Sources of productivity differentials in manufacturing in post-transition urban South-East Europe

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This research was supported by a grant from the CERGE-EI Foundation under a program of the Global Development Network. All opinions expressed are those of the author(s) and have not been endorsed by CERGE-EI or the GDN.

ABSTRACT

The paper analyses the effects of urbanisation and localisation economies on manufacturing firms' productivity across urban landscape in post-transition South-East European (SEE) countries. Estimations of panel data model with fixed effects on a large sample of firms shows that factors that account for productivity advantages of manufacturing firms in urban post-transition SEE are related to the firm and to the environment in which these firms operate. Firms located in diversified cities benefit from a productivity premium generated in this type of agglomeration, while no evidence was found that the relative specialisation across industries has any effect on firm productivity levels.

Key words: city, specialisation, diversification, manufacturing, total factor productivity, post-transition South-East Europe.
JEL: D24, R00, R12

INTRODUCTION

Recent research on local productivity advantages of Italian manufacturing firms (Di Giacinto et al., 2014) has found urban areas attractive for manufacturing over other types of firm agglomeration. It appears that manufacturing firms in urban areas accrue productivity advantages over firms in others types of agglomerations. The literature suggests that firms in larger cities tend to be more productive, and after ruling out localised natural advantage, this can be explained with agglomeration economies and stronger firm and worker selection (Combes et al., 2012). When the agglomeration type is considered, cities may be diversified or specialised and these particular settings may also influence firm performance. Cities often maintain specialised in a particular industry throughout larger periods.

Throughout South-East Europe (SEE), in the pre-transitional period there has been a tradition of specialisation in manufacturing throughout the urban space, often under the shield of protectionist trade policies and government subsidies. The economic structure of entire economies and their cities in transitional Europe has been transformed by transitional processes that included trade liberalisation since the early 1990es and by the European Union (EU) integration processes. However, the results of these changes to cities' economic structure are not well documented. Post-transition SEE consists mostly of countries that have not attracted sufficient attention of researchers as most are considered "late reformers". These countries are mostly underperforming compared to the "the early bird club" of economies that acceded to the EU by 2004 and have appropriated significant development advantages by attracting FDI and facilitating increase in trade flows (Botric et al., 2015). The economic importance of cities in SEE countries is unrivalled. Word Bank data show that in 2014 in most SEE countries at least over half of population reside in urban areas. Effects of joining the unified economic space can be observed through liberalisation of trade and capital flows.

In the economic literature, the effects of economic integration on spatial distribution of activity are predicted by new economic geography (NEG) concept (Fujita, Krugman, 2004). Stronger specialisation of spatial units is expected to occur as a result of trade liberalisation.

The goal of this paper is to contribute to understanding the effects of urbanisation and localisation economies to firm productivity differences. Industries are “mapped” across 98 cities in six post-transitional economies in SEE. Slovenia, Croatia, Bosnia and Herzegovina, Serbia, Bulgaria and Romania are post-transitional economies, with processes of de-industrialisation and re-industrialisation occurring simultaneously over the last two decades. Previous research on various aspects of industrial activity in transitioning Europe focuses mostly on regions as spatial units; the role of cities as locations of manufacturing firms in SEE is still largely unexplored.

These countries differ with respect to size, geographic position, the stage of EU integration and their development level. Slovenia, Croatia, Bosnia and Herzegovina are smaller countries, while Serbia, Bulgaria and Romania are larger counties. Slovenia and Croatia are the closest to the European core, while Bulgaria and Romania are the most peripheral. Slovenia has also been the most successful in converging to EU development level. This paper looks into the results of structural changes that have formed these cities' present industrial profiles. Research questions that are raised are: Firstly, do localisation and urbanisation economies play equally important role as industry or firm-traits in firm performance? Secondly, what have been the effects of localisation economies on firm performance in post-2008 period? In the first question, the structural traits of urban economies are considered as a factor that can be supportive for productivity growth. Industries are mapped across cities with over 50.000 populations, a population threshold that is in line with previous literature and with limitations of the dataset used in this research. The intention is to look into what type of economic structure is more conducive in creating positive local externalities that can lead to productivity advantages. The second question deals with the issue of exposure to economic shocks. The NEG predicts that, with the rise of specialisation across EU space, these specialised locations will be more exposed to asymmetric shocks. Given the fact that the period of observation also includes the period related to 2008-economic recession brought on by the global financial crisis from 2008, this prediction of NEG can be tested on a micro-scale.

The empirical analysis in this paper consists of two building blocks. The mapping of productivity differentials across firms relies on methodologies for estimating firms' total factor productivity (TFP). Sources of firm-level TFP differences are estimated in a panel data setting. An econometric model is built with the purpose to integrate firm, industry and agglomeration factors that can have effect on firm performance. By "mapping" industries across urban space and assessing the importance of different types of agglomeration economies for firm efficiency in European post-transitioning economies, this paper contributes to the current body of research on transitioning economies.

The paper is structured as follows: Section 2 provides a literature overview on city specialisation issues and reflects on it as a source of TFP growth; Section 3 describes the dataset, the sample of cities and discusses representativeness issues; Section 4 provides results on TFP estimation; Section 5 introduces an econometric model; Section 6 is dealing with robustness checks; Section 7 offers conclusions.

1. LITERATURE REVIEW

Empirical evidence of changes in the economic structure occurring through European integration across urban space of transitioning Europe is rare. The literature that exists does point to a growing economic polarisation between the capital cities and other cities in the national hierarchy. Broad evidence on the state of cities in transitioning Europe was gathered by Lintz et al. (2007), who report that market forces have spurred city development, but this was largely limited to the metropolitan regions, as the most attractive agglomerations. At the same time, many old industrial cities, coined “cathedrals in the desert” that hosted important industrial plants, have experienced a setback. Lintz et al. explain the context of this setback through lower business start-up rate of local population. Furthermore, attraction forces of metropolises have drawn in foreign investors enabling the capital-cities to strengthen their position within the national urban hierarchy. Dogaru et al. (2014) have found that capital city regions in transitioning Europe received more greenfield FDI and attracted a wider variety of investments, both in sectors and in functions. Largely, these findings would imply that “core” locations at the national level are better integrated through trade and capital flows than the rest of the urban space of transitioning countries in Europe.

Through trade liberalisation and EU integration processes, post-transitioning Europe, has opened to structural changes. These processes can lead to increase in specialisation across key manufacturing locations, including cities.

Increasing returns to scale (RTS) are the fundamental argument why firms would concentrate in space and why large plants would concentrate their production in single location rather than in more different locations (Ascani et al., 2012). Importantly, in NEG the external economies are considered a source of localisation of industries and resonate with Marshall’s agglomeration externalities - labour market pooling, availability of specialised intermediates and technological spillover effects (Krugman, 1991). Agglomeration externalities are the result of non-market interactions that produce increasing returns that are external to firms (paraph., Fujita, Thisse, 2009). Home market effects also play an important role in NEG models and can be explained in a core-periphery setting. Through circular causation of forward linkages (related to the workers/consumers' incentive to be close to producers of consumer goods) and backward linkages (related to the producers' incentive to concentrate in larger markets), the centripetal force is generated that reinforces the concentration in the industrial core (Fujita, Mori, 2005) and, thus also reinforces specialisation in the core.

Furthermore, in the light of NEG, Krugman (1991) has predicted that the removal of trade barriers and European integration will bring about more industrial specialisation (or concentration) across EU and, as a consequence, more exposure to asymmetric economic shocks. Evidence from the incumbent EU members over the last two decades was not supportive of this prediction, at least at the regional level (OECD, 2004). However, Longhi et al. (2014) argue that the metropolitan areas and major regional centres of larger EU countries may accumulate most benefits from European integration, using NEG as a theoretical foundation of their work. Longhi et al. (2014) research has shown that specialisation has increased and that sectoral structures have become more similar in services. Moreover, the integration jointly with development positively influences specialisation in the sense that the positive effect of development on specialisation is stronger in metropolitan areas that are better integrated with the EU.

Cities are considered centres of economic activity and, presumably, they remain attractive locations for manufacturing firms so as long as benefits agglomeration economies prevail over the costs of agglomeration diseconomies. Agglomeration economies attract firms and labour to co-locate, while agglomeration diseconomies push firms and labour to relocate to decentralised locations (Richardson, 1995). All cities are characterised by being either specialised or diversified, depending on whether their economic activity is concentrated in similar or dissimilar types of production – and larger cities tend to be more diversified (Duranton, Puga, 2000). Evidence on the productivity advantages that firms can appropriate by locating in larger cities and in more diversified locations can be found in the empirical literature. Firms in larger cities are overall more productive than firms in smaller cities

(Combes et al., 2012; Rosenthal, Strange, 2004), due to a number of reasons, including foremost the agglomeration economies, but also localised natural advantage, stronger worker and firm selection (Combes et al., 2012). Furthermore, productivity advantages of firms located in cities as more diversified locations are noted over firms in more specialised industrial-district-type of areas (Di Giacinto et al., 2014 provide convincing evidence for Italy).

On a micro-scale, agglomeration forces influence firm performance through indivisibility, synergy and proximity, as summarised by Capello (2009): a) *indivisibilities* emerge through economies of scale and are industry specific; b) when firms cooperate and through market interactions, *synergy* is created through outsourcing and flexibility in production that allows for minimization of transaction and production costs that leads to greater firm productivity; c) *geographic proximity* i.e. the spatial concentration of firms is supportive of both indivisibilities and synergy. Syverson (2011) provides an extensive overview of research on sources of differences in productivity levels of firms. As a starting point, productivity differences among firms are found to be persistent, even in narrowly defined industries. While some of the factors are firm-related such as management practices or intangible capital, many are embedded in firm environment, for example competition, demand structure, regulation, etc. In the case of emerging economies, Syverson refers to the literature that recognises that firm inefficiencies arise from inadequate allocation of resources in production.

FDI is considered a channel of economic integration for transitional Europe that may bring knowledge transfer, restructuring of local firms and integration into global value chain through exporting activity on a micro-scale. All of these activities should lead to higher efficiency of firms in foreign ownership in SEE, while the effects on other local firms do not necessarily have to be positive. Early evidence from CEE economies has revealed that with advent of multinational firms, that has been some integration of local firms into global production networks but these effects have been constrained to their subsidiaries (Kaminski and Smarzynska, 2001). Zukowska-Gagelmann (2000) and Hamar (2001) reported about emergence of two-tier economy in Poland and in Hungary, where enterprises that have received FDI dominate the economy while, while local enterprises only try to catch up. Konings (2001) did not find any positive spillover in Bulgaria, Poland and Romania from foreign-owned enterprises to local firms in the period of 1993-1997. Newer evidence is provided by Stojcic and Orlic (2015), who using the spatial Durbin model to show that horizontal and backward spillovers in the same region were negative suggesting that local firms do not meet quality standards of multinational corporations. At the same, urbanisation externalities and firm size, in the case of larger firms, were found important channels for improving productivity of local firms. Botric et al. (2015) tackle the issue of inter-relatedness of trade and FDI in SEE, including all countries observed in this paper apart from Slovenia. Using econometric estimates on data for the period 2001-2013, authors confirmed long-run relationship between FDI and trade, suggesting that countries that have received more FDI, are more trade-orientated and thus, more integrated into global value chains. Drawing on these findings for transitional Europe, positive effects of FDI appear largely limited to firms in foreign ownership since positive spillovers to local firms are not verified.

2. DATASET DESCRIPTION

The empirical analysis was conducted on large unbalanced panel of 63,506 manufacturing firms observed over the period 2006-2013. The data were obtained from Bureau Van Dijk's Amadeus firm-level database containing, most importantly, balance sheet data and profit-and-loss account data for CEE. The unit of analysis is the firm defined as a legal entity, as opposed to the establishment. This procedure yielded a total of 98 'cities' in SEE, covering 35.3% of the total SEE population (Census data, 2011[1]). The number of cities in each country and their share of the total national population are as follows: Bosnia and Herzegovina - 12 cities or 35.6% of the 2011 population; Bulgaria - 18 cities or 44.7% of the 2011 population; Croatia - nine cities or 35.4% of the 2011 population; Romania – 38 cities or 32.8% of the 2011 population; Serbia – 17 cities or 35.7% of the 2011 population; Slovenia – four cities or 24.8% of the 2011 population.

To address the issue of incumbent and new firms, assumptions were made on firm entry and exit: a) firms that were recorded in the database at the beginning of the observed period are assumed incumbent, while firms that appear later years are assumed to new firms, and b) firm exit is assumed if data for firm cease to be recorded or if information on their status indicates that they are dissolved. The share of firms that were observed over the entire sample period is 42.5%. The analysis is focused on manufacturing industry alone because measuring and estimating productivity in services raises additional methodological challenges. The dataset includes 414,052 observations. To simplify summary analysis and reporting, the 30 separate manufacturing industries of two-digit NACE codes were grouped into the 10 industry groupings[2].

To produce the city-class-size ranges, the total population of the city area was used. The greatest number of the observations, 37.1% refers to firms located in large cities (cities with more than 500,000 inhabitants), followed by firms located in cities between 100,000 and 249,000 inhabitants (24,2% of the observations) and firms located in cities between 50,000 and 99,000 inhabitants (Table 1). About 63% of the observations refer to four industry

[1] Available at national statistical offices' websites.

[2] Coke and refined petroleum products as the 11th industry grouping were dropped from further analysis due to insufficient number of observations.

groups: food, beverages and tobacco industry, furniture, other manufactured goods and textiles, and to the apparel and leather industry (Table 1).

TABLE 1: The sample – number of observations

	City size class				
	less than 99,000	100,000-249,000	250,000 - 499,999	> 500,000	Total
Food, beverages, tobacco	17,715	16,315	10,997	23,840	68,867
Textiles, apparel, leather	15,783	16,292	9,947	20,677	62,699
Wood, cork, paper, printing, recorded media	11,792	11,053	8,759	22,474	54,078
Chemicals, pharmaceuticals, rubber, plastic	7,943	8,336	5,647	14,308	36,234
Other non-metallic mineral products	4,196	4,111	2,239	6,184	16,730
Basic metals, metal products	14,855	15,772	9,871	19,796	60,294
Machinery and equipment	3,161	3,909	2,738	6,399	16,207
Computer, el. and optical products, el. equipment	3,469	5,490	3,317	12,056	24,332
Transport equipment	1,534	2,407	1,087	2,483	7,511
Furniture, other manufactured goods	12,588	16,506	12,491	25,515	67,100
Small firms (less than 50 employed)	82,554	88,543	60,258	139,648	371,006
Medium sized firms (50-250 employed)	7,596	8,548	4,556	9,612	30,312
Large firms (more than 250 employed)	2,886	3,100	2,279	4,472	12,734
Total	93,036	100,191	67,093	153,732	414,052

Source: Amadeus, National Statistical Offices

Since data on the number of firms in manufacturing were not publicly available for all of the selected cities, the total number of manufacturing firms in the country is resorted to as another option for assessing data coverage (Table 2). Thus, coverage is considered as the share of firms from the sample in the firm population in the country, and also as the share of employment in the sample in total country employment. Romanian and Bulgarian firms prevail in the sample and, clearly this can be attributed to the higher number of cities from these countries that are represented in the sample. Coverage rate in terms of number of firms is ranging from about 11 percent in Slovenia to 60 percent in Romania. A parallel can be drawn to population data in these cities, as they range from 24.8 percent in Slovenia to 44.7

percent in Bulgaria, displaying varying patterns of agglomeration that are quite likely to reflect in firm agglomeration as well. Coverage considered in terms of number of employees is quite stronger, as expected, ranging from 19.2 percent in Slovenia to 56.1 percent in Romania. Lower coverage of Croatian and Slovenian data is striking in the light of small vs. large country differences and may shed some light on the geographical distribution of manufacturing activity in smaller economies. Obviously, a greater part of manufacturing industries is located outside the selected cities in these two small economies.

TABLE 2: Coverage of countries' firm population

Country	Total coverage, in terms of:	
	- number of firms	- number of employees
BA	39.9%	38.9%
BG	49.9%	54.5%
HR	22.7%	36.9%
RO	60.1%	56.1%
RS*	50.3%	53.7%
SI	11.0%	19.2%

Source: prepared by authors, Amadeus, Eurostat,
*National Statistical Office

Examining the data on the population of manufacturing firms in capital cities also provides a way to addressing issues of sample representativeness. Capital cities keep their own statistics of city-related economic data, but this is not the case with other cities (table 3). Coverage in Croatia's capital – Zagreb is quite encouraging as 91 percent of manufacturing firms are included in the sample. In the case of Bosnia and Herzegovina's capital city Sarajevo, 71.8% of the population of manufacturing firms are covered by the sample, while for Slovenian capital Ljubljana coverage rate is 71.8%. Belgrade, Serbian capital city data are less detailed, yet the coverage is 66 percent[3]. Consideration must be given to less detailed data from city statistics on the firm population in Belgrade that does not include information on whether firms are active or not. If both categories are included in the population, then data coverage is

[3] Data for Bulgarian and Romanian cities are not available.

even higher. Overall, these additional checks of data coverage appear rather satisfactory and the sample can be considered representative.

TABLE 3: Coverage of capital cities' population of manufacturing firms

Capital city	Total coverage
Sarajevo (BA)	74.5%
Sofia (BG)	n.a.
Zagreb (HR)	91.0%
Bucharest (BG)	n.a.
Belgrade (RS)	66.0%
Ljubljana (SI)	71.8%

Source: prepared by authors, Amadeus, Capital cities' statistical offices

When the data from Amadeus database at city level are compared to data from the official statistics, it is evident that employment in manufacturing has fallen dramatically in the selected countries and cities, a phenomenon referred to as "deindustrialisation". During 1989-2012 employment in manufacturing declined from about 56 in the case of Croatian and Serbian cities to about 75 percent in the case of Bosnian and Herzegovinian cities[4].

Looking at the capital city level for which data are available in the capital cities' statistics, more than half of industrial jobs were lost over the 1989-2012 in Croatian capital Zagreb while in Serbian capital Belgrade loss amounted to 56 percent[5]. After the Second World War the main source of economic growth in Croatia and other former Yugoslav republics, of which Slovenia, Bosnia and Herzegovina and Serbia are included in this research, was forced industrialisation. Industry was dominated by a number of socialist "giants" that have employed substantial number of workers. Former Yugoslav republics experienced strong growth after the 1940's until the beginning of the 1980's and the manufacturing accounted for about 40% gross product in the late 1970's (Kukić, 2015).

[4] Detailed data for Bulgarian and Romanian cities were not available.
[5] 1989-2013 period for Belgrade.

Generally, since the beginning of the economic transition, SEE countries have experienced a rapid de-industrialisation process marked by a sharp contraction of industrial employment. De-industrialisation process was linked to the difficulties within the manufacturing sector and to the economy as a whole. Additionally, in the case of the former Yugoslav countries, decrease in manufacturing jobs was supported by shocks to the system caused by the War during 1990-1995. The strong contraction in the 1990es was followed by slow recovery of industry until the latest financial crisis (in 2008) that resulted in a sharp industrial decline. The deindustrialisation process was further supported by the privatisation process. Namely, large public industrial enterprises – such as metal industry, shipyards, utilities and railways have been difficult to privatise, so they largely remained public and dependent on public aid.

3. PRODUCTION FUNCTION ESTIMATION

This part of the analysis is based on estimation of TFP dynamics for manufacturing industries and firm using a panel data on manufacturing firms in 2006-2013. To calculate TFP we employ a general formation of a Cobb-Douglas production function:

$$Y_{iut} = A_{iu} K_{iut}^{\alpha} L_{iut}^{\beta} \quad (1)$$

where Y is output measured by real value added, K stands for total fixed asset value, L for number of employees, while A represents the TFP. The index *i* stands for firm, *u* for city and *t* for period of time. A log linearization of (1) yields the following estimation equation for a three dimensional panel:

$$y_{iut} = a_{iu} + \alpha k_{iut} + \beta l_{iut} + \varepsilon_{iut} \quad (2)$$

where small letters indicate variables in logs. TFP is estimated as the production function residual using Levinsohn and Petrin (2003) approach. TFP reflects the productivity gains that emerged independently of changes in capital and labour inputs. The estimation of firm-level TFP from Cobb-Douglas production function with capital and labour is being undertaken separately for individual industry groups by each country in order to capture the heterogeneity arising from different production technologies, quality and intensity of inputs used in the production. Levinsohn-Petrin (2003) methodology introduced the intermediate inputs in the model as opposite to previously developed Olley and Pakes (1996) methodology in which investment variable is used as the proxy for unobserved productivity. In our production function, output was proxied with value added (GVA) obtained by subtracting intermediate inputs from turnover. Capital is measured by stock of tangible fixed assets (TFA) by book value and labour with number of employees. As a proxy of intermediate input in applying Levinsohn and Petrin methodology, we use material costs data. All financial variables in our model were deflated using industry producer price deflators obtained from Eurostat or from National Statistical Offices[6] at either two- or three-digit NACE Rev. 2007.
Firms with zero or one employee were omitted from the sample due to the noisiness of the data, as well as all firms that were in bankruptcy or in liquidation, so the final dataset includes 414,042 observations. Basic characteristics of the data used in the productivity estimations across countries are reported in Table 4.

TABLE 4: Summary statistics, manufacturing firms by countries

	N	Employment per firm	Total Employment	rGVA (mio. EUR)	rGVA/Emp	rTFA (mio. EUR)	rGVA/rTFA
BA	1,896	25.4	48,067	422.6	8,791.0	1602.1	0.26
BG	15,056	21.0	316,634	4617.6	14,583.3	4616.4	1.00
HR	5,198	20.0	104,002	3443.8	33,112.8	2936.4	1.17
RO	30,835	23.3	717,758	14547.5	20,268.0	15577.6	0.93
RS	8,628	21.4	184,222	2787.1	15,129.1	4653.3	0.60

[6] In the case of Serbia and Bosnia and Herzegovina.

SI	1,893	21.2	40,147	2160.9	53,823.7	1799.8	1.20

Note: average data calculated for 2006-2013 period.

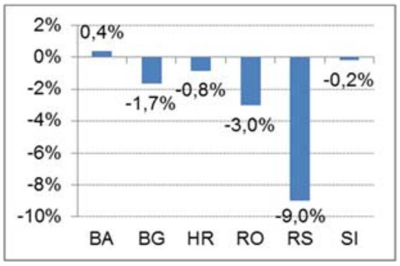
Total annual real GVA ranged from 422.6 mio. euro in Bosnia and Herzegovina to 14,547.5 mio. euro in Romania. There are no particular patterns in manufacturing employment that, on average, ranged between 25 employees per firm (in Bosnia and Herzegovina) to 20 (in Croatia), while both capital and labour productivity follow the pattern of development as it is highest in Slovenian manufacturing firms and lowest labour productivity in Bosnian and Herzegovinian manufacturing firms.

The results obtained using Levinsohn and Petrin methodology are indicating that constant RTS could not be confirmed across a large number of industrial groups. A large number of industry groups in analysed countries are operating under decreasing RTS. Although these results may appear surprising, they are in line with previous research focused on post-transition economies. Lizal et al. (2001) and Dobrinsky et al. (2008) also find decreasing RTS for Czech Republic, Bulgaria and Hungary and explain it as transition path dependence and more related to small firms. Galuščák and Lizal (2011), who use a panel of Czech manufacturing firms to measure firm-level production function in period 2003-2007, show that majority of industries in Czech Republic show constant or decreasing RTS when applying the standard Levinsohn-Petrin methodology. Moreover, Gao and Kehring (2016) explain, using U.S. data, how lower RTS across industries are not necessarily related to inefficiency, but may reflect wider dispersion of productivity in an industry. Apart from the “transition” argument, the literature points to other factors such as country size and industry specifics in explaining decreasing RTS. For example, Briguglio (1998) analysis of 43 countries shows that there is a link between the country size and RTS and that manufacturing firms in larger countries realise more positive effects from increasing RTS than those in smaller-sized countries. Bos et al. (2010) analyse 21 EU manufacturing industries in six EU countries in the period 1980-1997 and find that less technologically advanced industries exhibit decreasing RTS.

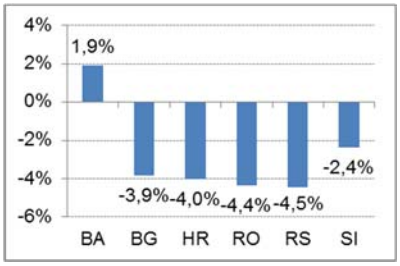
Results on firm-level TFP were aggregated to industry group level using surviving firms' data. Summarising the results on industry group-level TFP growth, it is evident that recession has affected all industry groups across most countries, but the magnitude of this negative effect has been diverse. Bosnia and Herzegovina stands out with an exceptional recovery effect, but also with a relatively low TFP level, while TFP-level and TFP-growth disparities were the lowest in the most developed economy - Slovenia.

FIGURE 1: TFP change by sector and by country

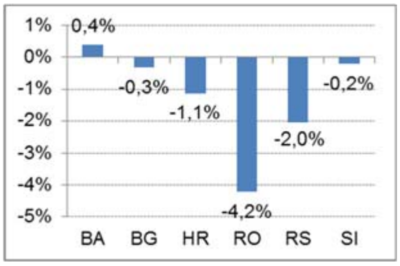
1. Food, beverages, tobacco



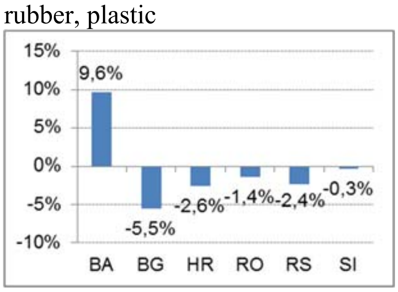
2. Textiles, apparel, leather



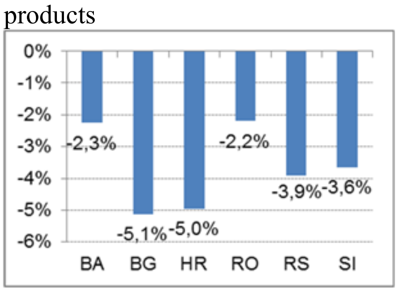
3. Wood, cork, paper, printing, recorded media



4. Chemicals, pharmaceuticals, rubber, plastic

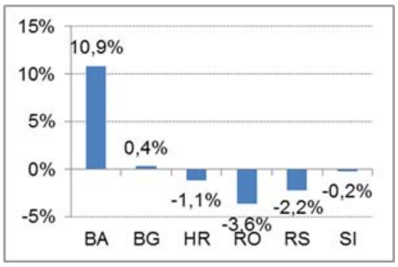


5. Other non-metallic mineral products

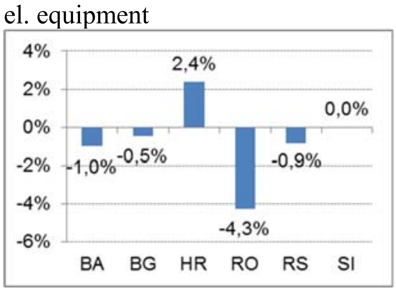


6. Basic metals, metal products

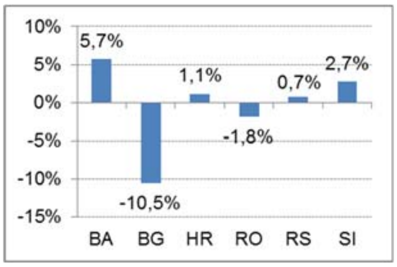
7. Machinery and equipment



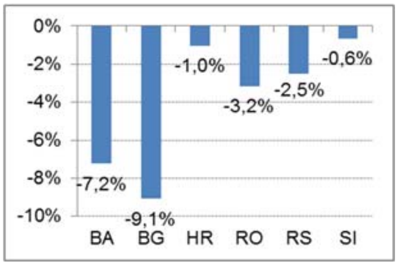
8. Computer, el.&optical products, el. equipment



9. Transport equipment



10. Furniture, other manufactured goods



Note: average growth rate calculated for 2006-2013 period.
Source: authors' estimation.

The recession period in some of the observed economies has been researched on the micro-level, revealing the most likely causes of the TFP backdrop in manufacturing. Aprahamian and Correa (2015) identified the low rate of firm entry and exit as the cause of low productivity of Croatian firms during the recession period, supported by market characteristics which eliminate firms that are potentially more productive from the market, or conversely, prevent the entry of more productive firms. Perić and Vitezić (2016) analysis of impact of economic crisis on firm growth in Croatia showed that employment in surviving manufacturing firms was affected by crisis, resulting in 15 percent decrease, while turnover growth was positively associated with companies' size. Similarly to Croatia, the low firm entry rates also explain for a negative impact on manufacturing productivity in Bulgaria, along with the significant misallocation of resources where productive firms remained small, while unproductive firms employ a large share of labour workforce (World Bank, 2015).

Given the specific period under consideration in this research, there can be no a priori expectations regarding the results of the model estimation of firm-level productivity differences in the next section.

4. THE ECONOMETRIC ANALYSIS

5.1. Model specification

A model is constructed for explaining TFP differences across firms in the observed cities, in line with broader theoretical foundations and in line with the findings from previous empirical research. Drawing on TFP firm-level estimates obtained in the previous section, the baseline model can be specified as follows:

$$\begin{aligned} \ln TFP_{it} &= \beta_1 \ln diversification_u + \beta_2 \ln specialisation_{ut} + \beta_3 \ln humancapital_{ut} \\ &+ \beta_4 university_u + \beta_5 \ln concentration_{st} + \beta_6 \ln firmsize_{it} + \beta_7 \, intellectuaproperty_{it} \\ &+ \beta_8 foreignown_{it} + FE_c + FE_s + FE_t + \varepsilon_{it} \end{aligned} \quad (3)$$

where subscript *i* denotes firm, *u* denotes city, *s* denotes industry and *t* denotes time; $diversification_u$ variable represents *urbanisation economies*. The variable is included as the relative diversification index (RDI) value. RDI is the inverse of the sum of the absolute values of the difference between each sector's share in city's employment (denoted as x_{ij}) and its share in national employment (denoted as x_j) for each city over all sectors (Duranton and Puga, 2000), at NACE 2-digit level. RDI is given as:

$$RDI_{uj} = 1 \Big/ \sum_j \left| x_{uj} - x_j \right| \quad (4)$$

$specialisation_{ut}$ variable represents *localisation economies* and similarly to the urbanisation variable, it is represented with the specialisation index calculated as the ratio of each industry's share (at NACE 2–digit level) in city's employment and the corresponding share at the national level. The specialisation index is given as:

$$SI_{ij} = \frac{x_{uj}}{x_j} \quad (5)$$

$humancapital_{ut}$ variable is included as the share of employed in high-technology manufacturing in total city employment in manufacturing;

$university_u$ is a bivariate variable indicating presence of a university in a city, taking the value of 1 if university presence is established, 0 otherwise;

$concentration_{st}$ variable represents concentration across industry branches in a city. It is constructed as the share of turnover in an industry (at NACE 2-digit level) in city's manufacturing turnover. The turnover of the leading firm in industry is excluded;

$\text{int}\,ellectualproperty_{it}$ variable represents firm's intellectual property and is included as the value of intangible assets ;

$firmsize_{it}$ variable represents firm size measured by number of employees;

$foreignown_{it}$ is a dummy variable representing foreign ownership, where firms with presence of a foreign owner in their capital structure were assigned the value of 1.

$FE_{country}, FE_{industry}, FE_{time}$ are country, industry (NACE, 2-digit level) and year fixed effects.

ε_{it} is an error consisting of two independent random terms, as it is assumed that errors are not normally distributed. Error is included as a sum of a city term and of an idiosyncratic residual, as follows:

$$\varepsilon_{it} = city_u + \gamma_{it} \qquad (6)$$

Presence of universities in cities was established using national websites, while all the other data were calculated using Amadeus database.

Accounting for unobserved country fixed effects allows cross-country assessment of TFP levels, while time and industry effects are expected to capture changes in the economic dynamics. Industries may differ in the way they function, in terms of input and technology requirements, for example. If these effects are not accounted for, they may easily translate into biased model estimation.

Estimation of the model (3) was carried out with errors clustered at city level. The model is estimated using, as the dependant variable, firm-level TFP based on Levinsohn Petrin and OLS procedures. The results of estimations are reported in Table 5. Independent variables that were found significant carry the same sign in all estimations of the model. This attests to the robustness of TFP estimations carried out with different methods. With the purpose of obtaining additional observations, missing data for data for labour and material costs were imputed using simple algorithms and then used in TFP estimation. Imputation procedure allowed for 1,239 extra observations to be regressed in the panel data model[7]. However, using non-imputed data results in less satisfactory goodness of the fit, so the preferred model estimation is the one based on the original dataset. Further on, interpretations of the model estimations are based on Levinsohn-Petrin's TFP estimates. Both city and firm-related variables are found significant in explaining differences across TFP levels.

TABLE 5: Results of estimation with lnTFP as dependent variable

	Original data			Imputed data
		Model I	Model II	Model I
	Levinsohn -Petin[a]	Ordinary least squares[b] (OLS)	Levinsohn -Petin[a]	Levinsohn -Petin[a]
City-related variables:				
Diversification	0.310***	0.236***	0.351***	0.343***
	(0.055)	(0,047)	(0.049)	(0.057)
Specialisation	-0.029	0.006	-0.027	-0.039
	(0.021)	(0.008)	(0.020)	(0.024)
Human capital	0.025*	0.020*		0.019
	(0.013)	(0.010)		(0.013)
University	0.101**	0.088	0.127**	0.107**
	(0.049)	(0.034)	(0.049)	(0.050)
Industry-related variable:				
Concentration	-0,011	0.000	-0.009	-0.023
	(0.022)	(0.012)	(0.020)	(0.023)
Firm-related variables:				
Intellectual property	0.055***	0.034***	0.056***	0.052***
	(0.007)	(0.006)	(0.007)	(0.008)
Firm size	0.225***	-0.046***	0.224***	0.228***
	(0.019)	(0.007)	(0.018)	(0.017)
Foreign ownership	0.103***	0.072***	0.106***	0.094***
	(0.018)	(0.013)	(0.018)	(0.017)
Number of observations	61.386	62.617	63.927	62.625
Adjusted R-squared	0.461	0,071	0.460	0.373

[a] Standard errors (in brackets) are corrected by clustering at city level.
[b] Model estimations based on TFP estimates obtained using OLS do not include industry fixed effects and thus results in low R-squared value.
***, ** and * denote statistical significance at 1, 5 and 10 percent, respectively.

[7] Since only 43.4% of the firms in the sample reported the value of material costs and 50% of the firms reported the employment, imputation methods were introduced to overcome the gaps in the data in these two series. The missing values were imputed as averages of adjacent observations as the first step. In the case of missing values of number of employees, in the second step, the missing value was replaced by the reported values in the year before the missing value or by the reported values in the year after the year with missing value.

Results of the model estimation show that diversified composition of economic activities is translated into productivity advantages of firms in urban SEE. Diversified economic structure of cities raises productivity level of firms by 31.0 percent, on average. This clearly indicates the workings of urbanisation economies that create an environment that is more conducive to externalities. On the other hand, as RDI and city size (in terms of population and labour market size) are well correlated, home market effect cannot be ruled out. This confirms the finding of Traistaru et al. (2002) that in EU accession countries, industries tend to locate where production factors are abundant. No evidence is found that localisation economies have any effect on firm-level productivity in the sample. If positive effects were confirmed, this would indicate greater level of integration and that local firms are already integrated into global value chains. Traistaru et al. (2002) have found that changes in specialisation occurred in regions closer to EU market or closer to large local markets.

Agglomeration economies are associated to externalities that may include knowledge spillovers, business communications, face-to-face communication, and other spatial externalities (Fujita, Thisse, 2008). Human capital, indicating possibility of knowledge spillovers, was found significant in explaining differences in TFP levels and it raises TFP level by 2.5 percent. The mean value of human capital share in the sample of cities was 5.2 percent, and the highest shares were mostly observed in capital cities and regional centres. Nevertheless, city size and human capital share are not particularly correlated in the sample as correlation coefficient is at 0.21. Presence of human capital in cities is considered an advantage for firms, as knowledge spillovers tend to be localised. Well-educated labour force is attracted to cities as centres of economic activity as cities are assumed to provide more opportunities for employment for individuals who are also attracted to various amenities compared to other locations. Overall, cities are considered as locations that enable better matching in the labour market due to firm and worker agglomeration. Stronger presence of human capital would suggest that there are more opportunities for innovation, through exchange of ideas and knowledge spillover. Thus, human capital is one of most researched sources of productivity advantages in literature, but its positive role for local firm performance is not always confirmed. Di Giacinto et al.'s research for Italy (2014) shows that the role of human capital tends to be location- and industry-specific in the sense that manufacturing firms in specialised locations of industrial-district-type benefit more from skilled labour force while firms in diversified urban locations benefit more from educated labour force. Another channel for generating productivity advantages may be inter-institutional externalities. Universities may be observed as an element of location institutional infrastructure that may generate positive spillovers for firms through local networking. Results of model estimation in this research indicate that presence of a university is supportive of firm performance. University presence improves firm performance in the sample by 11.6%, on average. The positive effect that universities exert on firms is most likely taking place through cooperation between universities and public institutions aiming at supporting development of local firms and their specific activities. The inter-institutional cooperation is directed to joint design of public policies and programmes. By providing expert knowledge, universities are indirectly supporting firms' capacities.

A possible industry-related source of TFP difference that was assessed is concentration, but this variable was found insignificant, and with a negative sign before coefficient. Thus, it appears that there is no evidence that concentration is producing productivity advantages for firms, at least in the SEE city-context. This is counter the prediction of NEG that economic integration would result in concentration of economic activity across locations leading to increasing RTS, otherwise effects on firm efficiency would be confirmed. The predicted increase in concentration and associated positive effects might be occurring throughout regions and not in cities per se. Furthermore, this finding can also indicate intra-industry heterogeneity with respect to product quality, so that firms belonging to the same industry are not directly competing in the same price or quality segment. Also, previous findings point to the low firm entry and exit dynamics and associated inefficient reallocation mechanisms in some of the observed economies in SEE. Iooty et al. (2014), using Eurostat and FINA data, find that firm exit rates are prevailing over entry rates in Romania and Croatia, while the opposite is true for Bulgaria and Slovenia. For the former countries, the creative destruction process can be considered weak and economies less dynamic.

Firm-level sources were found highly significant in explaining productivity advantages of firms. Most important firm-related variable is firm size, positively correlated with TFP and measured with number of employees. On average, relatively larger firms generate 22.5 percent larger TFP, with other things being equal. This finding is also not surprising as it is in line with evidence from the empirical literature. Larger firms have more capacities than smaller firms to be directed into achieving efficiency goals, e.g. professional management and better organisation practices or, for example, already developed know-how. Results of research on the importance of managerial talent and practices appear important for firm performance (Syverson, 2011). Bloom et al. (2012) research on management practices in transition economies has shown that managerial practices in some transition countries are close to those of Western European countries. Bulgaria's score on management practices was the highest, closely followed by Serbia, while Romania score was the lowest among eight European transitioning countries.

Another source of productivity advantages is observed through the value of intangible fixed assets, representing firms' intellectual capital. To be precise, intangible fixed assets entail the value of intellectual property, including copyrights, patents, trademarks, franchise and licensing agreements. By investing into intellectual property, firms can increase their value added and achieve more dynamic productivity growth and higher level-TFP. In knowledge-based economies of today, developing innovation activities are considered an important factor in creating and sustaining competitiveness of firms and locations. The results of the model estimation confirm that intellectual property of firms raises their TFP level by 5.5 percent on average, obviously creating a competitive advantage for those firms.

Finally, model estimation results confirm that foreign ownership of local firms creates a productivity premium, by 10.3 percent on average. There is plenty of evidence of positive effects of foreign ownership throughout the literature, and in brief, these are restructuring, transfer of technology and know-how and upgrading of employee skills.

Attention can also be devoted to the specific period under consideration that includes a recession episode for observed countries brought on by global financial crisis from in 2008. Crisis spread to the observed economies, resulting in recessions with different cross-country duration and the recession is correctly picked up by time fixed effects that display negative values over the period 2009-2013.

5.2. Robustness checks

Capital cities' economies

A number of specific traits relate to capital cities alone. A common factor is their centrality and size. Capital cities represent the economic "core", being the largest firm and workers' agglomeration in the observed countries, thus also representing the key home market. Hence, they are front-ranked cities in each of the countries. The institutional infrastructure of capital cities is superior as they often host all or most major national public institutions. Moreover, capital cities are the major location for headquarters of large firms and investors. Data on foreign investment inflows in transition economies mostly show that capital cities (or capital city/metropolitan regions) attract the bulk share of capital flows due to their superior business infrastructure and concentration of resources (Lintz et al., 2007; Dogaru et al., 2014). For these reasons a robustness check is performed by excluding manufacturing firms located in capital cities from the sample. The purpose is to eliminate the influence of capital cities' economies in the model estimation. By doing so, the number of observations drops by 23.790, roughly over one third of the total.

Model is re-estimated using the remaining 37.596 observations. Goodness of the fit drops from 0.461 to 0.407, but it can still be considered satisfactory (Table 6). Estimations of the model on this smaller sample with cities of regional and local importance principally yield results similar to the main estimates - signs before coefficients remain consistent and the strength of influence is basically unchanged. Localisation economies do not emerge as relevant with the re-estimation. Perhaps the only point of difference worth elaborating is the magnitude of influence that urbanisation economies have in creating productivity premium for firms. By excluding influence of large agglomerations of capital cities, productivity premium for firms in diversified cities drops from 31.0 to 21.2 percent, thus implying that capital cities were driving the productivity premium of firms in urban SEE upwards quite strongly. Overall, re-estimation of the model on a smaller sample yields results that are consistent with the main estimates, as another proof of robustness of the main results.

TABLE 6: Results of model estimations using a sample of firms located outside capital cities

	Model I	Model II
	Levinsohn -Petin[a]	Levinsohn -Petin[a]
City-related variables:		
Diversification	0.212**	0.258**
	(0.095)	(0.088)
Specialisation	-0.017	-0.014
	(0.015)	(0.014)
Human capital	0.026**	
	(0.013)	
University	0.120**	0.142***
	(0.041)	(0.038)
Industry-related variable:		

Concentration	-0.031	-0.026
	(0.020)	(0.019)
Firm-related variables:		
Intellectual property	0.040***	0.047***
	(0.005)	(0.005)
Firm size	0.220***	0.218***
	(0.010)	(0.010)
Foreign ownership	0.119***	0.121***
	(0.023)	(0.022)
Number of observations	37.596	40.138
Adjusted R-squared	0.407	0.406

[a] Standard errors (in brackets) are corrected by clustering at city level.
[b] Model estimations based on TFP estimates obtained using OLS do not include industry fixed effects and thus result in low R-squared value.
***, ** and * denote statistical significance at 1, 5 and 10 percent, respectively.

Multiplant firms and headquarter-plant separation

Data from Amadeus database are legal-entitles data i.e. data on firms, not data on plants. With this type of data, issues of multiplant firms arise. The question that appears is that of where economic activity of such firms is registered? Placed into the context of the data used in this research, it possible that some firm data are actually headquarter data with plants existing in another location or that single-firm data, in fact contain information on more plants/firms. Including these firms into model estimation may push coefficients of some city-related variables upwards as headquarters of these firms will most likely be located in larger, more diversified cities. This issue can be addressed simply by excluding firms that are suspected to either have headquarters and plants separated in more locations and/or by excluding firms that are a part of company groups. Amadeus database contains both information on number of companies in company group and information on the location of the domestic ultimate firm owner (DUFO). Using these information, firms that are a part of company group are easily omitted from the sample and model is re-estimated using data on remaining firms (Table 7. a). Headquarter and plant separation issue is tackled using data on location (city) of domestic ultimate owner of the firm (DUOF). Suspecting that there might be functions separation issue in the case when the manufacturing firm and DUFO are not located in the same city, the sample is additionally reduced and then re-estimation is carried out (Table 7. b). As differences in the number of observations between two reduced samples are trivial, model re-estimates are close. Goodness of the fit is similar to that of the main model. Variables that have consistently explained the variation of the dependant variable, and those are diversification economies and firm-level variables, remain significant. A disadvantage of taking this approach is that data on firms in foreign ownership are entirely lost. This is the principal reason why foreign ownership does not continue to explain for variation in firm productivity. Principally, new estimates are in line with the main findings despite the pronounced loss of observations.

TABLE 7: Results of model estimations using a sample of firms assumed to be non-multiplant firms and non-separated plant and headquarter firms

	a) Sample of firms assumed to be non-multiplant firms	b) Sample of firms assumed to be non-multiplant firms and non-separated plant and headquarter firms
City-related variables:		
Diversification	0.293***	0.293***
	(0.058)	(0.058)
Specialisation	-0.005	-0.005
	(0.022)	(0.022)
Human capital	0.006	0.006
	(0.013)	(0.013)
University	0.154*	0.156*
	(0.058)	(0.058)
Industry-related variable:		
Concentration	-0.045*	-0.045*
	(0.027)	(0.027)
Firm-related variables:		
Intellectual property	0.042***	0.042***
	(0.011)	(0.011)
Firm size	0.223***	0.223***
	(0.016)	(0.016)
Foreign ownership	0.098	0.195
	(0.172)	(0.172)
Number of observations	24.809	24.782
Adjusted R-squared	0.433	0.433

[a] Standard errors (in brackets) are corrected by clustering at city level.

[b] Model estimations based on TFP estimates obtained using OLS do not include industry fixed effects and thus result in low R-squared value.
***, ** and * denote statistical significance at 1, 5 and 10 percent, respectively.

Period specific effects

The period of estimation is specific due to a recession episode across observed economies. As pointed out, time fixed effects have correctly captured the negative effects arising from the economic downturn. Due to the period specifics, the model is re-estimated for two separate periods, one being the prerecession period and the other one being the recession period. In observing the period of crisis separately from the growth period there is a possibility that specialisation arises as a determinant of TFP differences because an overly-specialised cities are more exposed to economic changes (Cuadrado-Roura et al., 1998; Longhi et al., 2014). Performing this robustness check also allows for testing the hypothesis of pronounced risk exposure of specialised locations on a microscale. Results of re-estimation for 2009-2013 period carried out on 36.685 observations presented in Table 8 are consistent with the results of the main estimations. Firm size, as the major firm-level determinant of firm performance, generates larger premium for larger firms, 26.0 percent in the crisis period compared to the 16.6 percent premium estimated for positive growth period 2006-2008. Evidently, larger firms were successful in sustaining productivity advantages over the economic crisis period, post-2008. Moreover, these findings also suggest that the productivity gap between larger and smaller firms has deepened over the crisis period, so that exposure of smaller firms to risks associated to crisis has been greater. Diversification economies still enabled firms to maintain their productivity premium, but these effects were less pronounced than during the period of economic upturn. Firms located in diversified cities were affected by crisis and productivity gap between firms in diversified and firms in non-diversified cities has decreased, by approximately 4.8 percentage points. Specialisation does not appear to affect TFP level at all during crisis period, suggesting that there has not been over-exposure. The role of human capital in assuring knowledge spillovers remains important in both periods. While these effects are not large, 2.8 percent over the average TFP in crisis period, they are indicative of the stronger potential firms located in cities with higher shares of human capital to overcome periods of economic downturn compared to firms in other locations.

TABLE 8: Results of model estimations for the periods

	2006-2008		2009-2013	
	Model I	Model II	Model I	Model II
City-related variables:				
Diversification	0.341***	0.373***	0.293***	0.340**
	(0.056)	(0.049)	(0.060)	(0.052)
Specialisation	-0.024	-0.023	-0.031	-0.028
	(0.024)	(0.023)	(0.021)	(0.020)
Human capital	0.021*		0.028*	
	(0.012)		(0.015)	
University	0.107**	0.125**	0.100*	0.127*
	(0.050)	(0.043)	(0.052)	(0.046)
Industry-related variable:				
Concentration	-0.037	-0.030	0.000	-0.000
	(0.022)	(0.021)	(0.025)	(0.023)
Firm-related variables:				
Intellectual property	0.067***	0.069***	0.049***	0.049***
	(0.009)	(0.008)	(0.006)	(0.006)
Firm size	0.166***	0.163***	0.260***	0.260***
	(0.021)	(0.020)	(0.018)	(0.017)
Foreign ownership	0.122***	0.125***	0.100***	0.102***
	(0.023)	(0.023)	(0.018)	(0.017)
Number of observations	21.701	22.597	39.685	41.330
Adjusted R-squared	0.421	0.420	0.483	0.483

[a] Standard errors (in brackets) are corrected by clustering at city level.

[b] Model estimations based on TFP estimates obtained using OLS do not include industry fixed effects and thus result in low R-squared value.

***, ** and * denote statistical significance at 1, 5 and 10 percent, respectively.

Noisiness of the data

As discussed earlier, TFP estimations were obtained using data on firms with two or more employees due to noisiness of the data. Excluding these data was an expendable loss as it enabled obtaining acceptable TFP estimations. However, data on firms with small number of employees tend to noisy and as a common practice, firms with less than 10 employees are omitted from samples used in model estimations. This type of exercise is carried out in this section with the intention to exclude the possibility of spurious data affecting model estimates. By excluding firms with fewer than 10 employees, the number of observations drops to 18.348. The new estimation yields similar results with regard to variables' statistical significance and the estimated coefficients' signs (Table 9). Goodness of the fit was more favourable in the main estimation, so including smaller firms from the start has proven a more feasible option.

TABLE 9: Results of model estimations for the sample of firms with over 10 employees

	Levpet	
	Model I	Model II
City-related variables:		
Diversification	0.349***	0.349***
	(0.078)	(0.068)
Specialisation	-0.034	-0.031
	(0.027)	(0.026)
Human capital	-0.003	
	(0.017)	
University	0.156	0.141*
	(0.013)	(0.050)
Industry-related variable:		
Concentration	-0.013	-0.011
	(0.031)	(0.028)
Firm-related variables:		
Intellectual property	0.052***	0.052***
	(0.009)	(0.009)
Firm size	0.290***	0.291***
	(0.032)	(0.031)
Foreign ownership	0.161***	0.155***
	(0.033)	(0.032)
Number of observations	18.348	19.0959
Adjusted R-squared	0.377	0.376

[a] Standard errors (in brackets) are corrected by clustering at city level.
[b] Model estimations based on TFP estimates obtained using OLS do not include industry fixed effects and thus result in low R-squared value.
***, ** and * denote statistical significance at 1, 5 and 10 percent, respectively.

Country heterogeneity

In the main model estimation, country fixed effects were included among controls to account for unobserved country factors. Yet country heterogeneity, if not properly picked up by fixed effects, may result in biased model estimation. This issue is addressed by successively removing firms coming from an individual country out of the sample, and then re-estimating the model again. Results show that firm-related variables and urbanisation economies across all estimations remain highly significant (Table 10), even in the estimation where data for Romania are excluded. Observations on Romanian firms bring the highest risk of estimation bias as their share in total observations is the highest. University variable is interchangeably significant and small-versus-large country differences are the most likely cause. There is insufficient variation of university data in smaller countries because they are represented with fewer cities. When firm data from small countries are dropped from the sample, university variable is found significant. Thus, these results should not be taken as a lack of evidence of positive externalities related to intra-institutional cooperation in small countries, but rather as the result of the limitation of the methodological approach.

TABLE 10: Results of model estimations for SEE, with individual country data excluded

	a) Sample with BH data omitted	b) Sample with BG data omitted	c) Sample with HR data omitted	d) Sample with RO data omitted	e) Sample with RS data omitte	f) Sample with SI data omitted
City-related variables:						
Diversification	0.318***	0.304***	0.304***	0.422***	0.269***	0.321***
	(0.056)	(0.059)	(0.056)	(0.155)	(0.054)	(0.053)
Specialisation	-0.031	-0.030	-0.024	-0.063	-0.018	-0.023
	(0.021)	(0.021)	(0.021)	(0.056)	(0.023)	(0.016)
Human capital	0.026**	0.021	0.026*	0.021	0.030***	0.020
	(0.013)	(0.014)	(0.014)	(0.029)	(0.013)	(0.014)
University	0.091*	0.132	0.095*	0.069	0.089	0.112**
	(0.050)	(0.054)	(0.051)	(0.075)	(0.054)	(0.049)
Industry-related variable:						
Concentration	-0.017	-0.022	-0.002	-0.047	0.002	-0.030
	(0.024)	(0.018)	(0.025)	(0.049)	(0.023)	(0.023)
Firm-related variables:						
Intellectual property	0.057***	0.051***	0.057***	0.046***	0.058***	0.056***
	(0.007)	(0.008)	(0.007)	(0.010)	(0.007)	(0.008)
Firm size	0.225***	0.233***	0.207***	0.258***	0.222***	0.220***
	(0.019)	(0.023)	(0.011)	(0.029)	(0.021)	(0.019)
Foreign ownership	0.094***	0.108***	0.117***	0.097***	0.096***	0.108***
	(0.017)	(0.021)	(0.017)	(0.027)	(0.020)	(0.018)
Number of observations	60.033	50.506	55.817	27.766	54.108	58.700

Adjusted R-squared	0.484	0.494	0.402	0.504	0.484	0.394

[a] Standard errors (in bracktes) are corrected by clustering at city level.
***, ** and * denote statistical significance at 1, 5 and 10 percent, respectively.

5. CONCLUSION

The main goal of this paper was to study sources of productivity advantages of manufacturing firms located in urban post-transition SEE, with a particular interest in the role of the structure of the urban economy. More precisely, the role of localisation (or specialisation) economies and the urbanisation (or diversification) economies was examined. On the basis of the population threshold and also, taking into consideration data limitations, 98 cities with population above 50.000 were included in the sample. The industry data were aggregated from firm-data obtained in Bureau van Dijk's Amadeus database for Central and Eastern Europe for the period 2006-2013.

Firm productivity differences were asessed using TFP estimation techniques for the entire period.. The important sources of local productivity advantages of firms were found to be firm-related factors and city diversification, while there was no evidence of localisation economies producing any effect. This implies that diversified cities, found to be correlated to large labour markets, constitute an environment that is more conducive to agglomeration externalities. Furthermore, in the context of the NEG, this also reinforces the importance of home market effect for manufacturing firms in urban SEE. Firms located in cities with higher shares of human capital (the share of employed in high-technology manufacturing) benefit from knowledge spillovers, while at the same time, having a university in urban location can indirectly be supportive of firms' capacities, probably through university's involvement in creation of local policies and programmes. Firm size, foreign ownership and the intangible assets were found to be important sources of productivity advantages. Since industry concentration and city specialisation were not found relevant in explaining firm efficiency, it can be assumed that within-industry heterogeneity at this level of aggregation (at NACE 2-digit level) is greater than expected or alternatively, the economic integration at city level has not been deep enough to produce positive effects on TFP level. However, the possibility that concentration of manufacturing is occurring outside cities, across regions cannot be excluded.

The model was also estimated for the period of economic crisis (2009-2013), and relative city specialisation across industries was not found to influence TFP negatively. Thus, larger relative specialisation in a particular industry in an urban location in SEE does not lead to over-exposure on a micro-scale. To the contrary, city diversification was found to create and sustain productivity advantages of firms, even during this recession episode. Model estimates have remained robust to various checks, performed to address the issues of multi-plant firms and firm functions separation, period specifics, heterogeneity of countries and data noisiness.

The implications of this research can be important for local policies. Policies that encourage initiating economic activities that are entirely new to cities, in particular in knowledge-intensive industries, can be placed on the local agenda. This type of policy direction can also be beneficial for firms working in the industry that the city is specialised in, as knowledge transfer can emerge from the new industries. The findings from this research suggest that cities already have the appropriate tools to reach these types of goals as inter-institutional cooperation has shown to be an important channel for positive externalities. Firms can obviously indirectly capitalise on strengthening of local institutional networks. Implications can also be drawn for entrepreneurial policies to design mechanisms of support for small firms during economic recessions as they appear more vulnerable than larger firms during these times.

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