the time series of the GDP per capita, no cointegration relationships can exist. Consequently, they shall not be eliminated from the analyses verifying the existence of an error correction model for this cluster.

Cluster C (The Czech Republic, Slovenia, Estonia) have three variables that do not meet the above requirement, i. e. ESB (Employment share of enterprise births), YOE2 and DAE. Knowing that between the time series of these variables and the real GDP per capita there can be no long-term balance relationships (cointegration), they shall no longer be taken in consideration for the verification of the error correcting model for Cluster C.

With the help of the methodology, the research was conducted to verify the existence or non-existence of cointegration for each of the clusters, partly by testing the level of correlations between variables, and eliminating those that did not meet the requirements, after which it was verified the existence of cointegration relationships, estimated the parameters of the VEC model, and identified the error correction model (MEC).

In Cluster A (Table 5), with the *Sig.*(2-*tailed*) values below the significance threshold (α = 0.05), only the Pearson parametric correlation coefficients are statistically relevant for the variables CHR, DTH, YOE1, YOE2 and DAE. Their values reveal a correlation of a relatively medium intensity.

Table 5. The values of Pearson Correlation between GDP and factorial variables for Cluster A

	Indicators	BRT	CHR	DTH	ESB	NBPG	DBRT
GDP	Pearson Correlation	–.029	–.460**	–.457**	–.088	.064	.307
	Sig. (2-tailed)	.877	.008	.009	.630	.730	.087
	Indicators	SVR1	SVR2	YOE1	YOE2	DAE	
	Pearson Correlation	.055	–.106	–.472**	–.564**	.681**	
	Sig. (2-tailed)	.765	.562	.006	.001	.000	

Note: ** Correlation is significant at the 0.01 level (2-tailed).

Further, with the help of the bilateral correlation coefficients between the factorial variables that fulfilled the first requirement (Table 6), it was verified if any bilateral correlations exist between them. Knowing that no correlations should exist between factorial variables, it means that only variables DTH and YOE1 fulfill this second requirement (the bilateral correlation coefficient between them is not statistically significant, *Sig.*(2-*tailed*) being higher than the significance threshold).

Table 6. Values of the bilateral correlations between the factorial variables in Cluster A

		CHR	DTH	YOE1	YOE2	DAE
CHR	Pearson Correlation	1				
	Sig. (2-tailed)					
DTH	Pearson Correlation	.862**	1			
	Sig. (2-tailed)	.000				
YOE1	Pearson Correlation	.358*	.192	1		
	Sig. (2-tailed)	.045	.293			
YOE2	Pearson Correlation	.383*	.318	.556**	1	
	Sig. (2-tailed)	.030	.077	.001		
DAE	Pearson Correlation	–.594**	–.518**	–.393*	–.522**	1
	Sig. (2-tailed)	.000	.002	.026	.002	

Note: **. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Therefore, in Cluster A it was verified the existence of a long-term balanced relationship only between the time series of a real GDP per capita and the time series of the Death rate and the Percentage of 1 year old enterprises' share of the business population. Knowing that the value of *Prob.* = 0.0001 (Table 7) is smaller than the significance threshold ($\alpha = 0.05$), the null hypothesis is rejected (no cointegration relationship exists), and it was found that the Johansen Cointegration Test indicates a cointegration relationship of level 0.05.

Table 7. Johansen Cointegration Test for Cluster A

Series: GDP DTH YOE1				
Lags interval (in first differences): 1 to 2				
Unrestricted Cointegration Rank Test (Trace)				
xcHypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.
None *	0.815512	41.99008	24.27596	0.0001
At most 1	0.275259	8.186714	12.32090	0.2226
At most 2	0.083685	1.747903	4.129906	0.2188

Note: * Trace test indicates 1 cointegrating eqn(s) at the 0.05 level.

The estimated values of the model's parameters are displayed in Table 8. The *t-statistic* values are greater than $\left|t_{critic}\right| = \left|t_{\alpha=0.05;17}\right| = 2.11$, which determines the rejection of the null hypothesis (coefficients' values are not statistically significant) and the acceptance of the alternative hypothesis (coefficients' values are statistically significant). Similarly, knowing that the *CointEq1* is negative, and that $\left|t_{statistics}\right| = 3.77962$ is significantly higher than the critical value (2.11), the cointegration model for Cluster A is statistically significant and describes the long-term balanced relationship between GDP per capita, DTH and YOE1.

Table 8. Estimation and validation of the main parameters of the cointegration model for Cluster A

Vector Error Correction Estimates			
Cointegrating Eq:	CointEq1	Standard errors	t-statistics
GDP(–1)	1.000000		
DTH(–1)	977.9304	(396.367)	[2.46724]*
YOE1(–1)	–3679.549	(558.945)	[–6.58302]**
Error Correction:	D(GDP)		
CointEq1	–0.014432	(0.00382)	[–3.77962]**

Note: **. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

The explicit form of the model for the Vector Error Correction is:

$$d(GDP) = -0.014432 \cdot \left(GDP_{t-1} + 977.9304 \cdot DTH_{t-1} - 3679.5493 \cdot YOE1_{t-1}\right) + 0.1160 \cdot GDP_{t-1} - 0.0452 \cdot GDP_{t-2} - 15.3938 \cdot DTH_{t-1} + 5.1225 \cdot DTH_{t-2} - 25.4931 \cdot YOE1_{t-1} + 35.5663 \cdot YOE1_{t-2}. \quad (6)$$

The long-term balanced relationship between the time series of the GDP per capita, DTH and YOE1 is:

$$GDP = -977.9304 \cdot DTH + 3679.5493 \cdot YOE1. \quad (7)$$

An additional verification of the existence and mode of action of the error correction model (7) is possible by testing its model's stability through application of unit impulses to its variables.

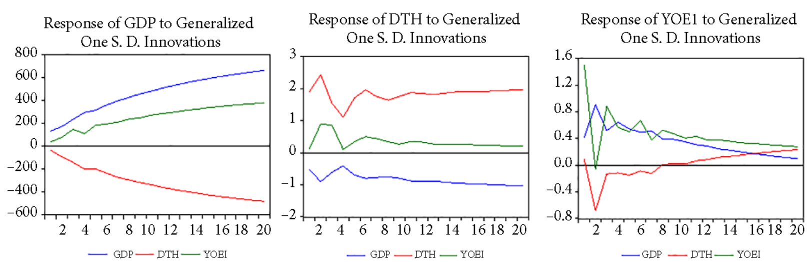

Figure 2. Response of model of Cluster A to Generalized One S.D. Innovations
(source: authors 'own design)

The response of the model (Figure 2) indicates a relatively good stabilization. This demonstrates that the model is not significantly affected by disturbances, meaning that whenever one of the variables increases or decreases significantly, the error correction model will cause the reversal to the long-term balance between the three variables. In Cluster B (Latvia, Lithuania and Slovakia), of all the eight variables of the business demography that meet the cointegration requirements, the Pearson parametric correlation coefficients (Table 9) are statistically significant only for DTH, CHR, SR1, SRV2 și DBRT, with the *Sig.*(2-*tailed*) values being smaller than the value of the significance threshold of α = 0.05. The intensity of the bilateral correlations between this and real GDP per capita is average.

Table 9. The values of Pearson Correlation between GDP and factorial variables for Cluster B

	Indicators	BRT	DTH	ESB	NBPG	CHR	SVR1	SVR2	DBRT
GDP	Pearson Correlation	–.288	–.497*	.224	.288	–.480*	.467*	.544**	.539**
	Sig. (2-tailed)	.173	.014	.292	.172	.018	.021	.006	.007

Note: ** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Regarding the second condition of filtering, it is met only by the variables DBTR and DTH (Table 10), because Sig. (2-tailed) = 0.842 is much higher than the significance threshold, α = 0.05, and consequently, the value of the bilateral correlation coefficient between the two variables is statistically insignificant.

Table 10. Values of the bilateral correlations between factorial variables in Cluster B

		CHR	DTH	SVR1	SVR2	DBRT
CHR	Pearson Correlation	1				
	Sig. (2-tailed)					
DTH	Pearson Correlation	.874**	1			
	Sig. (2-tailed)	.000				
SVR1	Pearson Correlation	–.646**	–.576**	1		
	Sig. (2-tailed)	.001	.003			
SVR2	Pearson Correlation	–.648**	–.546**	.896**	1	
	Sig. (2-tailed)	.001	.006	.000		
DBRT	Pearson Correlation	.268	–.042	–.082	–.063	1
	Sig. (2-tailed)	.205	.846	.702	.772	

Note: **. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

In order to verify the existence of cointegration relationships between the time series of the variable Real GDP per capita and the time series of variables Death rate (DTH) and Density of birth rate (DBRT), it was used the Johansen Cointegration Test. The results (Table 11) demonstrate the existence of a cointegration equation for a confidence coefficient for 95% (α = 0.05).

Table 11. Johansen Cointegration Test for Cluster B

Series: GDP DBRT DTH				
Lags interval (in first differences): 1 to 2				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.
None *	0.601534	25.50583	24.27596	0.0348
At most 1	0.298905	7.103149	12.32090	0.3149
At most 2	4.51E-05	0.000903	4.129906	0.9823

Note: * Trace test indicates 1 cointegrating eqn(s) at the 0.05 level.

Following the above, it was estimated the VEC model for Cluster B. The results obtained (Table 12) lead us to the conclusion that the regression coefficient corresponding to variables DBRT and DTH are statistically significant for a confidence level of 99%. At the same time, considering the negative value of *CointEq1* (–0.009404), on the one hand, and the fact that this value is statistically significant for a confidence coefficient of 95%, on the other, it results that the cointegration model for Cluster B is statistically significant.

Table 12. Estimation and validation of the parameters of the cointegration model for Cluster B

Vector Error Correction Estimates			
Cointegrating Eq:	CointEq1	Standard errors	t-statistics
GDP(–1)	1.000000		
DBRT(–1)	–429.9375	(113.596)	[–3.78478]**
DTH(–1)	1749.126	(453.891)	[3.85362]**
Error Correction:	D(GDP)		
CointEq1	–0.009404	(0.00523)	[2.1121]*

Note: **. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

The explicit form of the model for the Vector Error Correction is:

$$d(GDP) = -0.009404 \cdot \left(GDP_{t-1} - 429.9375 \cdot DBRT_{t-1} + 1749.126 \cdot DTH_{t-1}\right) + 0.5065 \cdot GDP_{t-1} - 0.0034 \cdot GDP_{t-2} - 5.6512 \cdot DBRT_{t-1} + 0.4591 \cdot DBRT_{t-2} - 22.4374 \cdot DTH_{t-1} - 20.5062 \cdot DTH_{t-2}. \quad (8)$$

Knowing that in model (8), the long-term balance relationship between the time series of the analyzed variables is expressed as:

$$GDP = 429.9375 \cdot DBRT - 1749.126 \cdot DTH\ . \quad (9)$$

The veracity of the results so obtained was verified by testing the stability of the system when applying the unit impulses to its variables.

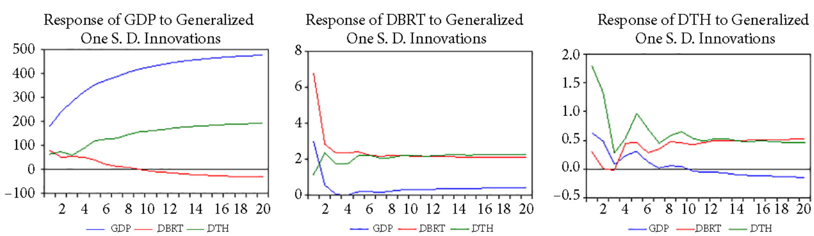

Figure 3. Response of model of Cluster B to Generalized One S.D. Innovations
(source: authors 'own design)

The results obtained (Figure 3) demonstrate that the error correction model has immediate effects so that, as soon as a disturbance appears, it tends to revert the system to its initial balance. In the case of Cluster C (The Czech Republic, Estonia and Slovenia), of all the variables that meet the cointegration requirements (Table 13), the Pearson parametric correlation coefficients are statistically significant only for DTH, CHR, SRV1 and SRV2, with the *Sig.*(2-*tailed*) values being lower than the value of the significance threshold α = 0.05. The intensity of the bilateral correlations between this and the real GDP per capita are also of medium intensity.

Table 13. The values of Pearson Correlation between GDP and factorial variables for Cluster C

	Indicators	BRT	DTH	NBPG	CHR	SVR1	SVR2	YOE1	DBRT
GDP	Pearson Correlation	–.120	–.640**	.248	–.410*	.652**	.714**	–.058	–.044
	Sig. (2-tailed)	.576	.001	.243	.046	.001	.000	.789	.837

Note:**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

The analysis of the values of the bilateral correlation coefficients among the four variables of business demography that meet the above requirement (Table 14), and the values of *Sig.* (2-*tailed*), demonstrates that the second churning condition is fulfilled only by CHR and SVR2.

Table 14. Values of bilateral correlations between factorial variables in Cluster C

		CHR	DTH	SVR1	SVR2
CHR	Pearson Correlation	1			
	Sig. (2-tailed)				
DTH	Pearson Correlation	.739**	1		
	Sig. (2-tailed)	.000			
SVR1	Pearson Correlation	–.323	–.357	1	
	Sig. (2-tailed)	.123	.087		
SVR2	Pearson Correlation	–.077	–.507*	.563**	1
	Sig. (2-tailed)	.720	.012	.004	

Note: **. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Like in the case of the clusters analyzed above, it was applied the Johansen Cointegration Test in order to verify the existence of cointegration relationships between the time series of the variable real GDP per capita and the time series of variables Business churn (CHR) and Survival rate 2 (SVR2). The results (Table 15) demonstrate, also, the existence of a cointegration equation for a confidence coefficient of 95% (α = 0.05).

Considering the results of the Johansen Test, it was estimated the coefficients of the VEC model corresponding to this cluster, for which the main values are displayed in Table 16. Knowing that the coefficients corresponding to variables CHR and SVR2 are statistically significant for a confidence coefficient of 99%, and that the value *CointEq1* is negative and statistically significant for a confidence level of 95%, it appears that the estimated model describes the cointegration relationship between the two variables.

Table 15. Johansen Cointegration Test for Cluster C

Series: GDP CHR SVR2				
Lags interval (in first differences): 1 to 2				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.
None *	0.52278	24.31722	24.27596	0.0493
At most 1	0.371354	9.701369	12.32090	0.1322
At most 2	0.020664	0.417620	4.129906	0.5816

Note: * Trace test indicates 1 cointegrating eqn(s) at the 0.05 level.

Table 16. Estimation of the cointegration model for Cluster C

Vector Error Correction Estimates			
Cointegrating Eq:	CointEq1	Standard errors	t-statistics
GDP(–1)	1.000000		
CHR(–1)	3268.243	(337.909)	[3.37312]**
SVR2(–1)	–1132.301	(453.891)	[–3.35091]**
Error Correction:	D(GDP)		
CointEq1	–0.009142	(0.00461)	[2.18417]*

Note: **. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

The explicit form of the model for Vector Error Correction corresponding to Cluster C is expressed as:

$$d(GDP) = -0.00914 \cdot \left(GDP_{t-1} + 3268.243 \cdot CHR_{t-1} - 1132.301 \cdot SVR2_{t-1}\right) + 0.4035 \cdot GDP_{t-1} + 0.0256 \cdot GDP_{t-2} - 44.1723 \cdot CHR_{t-1} - 26.2531 \cdot CHR_{t-2} - 26.4125 \cdot SVR2_{t-1} + 19.8998 \cdot SVR2_{t-2}. \quad (10)$$

In consideration of model (10), the long-term balance relationship between the time series of variables GDP, CHR and SVR2 is expressed as:

$$GDP = -3268.243 \cdot CHR + 1132.301 \cdot SVR2 . \quad (11)$$

The veracity of the results obtained for Cluster C was verified also by testing the stability of the system when unit impulses were applied to variables GDP, CHR and SVR2.

The responses illustrated in Figure 4 reveal a rather speedy stabilization effect, which leaves us to conclude that the long-term balance relationship between the variables is not affected significantly by disturbances. The results obtained through the analysis of the existence of long-term balance relationships between the time series of the real GDP per capita and the indicators of business demography confirm the existence of such relationships between the analyzed variables. They, however, vary from one group of states to another. For example,

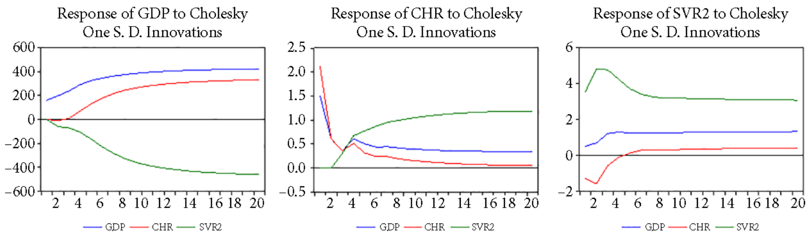

Figure 4. Response of model of Cluster C to Generalized One S.D. Innovations
(source: authors 'own design)

for the states in Cluster A (Hungary, Poland, Romania and Bulgaria), the long-term balance relationship was found to exist between the real GDP per capita, Death rate (DTH) and the percentage of 1 year old enterprises' share of the business population (YOE1). For the states in Cluster B (Latvia, Lithuania, Slovakia), the long-term balance relationship was found to exist between the real GDP per capita, Death rate (DTH) and Density of birth rate (DBRT); for the states in Cluster C (The Czech Republic, Slovenia, Estonia), the same relationship was found to exist between the real GDP per capita, Business churn (CHR) and Survival rate 2 (SVR2).

Conclusions

The analysis conducted for the purposes of this study took the period 2006–2016 as the reference time segment, in 10 of the EU member countries, except for Croatia, for which the data available were not sufficient to include it in this study, all of these countries being known to have had a centralized economy prior to 1990. Recognizing the fact that, after that year, the transition to a market economy took on different forms in each of these countries, business demography followed different paths, under the influence of primary factors, such as the economic environment, the social conditions, entrepreneurship background. Having these factors in view, the analysis pursued to verify the existence of long-term relationships (cointegration) between business demography and the economic growth expressed in terms of real GDP per capita, after we first examined and described the similarities and dissimilarities between the states under study from the viewpoint of business demography. As a result of the econometric methodology applied, it was obtained a picture of the similarities and dissimilarities between the 10 countries, but also of the existence of long-term balance relationships (cointegration) between their business demography and economic growths, expressed in terms of real GDP per capita. It was observed that, over the entire reference period (2006–2016), the Gross Domestic Product had a general rising trend in all the three clusters and each country.

The figures processed for the purposes of this study revealed that the ownership of the newly established business ventures was acquired either by incorporating new start-ups, by buy-outs, or inheritance, or by way of take-overs by the current owners. The business birth rates witnessed a slight downward trend in most of the ten countries, and in each cluster. In the reference time segment, the fluctuations of the business demography rates were studied without ignoring the heterogeneous nature of the founders of new business entities, and the errors made in the course of their advent to the market. It was found that resources, the organizational patterns, and financing schemes of the ventures acted as factors that influenced the performance of the new businesses to the effect of diminishing the death rates (from 3.38% per year in Lithuania to 0.1% in The Czech Republic) in almost all the ten countries and in all the clusters subjected to present scrutiny. The exceptions from this trend are Poland (0.55% per year) and Slovenia (0.16% per year), where, at the end of the period considered, the indicator had a slight growth.

A summary of the results obtained gives the picture of business demographics variations by country, by cluster, and degree of intensity. These features reflect in the particulars of the owners, in their management patterns, all with different effects on the business churn, the rate of which had an average growth of 0.41% per year in Polonia, and 0.55% per year in The Czech Republic. Another finding is that the variable Employment share of enterprise births, in the time span 2008–2015, shows the same tendency as the birth rate, by country and cluster. In the same context, the Survival rate1 and Survival rate2 followed similar curves b, by cluster. The time and space evolution of the two exogenous variables (1 year old enterprises' share of the business population, 2 year old enterprises' share of the business population) was determined in order to reveal the role and place of entrepreneurship in the fluctuations of the GDP. Poland and Bulgaria recorded average drops, while Hungary recorded an upward trend for both variables, with shares oscillating between –0.89% per year, and 0.16% per year. Romania is the only country in Cluster A where YOE1 kept decreasing at an annual average rate of 0.7%, and YOE2 kept increasing at an annual average rate of 0.27%. A situation similar to that of Cluster A was found in the other two clusters, B and C. Lithuania (Cluster B) and The Czech Republic (Cluster C) had a negative evolution at annual rates between 0.3% and 0.0014%, for the two indicators. Latvia, in Cluster B, and Slovenia, in Cluster C, had average growth rates for both variables at rates between 0.11% per year, and 0.47% per year. In Cluster B, Slovakia, and in Cluster C, Estonia, are the countries with different evolutions for the two indicators. Both countries had average growth rates for YOE1 (by 1.02% and 0.11% per year), and average decrease rates for the latter indicator, by 0.18% and 0.06% per year. These evolutions indicate a rather balanced distribution of these variables, and therefore of the processes that lead to initiating and maintaining efforts for the survival and early growth of business ventures, with positive effects on business demography.

The status of entrepreneurship goes hand in hand with a rising of the market share, paralleled by a territorial expansion capable to model clients' behavior patterns, which, in turn can shape managerial policies in the newly established and the long-standing business entities. Therefore, the performance of a business can be ascribed to two other indicators: density of birth rate and density of active enterprises. Looking at the evolutions by country and cluster, over the period 2008–2015, it can be seen the impact of these variables to the effect of stimulating entrepreneurship. Two countries, both in Cluster A, Romania and Poland, recorded a growth of the two variables at average annual rates between 0.35% and 14.48%. Hungary had an annual average drop of 0.07% for DBRT, and of 4.84% for DAE. Bulgaria had an average annual decrement of 1.36% for the former indicator, and an average annual growth of 15.73% for the latter indicator. The evolutions in the other two clusters were pretty much the same. Two of the member countries in each (Latvia and Lithuania in Cluster B, and

The Czech Republic plus Slovenia in Cluster C) had growing tendencies for both variables, while one country in each of the two clusters (Slovakia in Cluster B, respectively Estonia in Cluster C) scored decreasing rates for DBRT, and growing rates for DAE.

The relationships detected between the endogenous variable (GDP) and the 11 exogenous variables considered in this current analysis derive form a diversity of factorial combinations, based on the mode of interpenetration of the exogenous variables across the countries and across the years. Both with the aid of the preliminary results, and by way of the cointegration analysis, it was rendered the appearance and existence of long-term balance relationships between the time series of the real GDP per capita and the indicators of business demography that vary from one cluster to another. In this context, one can affirm that for Hungary, Poland, Romania, and Bulgaria, the countries grouped in Cluster A, a long-term balance relationship was documented between Death rate (DTH), Percentage of 1 year old enterprises' share of the business population (YOE1), and real GDP per capita. Latvia, Lithuania, Slovakia, as members of Cluster B, is countries where the long-term balance relationship exists between Death rate (DTH), Density of birth rate (DBRT) and real GDP per capita. The countries forming Cluster C, The Czech Republic, Slovenia, Estonia, demonstrated the existence of long-term balance relationship between Business churn (CHR), Survival rate 2 (SVR2) and real GDP per capita. The findings above would recommend that the incentives afforded via public policies should be carefully differentiated. This would capacitate the entrepreneurs of newly established businesses to conduct business at high performance indicators, if they feel more motivated than those already operating on the market.

Verifying the existence of long-term balance relationships between business demography and economic growth, in terms of real GDP per capita is a type of research of great topicality, which can play a significant role, due to the changing landscape of the European business environment under the pressure of volatile production boundaries, with an impact on the companies' economic efficiency. In the present circumstances, with the Covid-19 pandemic taking a toll on the economies of all the countries in the world, it is of great interest to approach the issue of the cointegration relations involving business demography and economic growth. This is one of the subjects intended to study in the future, namely a scientific research based on econometric models, bringing under scrutiny all the EU member states, plus other European states, such as Belarus and the Ukraine. Such an attempt, however, will probably have to overcome challenges like the lack of specifically aggregated data series, or their availability, or their spread over a relatively short period of time. This might affect the compactness of the approach or might limit the area of utility. To avoid such limitations, in this current study, the items chosen in the sample were based on the availability of the data required, respectively a batch of 1127 empirical values, which describe the time evolutions of business demography and real GDP per capita in the states chosen for this analysis, during the period 2006–2016.

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Author contributions

The present form of the manuscript is the full result of the joint work of all the authors. All authors have equal contributions in designing, work conceptualization, data acquisition, analysis and interpretation of data and results, drafting the article. All the authors have intellectuality discussed and agreed to submit the manuscript.

Disclosure statement

The authors declare that they have no competing financial, professional, or personal interests from other parties.

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