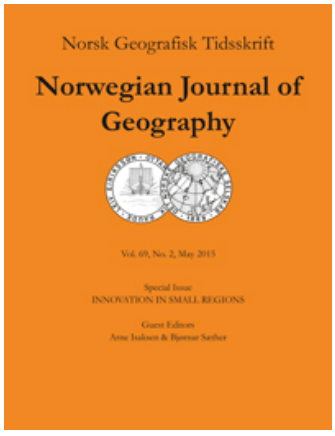

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Industrial specialization and economic performance: A case of Czech microregions

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An influential body of literature suggests that economic diversity rather than specialization fuels the economic performance of regions and nations. The authors argue that this hypothesis has no universal applicability and that a more differentiated view is needed. In particular, historical specificity of the local environment and structural characteristics of regional economies should be taken into account. They focus on the effects of industrial specialization on economic performance and the vulnerability of Central European post-communist regions, namely Czech microregions with less than 200,000 inhabitants. They examine whether the economic performance and vulnerability of these regions is fuelled rather by industrial specialization or diversity when controlling for other potential determinants of regional economic performance. Their findings show that the dependence of Czech regions on manufacturing correlates with higher economic performance but also with higher regional vulnerability. In addition, industrial specialization within manufacturing was found to be instrumental for the economic performance of regions with high dependence on manufacturing. With a decreasing share of employment in manufacturing, industrial diversity rather than specialization becomes more valuable for the economic performance of Czech regions.

Keywords: *Czechia, economic performance, microregions, specialization*

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Introduction

The relationship between economic diversity and regional economic performance has been widely studied. Economic diversity is often seen as a key driver of regional development (e.g. Glaeser et al. 1992; Frenken et al. 2007; Asheim et al. 2011). However, there are at least two reasons why these statements, built predominantly on empirical research from the most economically developed countries in the USA and Western Europe should not be interpreted in a universalistic fashion and uncritically applied elsewhere in Europe and around the world.

First, the effects of economic diversity are significantly influenced by geographical scale (Beaudry & Schiffauerova 2009). There is no reason to expect that the same patterns of industrial specialization or variety would produce the same results for national economies and large, medium-sized, and small cities or regions (Henderson 1997; 2003; Duranton & Puga 2000; Kemeny & Storper 2012). Second, industrial structure per se is not sufficient to create external economies of scale and scope. Various other conditions are necessary for agglomeration economies to take place, including highly context-specific and embedded regional institutions such as mutual trust or cultural proximity (Maskell et al. 1998; Boschma 2005).

Therefore, potential links between industrial structure in terms of specialization or diversity and regional economic performance can be quite different for different economic systems and they might also vary between regions within these economic systems. To date, very little has been known about how economic specialization and diversity shape regional development in institutional contexts less that are conducive to knowledge creation and dissemination, such as in economically less-developed post-communist Central European countries (for contextualization see e.g. Drahokoupil 2009; Nölke & Vliegenthart 2009; Blažek et al. 2011; Radosevic 2011; Ženka et al. 2014). Although inevitably limited by the absence of consistent time-series data, in this article we makes an initial attempt to fill this gap by examining the effects of economic specialization and diversity on economic performance and the vulnerability of Czech microregions with less than 200,000 inhabitants, which are relatively small spatial units on a European scale. Considering the traditionally high level of industrialization of Czechia, its relatively high innovation performance compared with its Central European neighbours, and its broad portfolio of technologically related industries (Hausmann et al. 2011), we expect the effects of economic diversity on regional per capita value added will be stronger in Czechia (and also Slovenia) than elsewhere in Central Europe. However, if these effects do not exist in Czechia, they are unlikely to exist in traditionally less-industrialized and less-diversified microregions in other Central European countries.[1]

This article is built around the following two main research questions: (1) Do more industrially diversified regions perform better economically than more specialized ones? (2) Is Czech regions' industrial specialization or diversity linked to their vulnerability to external demand shocks?

Drivers of economic performance of small regions

The majority of Czech microregions can be characterized as small, non-core, rural or peripheral in a European context.

Economic and innovation performance in such geographically disadvantaged regions have been defined and analysed by, for example, Onsager et al. (2007), Virkkala (2007), Doloreux & Dionne (2008), Doloreux et al. (2012), Baumgartner et al. (2013), and Rodríguez-Pose & Fitjar (2013). These authors argue that small regions are characterized by comparatively lower employment density, weaker local competition, smaller local markets, smaller supplier and knowledge bases, fewer local authors, and thinner regional innovation systems (for characteristics of thin regional innovation systems see Tödtling & Trippl 2005; Isaksen & Karlsen 2013). Together, these characteristics translate into the regions' typically limited endogenous innovation potential (North & Smallbone 2000), dependence on external demand and external knowledge sourcing (Isaksen & Karlsen 2013), and limited ability to capitalize on knowledge spillovers resulting from the technological relatedness of local industries (Onsager et al. 2007). Small regional economies are usually more specialized and manufacturing often tends to be a leading sector (Henderson 1997). As long as public and corporate research and development (R&D), high-quality universities, and highly-skilled labour are heavily concentrated in large metropolitan areas, there are usually less favourable conditions for the development of science-based industries, an analytical knowledge-base, and scientific and technological innovations in small regions (Isaksen & Karlsen 2013).

Most importantly for our research, there are several sound arguments supporting the expectation that the high per capita value-added small regions will be those with a more specialized production structure than a diversified one. First, compared to large metropolitan areas, small regions are less likely to capitalize significantly on urbanization economies related to urban scale and economic diversity (Asheim & Coenen 2005; Combes et al. 2012). Regions with a small but diversified production base lack critical mass and may face the threat of excessive fragmentation, which would not allow scale and scope economies to take effect. As Essletzbichler (2007, 205) explains: 'without commonalities between different entities, no synergies arise, and certain efficiency thresholds necessary for the economic survival of regions might never be reached'. Moreover, innovation demand and the ability to absorb external knowledge are much more modest in small regions than in large metropolitan areas. Small regions usually concentrate firms in mature, often low and medium-tech manufacturing industries (Henderson et al. 1995; Duranton & Puga 2001; 2004). They tend to host subsidiaries or branch plants with limited autonomy, oriented on downstream activities such as high-volume standardized production and assembly (Suorsa 2007). Such firms or plants either do not innovate at all or they focus on partial, incremental improvements to existing products and technologies (Therrien 2005), for which an accumulated stock of narrowly specialized knowledge is more relevant than a broad variety of knowledge available in regions with diversified production and knowledge base (Henderson et al. 1995). Local diversity, even if present, is thus of limited importance for innovation activity and economic growth in small regions, which concentrate firms in mature industries and later phases of a production life cycle.

Second, the specialized industrial structure and high economic performance of some small regions may result from the presence of a single large firm or plant. In these cases neither Marshall-Arrow-Romer (MAR) spillovers nor Jacobian externalities are the main factor of competitiveness, but rather internal scale economies (Malmberg et al. 2000; Parr 2002). Moreover, local innovation activities can be predominantly internal to the firm or subsidiary that collaborates with partners outside the region rather than local companies (Radosevic 2011). However, local subsidiaries, branch plants, or lower-tiered suppliers plugged into the global production networks may bring new ideas and technologies to the region (Perkmann 2006), inducing significant backward spillover effects (Damijan et al. 2003; Jindra et al. 2009) and increasing regional specialization in the particular industry.

Third, the current economic performance of small regions may be heavily influenced by their past specialization, which tends to be highly persistent, reproducing and reinforcing itself over decades (Martin 2006). This is valid especially for mature, low- and medium-tech manufacturing industries in small and medium-size cities, which have tended to develop mostly in localities with a historical concentration of these particular industries and a related stock of accumulated knowledge (Henderson et al. 1995, 1069). Dynamic MAR externalities resulting from long-term specialization in a single industry may be a key source of innovation activity, economic growth, and employment stability in small and medium-size cities or regions (Henderson 1997; van der Panne 2004). While the generic parameters and Jacobian externalities attract new industries and stimulate innovation activity in firms in the phase of product invention (Boschma & Lambooy 1999; Duranton & Puga 2001), specific parameters and MAR externalities are vital for retaining old industries in a region (Henderson 1997). Therefore, the combinations of agglomeration effects, the predominance of incremental technological innovations, and orientation towards mature industries are powerful sources of regional path-dependence with the possibility of both positive and negative development trajectories (Martin 2010; Henning et al. 2013).

The negative economic effects of industrial specialization in small regions may be attributed to generally lower adaptability and higher vulnerability to external shocks (Martin 2012). Small regions are more susceptible to lock-in (Hassink 2005), stemming not only from the above-mentioned cumulative mechanisms, but also from potential inwardness due to the lack of economic diversity and small number of local actors (Isaksen & Karlsen 2013). This can be especially harmful in regions dominated by a single company or a few large firms, which may capture regional specific assets for their own needs, and diminish the productivity of other local firms and prevent them from capitalizing on agglomeration economies (Chinitz 1961; Drucker & Feser 2012). When combined with external control these regions may suffer from branch-plant syndrome (Watts 1981; Sonn & Lee 2012) in terms of a high probability of plant downsizing or relocation, limited job creation, lower quality of jobs, limited local sourcing, and weak localized spillovers.

Regions with a diversified industrial structure may avoid high unemployment growth through absorption of the labour force by growing sectors – the portfolio effect (e.g. Frenken et al. 2007). Diversity also increases the structural redundancy of

local industry and reduces the mutual interdependence of local firms and industries. Therefore, an external shock may affect only some industries and not the whole regional system (Grabher 1994a).

By contrast, labour markets in export-oriented small regions specialized in manufacturing can be surprisingly stable when those regions concentrate large competitive firms, especially in capital-intensive industries (Baldwin & Brown 2004) (for the effects of large firms see Essletzbichler 2007). Additionally, specialized regions are usually able to coordinate the responses of local firms to external shocks more effectively than diversified regions, allowing for faster adaptation (Henderson 1997). To summarize, the effects of both present and past specialization on the economic performance of small regions are far from straightforward.

Czech microregions and their specific features

Although the majority of Czech microregions statistically fall into the category of rural regions (Eurostat 2010), they are relatively highly urbanized and traditionally heavily industrialized. As such they should not be confused with rural regions oriented predominantly towards agriculture, typical of eastern parts of Poland and Hungary or of the Mediterranean area. While these features are not specific only to the Central European context, there are some aspects that make Czech microregions distinct from their more economically developed Western European or Northern European counterparts. These specifics are historically rooted and their origins may be traced back to the 1930s. Current patterns of regional economic specialization were also largely formed during the first half of the 1948–1989 socialist era.

Before World War II and the post-war communist takeover of 1948, the majority of Czech microregions, except for a few larger cities and mining areas, had been oriented towards light manufacturing industries such as textiles, clothing, and food production. There had been a sharp polarity between the heavily industrialized northern parts of Czechia and the predominantly agricultural southern parts of the country, which had only a few important industrial centres (Koutský 2011). During the 1950s, 1960s, and 1970s the latter underwent an intensive, centrally planned implantation of heavy manufacturing industries (Mareš 1988; Kunc 2006), without regard for historical specialization and accumulated local assets. At the same time, growth in the largest metropolitan regions and suburbanization was politically restricted, while the small and medium-size cities were strongly supported (Musil 1993; Hampl 2005). Small and medium-size microregions thus became overurbanized and overindustrialized with respect to their population size and density (Tsenkova 2006; Mykhnenko & Turok 2008). Those regions dependent on manufacturing plants implanted in 1950s to 1970s faced rapid deindustrialization and unemployment growth during the post-communist transition in the 1990s, although the decline of formerly subsidized industries was partly compensated by the inflow of greenfield foreign direct investment (FDI) into export-oriented, low value-added production.

The majority of industrial concentrations across Czechia exhibit both weak interfirm links and science–industry links at local level. Horizontal spillovers induced by FDI play an insignificant role. There is a lack of high quality R&D centres and regional universities. Innovation collaboration and knowledge sourcing are predominantly international and intra-firm in nature (Žížalová 2010; Blažek et al. 2011; Gál & Ptáček 2011; Hanousek et al. 2011; Radosevic 2011; Szent-Iványi & Vigvári 2012). Although the existing evidence is anecdotal, the effects of MAR externalities seem to be much weaker than might be expected on the basis of relatively high levels of industrial specialization and employment. Existing industrial districts are represented rather by low-end satellite platforms than by Marshallian districts, and are also a few large hub-and-spoke clusters (Markusen 1996), mostly in the automotive industry (Širák & Řehák 2005; Ženka et al. 2014).

The absence of strong local inter-firm linkages and agglomeration effects may be explained by the socialist organization of industrial production, which has affected regional institutions and the entrepreneurial environment. Similarly to the situation in Eastern Germany, Czech industry was built around the large, state-owned, vertically organized industrial companies that typically produced a broad variety of complex products (Heidenreich 1994). Because of the 'economics of shortage' signified by the low quality and occasional inaccessibility of raw materials, components, and services (Kornai 1982), these companies attempted to internalize and integrate almost the whole value chain, including many economic activities not directly related to their core business. Conglomerates typically had their headquarters in one region, often a metropolitan region, and many subordinated production plants with hardly any strategic functions located in small and medium-size cities. This organizational pattern almost led to the destruction of local external linkages, deregionalization of production (Grabher 1994b; Krätke 1997), and the development of 'hollow clusters' (Bathelt 2009), despite high levels of industrial concentration and specialization (Schamp 2000).

Nevertheless, the current pattern of regional disparities in Czechia has been influenced not only by pre-1989 development, but also by the post-communist transition and privatization that mainly took place in the first half of the 1990s. Another important factor has been a massive FDI inflow since 1998. From the regional perspective, generally three main factors determined the transition success: (1) the position in the settlement hierarchy, (2) the adverse effects of an excessive specialization of some regions in heavy industries and mining inherited from the communist period, and (3) the horizontal geographic position in terms of the traditional east–west gradient (e.g. Blažek & Csank 2005; Hampl 2005; 2007). The combination of these factors has significantly improved the position of: metropolitan regions, smaller towns around large cities that have capitalized on the urbanization economies through residential and commercial suburbanization (Blažek & Netrdová 2012), and microregions in favourable geographical locations without any structural burden. Accordingly, old-industrial regions and peripheries insensitively industrialized during the 1950s and 1960s have become the most socio-economically problematic areas (MINRD 2006).

Spatial patterns of industrial linkages have changed significantly since 1998 because the vertically integrated state-owned companies were privatized, restructured, and integrated into the production networks of large foreign-owned transnational

corporations (TNCs) (Pavlínek 2004). This internationalization took place not only in plants acquired by foreign companies, but also in domestic firms, which have since been integrated into the supply chains of large transnational corporations, mostly in the position of second and third-tier suppliers (Blažek 2012). Nevertheless, deregionalization of production and weak local industrial linkages has persisted and has been reproduced further. It has frequently led to the establishment of new hollow clusters of foreign-owned, low value-added production branch plants (Ženka et al. 2014). Similarly to the situation in Eastern Germany, 'industry concentrations are based primarily on agglomerations of pure production tasks/facilities' (Hornych & Schwartz 2009, 523). Therefore, it is still possible to speak about a replication of the socialist pattern of deregionalized production with the TNCs instead of state-owned companies and with global production networks instead of national level linkages.

Although we have highlighted the importance of industrial legacy and persistence of the specialization patterns of small regions, there are certain limits to the applicability of the concepts of evolutionary economic geography for explaining regional development in Central Europe. The post-1989 radical socio-economic transition from centrally planned economy towards a market-driven one has been a discontinuity that calls for specific contextualization. We use the concept of rupture and rebundling (Bathelt & Boggs 2003; Bathelt 2013) as probably the most relevant framework for dealing with the development paths of Central European regions. In accordance with the four rebundling scenarios identified by Bathelt (2013), we argue that the most common scenarios of economically well performing Czech microregions were the ongoing and radical rebundling (Bathelt 2013, 7). The key to success was either FDI-driven upgrading[2] of local industries through coupling regional assets with the strategic needs of large foreign-owned TNCs (see MacKinnon 2012 for a very similar concept of strategic coupling) or FDI-driven transplantation of new technologies into the regions (see Martin & Sunley 2006 for scenarios of escaping regional lock-in).

Research questions

To summarize existing theoretical and empirical evidence, we have found strong arguments for why specialized Czech microregions should perform better than those that are diversified and vice versa. On the one hand, combinations of small production base, limited endogenous potential for knowledge creation and transmission, the dominance of low and medium-tech standardized production with weak innovation demand, and dependence on external knowledge sourcing lower the possibility to capitalize significantly on local economic diversity. Specialization thus enables both internal and external scale economies to take effect, which are crucial for the productivity growth in mature industries. On the other hand, excessive levels of specialization together with fundamental dependence on foreign capital and know-how increase microregions' vulnerability. Our first research question is thus: Do more industrially diversified regions perform better economically than more specialized ones?

Although we have several arguments for positive associations between economic specialization and regional performance, they are not in contradiction with the 'portfolio' or 'stability' argument suggesting that economic specialization can adversely influence the ability of regions to sustain external shocks (e.g. Frenken et al. 2007). The recent economic crisis, with its relatively marked onset and initial period, from mid-2008 to the end of 2009, provides a unique possibility to test the relevance of the 'stability' argument attributed to economic diversity. The set of Czech small regions, with their strong extra-regional linkages and other characteristics outlined above, represents a valid case to test this argument. We thus formulated our second research question as follows: Is economic specialization or diversity of Czech regions linked to their vulnerability to external demand shocks?

Data and methods

In the empirical analysis we used regional data disaggregated down to the level of 203 microregions of Czechia in terms of 'municipalities with extended powers' (*obce s rozšířenou působností*). We excluded the three biggest metropolitan regions, namely Prague, Brno, and Ostrava, each of which has a population above 300,000 and population density of more than 1000 inhabitants per km^2. We thus considered a set of non-metropolitan regions with a population below 200,000. Instead of focusing on isolated cities, we included their commuting hinterlands because most of the data are available for entire administrative regions and because in many of these regions a relatively significant portion of economic activities (e.g. those in industrial zones or logistics centres) is located in suburban areas outside of the city borders.

After expressing all of the proxy variables and their measures, we present the results of our analysis performed using a multiple regression framework. First, we examined the relationships between industrial specialization and economic performance. For this purpose, we considered our proxy indicators of regional economic performance as the dependent variables and the measures of industrial specialization as the main independent variables of our interest. Several control variables were included among the independent variables. We began with traditional Ordinary Least Squares (OLS) estimates and then compared the results with those obtained by employing some spatial regression techniques to account for spatial structure in the data. In the second step we similarly addressed the second research question with a proxy for vulnerability of regions to external demand shocks considered as the dependent variable and industrial specialization variables as the main independent variables of interest. Again, several control variables were included. We are aware that the cross-sectional design of this analysis is weaker in its reliability to establish cause-and-effect relationships compared to, for example, time-series data analysis. However, in the context of Central European post-communist countries, consistent time-series data for regional economic indicators are mostly inaccessible.

The main measures of the regions' current industrial specialization and economic performance are based on a unique data set compiled from the raw firm-level evidence collected by the Czech Statistical Office (CSO 2009a). The data cover regional

employment, production, and financial indicators disaggregated by the 2-digit NACE[3] classification of industries and by 203 regions. Although covering the most important sectors of the Czech economy, the data exclude several sectors such as mining and quarrying (which account for c.1% of total employment); energy, water distribution, sewerage, and waste management (2%); wholesale and retail trade as well as the repair of motor vehicles and motorcycles (12% nationally, 14% in Prague, the biggest city), and public services (21% nationally). Therefore, our data cover approximately two-thirds of the national-level employment size. With the exception of the mining sector, with its known spatial concentrations into a few mining regions, economic activities that are not covered by our data (such as public services and retail) can be assumed to have quite an even spatial distribution in their share of employment across the country. To express our regional-level measures of industrial legacy, we draw on employment data in particular manufacturing industries in 1987. This data set was compiled based on raw data used by the Czechoslovak Statistical Office for the annual reports on employment and wages in regions (CSO 1987). In order to make these historical figures comparable, we had to reclassify the data on manufacturing employment into the 2-digit NACE categories. Other data used in the analysis were taken from easily accessible public databases, with the exception of travel accessibility figures, which are based on a travel accessibility model (developed as part of the TRACC ESPON project that was operational at the Faculty of Science, Charles University in Prague, in 2013).

Dependent variables

Regional economic performance was measured by per capita value added. An alternative measure would have been value added per employee. We found that these two variables were highly related, with a correlation coefficient of 0.860, and both produced generally similar results when considered as dependent variables. We report results solely for the former.

The proxy measure for vulnerability to external demand shocks used as the dependent variable in the second part of the empirical analysis was the change in the unemployment rate between the end of 2008 and the end of 2009 (MLSA 2013). This period coincides closely with the onset of the impacts of the global economic crisis in Czechia, when all of the regions recorded more or less sharp increases in unemployment after several years of generally low unemployment and relative economic prosperity in the Czech economy.

Main independent variables of interest

Given the importance of manufacturing for a large part of Czech microregions, we start with a *dependence on* manufacturing as an important measure of the aggregate industrial specialization of these regions. The degree of regional dependence on manufacturing was measured as the share of manufacturing in total employment.

To account for specialization and diversity *within* manufacturing we applied the common Herfindahl index (HHI), calculated from the relative employment shares in individual manufacturing industries (industries 10–33 in the NACE 2-digit classification). Formally, this measure is denoted as:

$$HHI = \sum\nolimits_k e_k^2$$

where e_k is the relative share of employment in industry k in total manufacturing employment. Apparently, high values of HHI signify specialization and low values indicate industrial diversity of regions.

In addition to the economic importance of manufacturing, some other reasons for our concern specifically with specialization and diversity within manufacturing are as follows. First, as already noted, our data do not cover all non-manufacturing industries. Second, and more importantly, there is a tight correlation coefficient of 0.941 between the HHI within manufacturing industries and the HHI calculated from all 59 industry groups covered by our data. This suggests that regional variation in the degree of industrial specialization within manufacturing accounts for a great deal of variation in the overall economic specialization of Czech microregions. This suggestion is also supported by the higher mean HHI for manufacturing industries (0.176) and its coefficient of variation (0.480) compared to these statistics based on the regional variation in HHI calculated from employment shares in non-manufacturing industries with a mean of 0.117 and coefficient of variation of 0.249.

The correlation between the measures of dependence on manufacturing and specialization and/or diversity within manufacturing is significant (0.413). However, it also suggests that these two variables are not identical and that they capture complementary information about the structural characteristics of Czech regional economies, and it can be assumed that these two variables interact (see Brambor et al. 2005 for a discussion of interaction effects).

Other independent variables

As we have indicated, the development paths of small regions are often rooted in their history and significantly influenced by inherited specialization. Several of the Czech microregions inherited excessive levels of industrial dependence and strong specialization in either capital-intensive industries or labour-intensive industries. Any analysis of the drivers of regional economic performance should account for these types of historical determinations. As such, in addition to the dependence, specialization, and diversity variables calculated from the 2009 data, we also considered two analogous historical measures in terms of the HHI within manufacturing industries in the year 1987 and the number of employees in manufacturing in 1987 relative to the total population. These two variables (with a mutual correlation of 0.212) captured the variation in regional economic structure at the end of communist period.

To examine the effects of the extent of structural transformations of regional economies on our dependent variables, the Finger-Kreinin index (FKI) of structural change in manufacturing employment was applied. The index is based on comparisons of employment shares in particular manufacturing

industries over the period of post-communist transformation. Formally, it is expressed as:

$$FKI_{t1,t2} = 0.5 \sum_k \left| e_{k,t1} - e_{k,t2} \right|$$

where e_k represents the relative share of employment in sector k in total employment and $t(1)$ and $t(2)$ index two points in time.

There is usually a significant relationship between the economic performance of regions and a country's settlement structure, often attributed to various effects of urbanization economies. We applied a common proximate variable for urbanization economies in terms of the regional population size. In addition, we attempted to distinguish between urbanization economies sourcing from the concentration of population and economic activity per se and those related to the travel accessibility of a given region. In order to account for the latter, we considered the matrix D_{ij} of pair-wise travel accessibility distances d_{ij} between regional centres measured in time. A simple measure of the aggregate travel accessibility of a region i – also indicating the centrality of its position within a whole settlement system – was expressed as:

$$D_i = \sum_j d_{ij}$$

where lower values indicate better aggregate travel accessibility.

We noted that the relationships examined in our study, and especially the effects of economic specialization, might be confounded by regional differences in the size distribution of firms. We therefore applied the Gini coefficient of size distribution of economic entities (G_i), based on the interval data on size distributions of economic entities in individual regions (CSO 2009c).

Finally, it can be assumed that both the present economic performance and the degree of industrial specialization can be influenced by investments into these regions. Due to inaccessibility to regional level data on investments, we attempted to construct an indicative proxy for regional investment (inflows) activity based on the cumulative expected size of all investment projects with granted state incentives divided by the size of the economically active population. The figures were drawn from the 629 investment projects that received state incentives during the period 1998–2009 (CzechInvest 2013), which we localized into particular regions. The data cover more than 90% of investment projects in manufacturing. There are various criteria[4] for incentives based on the Investment Incentives Act No. 72/2000 Coll. as amended by Act No. 192/2012 Coll. The investment incentives can be granted only to projects in manufacturing or to support technology centres and centres of strategic services. The expected size of investments (i.e. promised volume of investments) often differ significantly from what is achieved in reality (e.g. Bolcha & Zemplinerová 2012). However, we still maintain that the measure can be informative with respect to the indication of regional differences in investment intensity. At the same time, the measure also contains information about regional differences in state investment subsidies.

Table 1 shows all of the variables and their proxy measures used in our analysis, with their basic descriptive statistics.

Table 1. Variables employed in the analysis and their basic descriptive statistics

Variable	Indicator	Abbreviation	Mean	Std. Dev.	Moran's I	Sources of data
Economic performance	Value added per capita (2009)	VA_pc	CZK 92,938 (EUR 3372)	49,925	−0.023	CSO (2009a)
Present industrial specialization	Herfindahl index for manufacturing employment (2009)	HHI_09	0.176	0.085	0.025	CSO (2009a)
Dependence on manufacturing	% share of manufacturing in total employment (2009)	MANUF_09	0.541	0.104	0.055*	CSO (2009a)
Past industrial specialization	Herfindahl index for manufacturing employment (1987)	HHI_87	0.355	0.190	0.071**	CSO (1987)
Past dependence on manufacturing	% share of manufacturing employment relative to total population (1987)	MANUF_87	0.158	0.078	0.222***	CSO (1987)
Extent of structural change	Finger-Kreinin index of structural change in manufacturing employment 1987–2009	FKI_87_09	0.500	0.082	0.155***	CSO (1987; (2009a)
Size	Population size	POP	42123 inhab.	32066	−0.038	CSO (2009b)
Travel accessibility	Explained in the text ('Data and methods')	ACCESS	2135674 sec.	349327	0.806***	Accessibility model
Investment activity	Investments with state incentives relative to economically active population	INVEST	CZK 131,073 (EUR 4755)	233,444	0.048	Czechinvest (2013)
Inequality of size distribution of economic entities	Explained in the text ('Data and methods')	SIZE_DIST	0.242	0.033	−0.022	CSO (2009c)
Vulnerability to external shocks	Change in unemployment rate at the onset of economic recession (end of 2008 to end of 2009)	UNEMP_CH_08_09	4.066%	1.304	0.445***	MLSA (2013)
Unemployment before economic crisis	Unemployment rate (1 January 2008)	UNEMP_08	6.893%	2.811%	0.586***	MLSA (2013)

Notes: For all variables N = 203 regions (covering whole area of Czechia excluding the metropolitan regions of Prague, Brno, and Ostrava); Moran's I measures the global spatial autocorrelation; *p < 0.1; **p < 0.05; ***p < 0.01 (pseudo p-values based on a permutation test)

After appropriate checks of the data, several of the variables were transformed for the purposes of regression analysis (as indicated in Tables 2 and 4).

Results

Table 2 depicts the results for six multiple regression models for examining the predictors of regional economic performance (VA_pc, log-transformed). Because of some concerns about multicollinearity we began with the presentation of three simple specifications (models 1, 2 and 3 in Table 2) with solely our main independent variables of interest in terms of the dependence on manufacturing (MANUF_09) and specialization within manufacturing (HHI_09). The first of these models (1) provides OLS estimates for the main effects of these two predictors. These results indicated significant positive effect of the dependence on manufacturing on the economic performance of regions but insignificant main effect of specialization within manufacturing. In the second (2) and third (3) models we assumed that the specialization within manufacturing could still be important for regional economic performance but that its effect could vary with different levels of dependence on manufacturing. This hypothesis was tested by the inclusion of an additional multiplicative interaction term (HHI_09×MANUF_09). In this case, appropriate diagnostics suggested a potential problem of spatially autocorrelated errors. We therefore ran the maximum likelihood spatial errors regressions on the full (2) and reduced (3) data sets. The latter refers to the set of 198 observations, after excluding five outliers identified on the basis of z-scores of original data below −3 or above 3.

As the interaction term appeared significant, in Figure 1 we show the interaction plot with the effects of industrial specialization on economic performance conditional on the share of manufacturing in total employment. Figure 2 analogously shows the effects of the share of manufacturing dependent on industrial specialization. The plots are based on 'realistic' results obtained by spatial error regression (3), excluding five regions with outlying observations. Interestingly, the plot in Figure 1 illustrates that it is only for regions with a high share of manufacturing employment where the effects of industrial specialization on regional economic performance are positive. Below a certain level of dependence on manufacturing, industrial diversity rather than specialization associates with higher economic performance. These estimates suggest that the latter finding holds for more than two-thirds of Czech regions. Figure 2 indicates a generally positive relationship between the share of manufacturing employment and economic performance, although the marginal effects of the dependence on manufacturing predominantly increase with the rise in industrial specialization. Also the significance of the interaction effect between HHI_09 and MANUF_09 outlined above was confirmed by the fifth model (5) in Table 2, in which we additionally controlled for other independent variables. Similarly, model (4) corroborated the significant main effect of MANUF_09 but not of HHI_09 when other potential predictors were considered. Both results seem to be robust across different model specifications.

When inspecting the distribution of individual regions in the context of the relationships that are examined in this section in

Table 2. Correlates of economic performance (dependent variable VA_pc log-transformed)

	Regression models											
	1		2		3		4		5		6	
	OLS		OLS		ML Spatial error model		ML Spatial error model		ML Spatial error model		OLS	
Variable	B	Std. error	B	Std. error	B	Std. error	B	Std. error	B	Std. error	B	Std. error
HHI_09	0.228	0.163	−4.288***	0.803	−4.468***	0.997	0.063	0.112	−1.276**	0.590	0.301**	0.149
MANUF_09	0.628***	0.133	−0.568**	0.243	−0.554*	0.315	0.260**	0.102	−0.110	0.189	0.157	0.140
HHI_87	–	–	–	–	–	–	0.063	0.050	0.036	0.050	−0.050	0.070
MANUF_87	–	–	–	–	–	–	0.034	0.129	0.060	0.128	0.413**	0.201
FKI_87_09	–	–	–	–	–	–	−0.271	0.105	−0.231*	0.105	−0.059	0.124
POP (logs)	–	–	–	–	–	–	0.099***	0.035	0.062	0.038	0.110**	0.046
ACCESS (logs)	–	–	–	–	–	–	−0.696***	0.168	−0.689***	0.166	−0.659***	0.138
SIZE_DIST	–	–	–	–	–	–	2.873***	0.300	2.893***	0.297	2.583***	0.422
INVEST (cube root)	–	–	–	–	–	–	0.001***	0.000	0.001***	0.000	0.001***	0.001
HHI_09 × MANUF_09	–	–	7.106***	1.242	7.132***	1.691	–	–	2.072**	0.897	–	–
λ	–	–	–	–	0.189*	0.102	0.459***	0.083	0.460***	0.083	–	–
R^2	0.151		0.270		0.189		0.713		0.720		0.620	
N	203		203		198 (excluding outliers)		203		203		145 (INVEST>0)	

Notes: * p < 0.05, ** p < 0.01, *** p < 0.001, **** In spatial error regressions λ refers to spatial autoregressive coefficient, which captures spatial autocorrelation of errors.

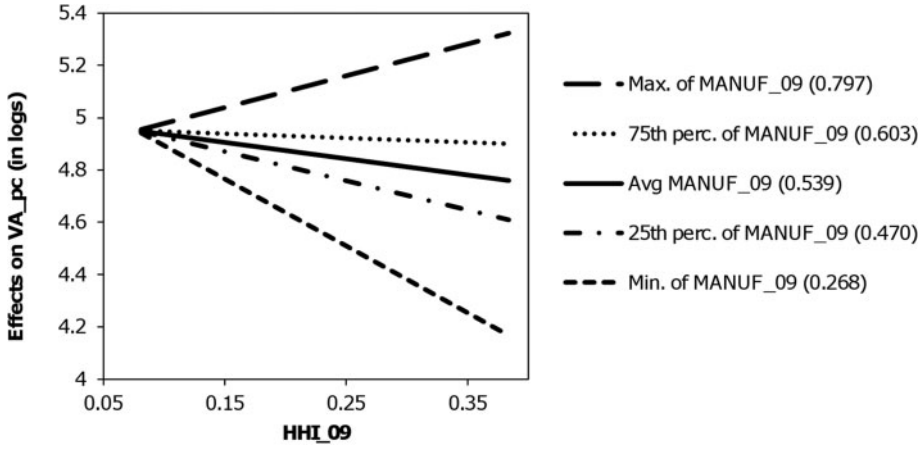

Fig. 1. Effects of industrial specialization on regional economic performance conditional on share of manufacturing in total employment; based on regression model 3 in Table 2; the range of HHI_09 (excluding outliers) extends from 0.081 to 0.384 (source: Fig. 2)

more detail, we ascertained that the interaction effects described above can partly be attributed to what can be called the 'size effect'. This refers to the fact that some more populous microregions tend (naturally) to be less dependent on manufacturing and have a more diversified industrial structure. However, this size effect does not provide a full explanation, as the above-mentioned interaction term remained significant even after controlling for population size and travel accessibility (among other control variables).

Regarding other independent variables examined in models 4 and 5, significant effects of population size and travel accessibility were found with the expected signs of these relationships. A strong positive effect was also indicated for the firm size structure in 2009. This can be viewed as indirect evidence that economic performance may be attributed to the presence of large manufacturing firms rather than to the effects of Marshallian industrial districts of small interconnected firms.

Although it was not a primary concern of our study, a significant positive relationship was uncovered between investment activity and economic performance. However, there were some concerns with the bimodality of the INVEST measure with 28% of zero observations. We therefore reanalysed the data, using only cases with non-zero INVEST observations, and the results are shown in the column for model 6 in Table 2. Even this exercise indicated a significant positive relationship between investment activity (and investment subsidies) and regional per capita value added.

There are very few examples of microregions that were able to attract large greenfield investments. The majority of large and successful projects have taken place in regions that had already performed well at the end of 1980s (for similar conclusions see Chen & Fleisher 1996; Lessmann 2013), and had concentrated large manufacturing firms, R&D centres, infrastructure, and a skilled labour force in either the same or a closely related industry as the investing firm (Ženka & Čadil 2009). This fact does not correspond with the official efforts of Czech economic policy to provide government incentives and attract investors to economically weak and structurally affected regions in order to reduce regional disparities.

By contrast, from the measures of past industrial legacy, only HHI_87 revealed a weaker positive relationship with present

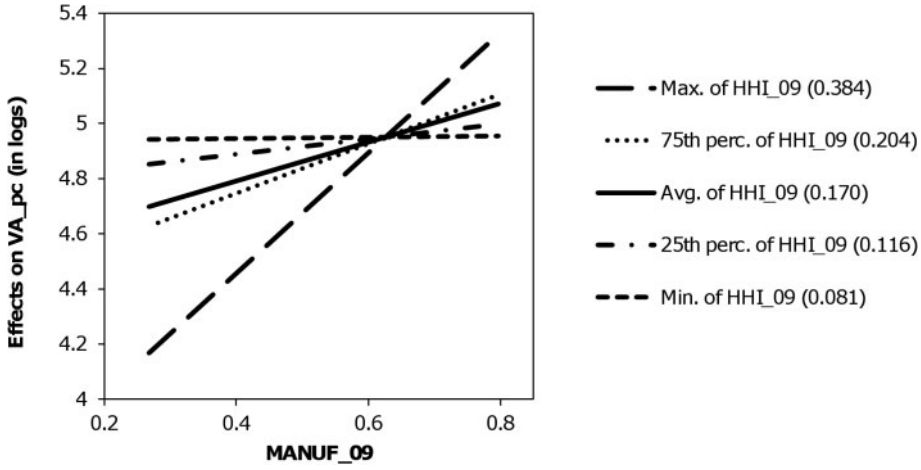

Fig. 2. Effects of share of manufacturing in total employment on regional economic performance conditional on industrial specialization; based on regression model 3 in Table 2; the range of MANUF_09 (excluding outliers) extends from 0.268 to 0.797 (source: Fig. 1)

regional per capita value added. These results do not suggest any straightforward link between past industrial specialization and present regional economic performance (i.e. beyond what is captured by the present industrial specialization variables). At first glance, this finding seems to contradict our previous statements about the significant effects of past specialization and centrally planned industrialization in 1950s and 1960s. Nevertheless, the fact that the transformation growth paths of regions highly industrialized and specialized in 1987 were contingent and diverse does not contest the effects of past specialization. Current regional economic performance in Czechia has been influenced by a plethora of factors, including industrial legacy (i.e. regions originally specialized in traditional labour-intensive manufacturing perform worse), success of privatization projects in the first half of the 1990s, large FDI inflows and externally-driven technological upgrading (e.g. Pavlínek 2004).

However, one feature is common to the majority of microregions with high per capita value added. The list of the 20 best performers in 2009 (Table 3) consists mostly of microregions that were already heavily industrialized in 1987, often dominated by a single large manufacturing company, and specialized either in capital-intensive or technology-intensive industries such as metallurgy (Třinec, Bohumín), automotive industries (Mladá Boleslav, Kopřivnice, Mohelnice), and tyres (Otrokovice). There are a few exceptions, such as Černošice or Říčany, which are towns near Prague and capitalize on residential and commercial suburbanization and development of services. More importantly, the economically successful regions have frequently maintained their core industries and the largest firms since the 1930s, or even longer. Nevertheless, successful large firms were usually taken over by transnational corporations, which ensured them market access and boosted their productivity through modernization, restructuring, technological upgrading, and integration into their own production networks (e.g. Pavlínek 2008).

Regarding the second research question, which addressed the stability argument in terms of the assumed association between economic specialization and vulnerability to external shocks, we identified a significant and consistent relationship between regional dependence on manufacturing and the rise in unemployment during the onset of economic recession (see models 1, 3, and 6 in Table 4). However, industrial specialization within manufacturing was not found to be related to the vulnerability of local labour markets. Also in this case we tested the interactions between the dependence on manufacturing and current industrial specialization, but the interaction term was found to be insignificant when excluding outlier observations (model 5 in Table 4). In other words, it seems that regional dependence on manufacturing but neither specialization nor diversity within manufacturing industries contributes to Czech regions' vulnerability to external shocks. As long as the Czech manufacturing industry firms are generally highly export-oriented, the relationship between regional dependence on manufacturing and unemployment volatility may be partly explained by the export orientation of the regional economic base.[5]

Table 3. Top 20 microregions according to per capita value added in 2009 (Source: CSO 2009a; 2009b)

City region	Pop.	VA_pc *	MANUF_09*	HHI_09*	MANUF_87*	FKI_87_09*	Dominant product
Otrokovice	34,987	451	125	233	211	73	rubber products (tyres)
Mladá Boleslav	106,848	428	138	396	141	39	automotive
Plzeň	185,855	240	96	54	140	97	electronics, heavy engineering, beverages
Mohelnice	18,736	233	146	291	156	72	automotive
Humpolec	17,174	231	108	154	118	92	automotive
Bohumín	29,826	209	143	155	195	101	railway engineering, basic metals
Kutná Hora	49,942	203	95	59	71	124	tobacco products
Hořovice	28,393	203	131	94	151	132	automotive
Frenštát p.R.	19,106	198	130	257	112	128	automotive
Říčany	54,210	192	60	59	31	130	construction, financial intermediation
Kolín	78,734	191	112	81	135	118	automotive
Jihlava	99,421	181	114	104	109	70	automotive
Kralupy nad Vltavou	29,305	180	89	103	124	95	basic chemicals
České Budějovice	154,323	179	73	47	75	59	automotive
Jablonec nad Nisou	54,657	179	127	99	200	68	automotive
Beroun	55,428	172	104	76	117	116	automotive, engineering, concrete
Kuřim	21,277	171	136	132	218	138	automotive
Tumov	32,064	171	122	57	141	86	engineering, plastics
Černošice	116,730	170	50	49	42	107	storage
Třinec	55,769	167	127	214	217	88	basic metals

Note: * The average of 203 Czech regions = 100

Table 4. Correlates of economic vulnerability (dependent variable change in unemployment during the onset of economic recession) (Source: CSO 2009a; 2009b; 2009c)

	Regression models											
	1		2		3		4		5		6	
	OLS		OLS		ML Spatial lag model		ML Spatial lag model		ML Spatial lag model		ML Spatial lag model	
Variable	B	Std. error	B	Std. error	B	Std. error	B	Std. error	B	Std. error	B	Std. error
HHI_09	−0.544	1.258	−13.374	6.854	−0.658**	0.991	−10.097*	5.420	−5.602	6.498	−1.787	1.132
MANUF_09	3.851***	1.179	0.551	2.092	2.516***	0.930	0.105	1.649	1.522	1.987	2.588***	0.888
HHI_87	0.500	0.510	0.321	0.515	0.442	0.401	0.310	0.406	0.194	0.386	0.232	0.381
MANUF_87	2.213	1.351	2.267*	1.342	2.049*	1.071	2.078*	1.064	1.265	1.008	1.275	1.009
UNEMP_08	0.095**	0.037	0.100***	0.037	0.038	0.029	0.042	0.029	0.059**	0.028	0.058**	0.028
VA_pc (logs)	−0.661	0.722	−0.810	0.722	−0.807	0.569	−0.914	0.568	−0.563	0.543	−0.522	0.539
POP (logs)	−0.270	0.413	−0.570	0.440	−0.396	0.325	−0.615*	0.346	−0.552	0.339	−0.495	0.325
ACCESS (logs)	−2.427*	1.389	−2.665*	1.385	−1.507	1.100	−1.686	1.098	−1.899*	1.046	−1.816*	1.038
INVEST (cube root)	−0.004	0.004	−0.004	0.004	0.001	0.003	0.000	0.003	0.000	0.002	0.000	0.003
HHI_09 × MANUF_09	–	–	19.932*	10.470	–	–	14.662*	8.278	6.441	10.804	–	–
W_dependent****	–	–	–	–	0.620***	0.064	0.615***	0.064	0.610***	0.065	0.606***	0.066
R^2	0.175		0.190		0.462		0.469		0.444		0.442	
N	203		203		203		203		196 (excluding outliers)		196 (excluding outliers)	

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, ****In spatial error regressions W_dependent refers to spatial lag in dependent variable included to capture spatial autocorrelation of dependent variable.

Conclusions

The main aim of this article is to explain the role of regional industrial specialization and diversity with respect to differences in economic performance and the vulnerability of Czech microregions. In the first part we outlined several specifics of Czech microregions, while pointing at the generally high importance of manufacturing and typically strong extra-regional linkages of many regions. Bearing in mind these specifics, in our empirical analysis we referred both to regional economies' degree of dependence on manufacturing and to the respective specialization or diversity within the manufacturing sector. Although we noted some limitations of our analysis, stemming for example from its cross-sectional design and data unavailability, we have presented several interesting findings that can be summarized as follows.

First, the analysis confirmed the highly important but ambiguous role of regional dependence on manufacturing, which is strongly associated with the higher economic performance of Czech regions. However, we also found this significantly positively related to increasing regional unemployment rate during the onset of the impacts of the global economic recession in Czechia, with the latter variable considered as the proxy for vulnerability to external demand shocks. Both of these results are important. On the one hand, our findings negate some overly optimistic and universalistic expectations of straightforwardly positive impacts of economic diversity on economic performance, stemming from a naive reading of recent Western-based economic geography literature and often disregarding important variations in historical circumstances and local contexts. On the other hand, the results simultaneously suggest the relevance of the stability argument, suggesting adverse effects of regional economic specialization due to the higher vulnerability of specialized regions to external demand shocks.

Second, no less interesting results were obtained regarding the effects of our second measure of specialization or diversity within the manufacturing sector on economic performance. However, in this case we showed that these effects are conditional on the degree of dependence on manufacturing of the regional economy in question. For the Czech regions with a high share of manufacturing employment, the specialization within manufacturing is associated with higher per capita value added. However, for a significant number of Czech regions with comparatively lower dependence on manufacturing, the diversity rather than the specialization of manufacturing industries in a region became instrumental with respect to economic performance. To some extent, this finding can be attributed to the 'size effect', the fact that some more populous microregions tend naturally to be less dependent on manufacturing and at the same time tend to have a more diversified industrial structure. However, this size effect does not provide a full explanation, as the above-mentioned relationship uncovered in our analysis remained significant even after controlling for population size or travel accessibility (among other controls). Further, these results warn against simplistic generalizations about the impacts of economic specialization and diversity.

Third, to put our results into the Czech regional context, it should be noted that the most specialized and economically well

performing microregions were generally dominated by a single large manufacturing branch plant rather than by the presence of Marshallian industrial districts.

Fourth, during our analysis we attempted to identify the extent to which current patterns of regional economic performance had been influenced by the industrial legacy from the communist era. The regression analysis did not reveal any significant relationship between past industrial specialization and current economic performance that would go beyond what has been captured by the present specialization variables. However, this does not deny the fact that most Czech regions with the highest per capita value added exhibited a strong persistence in their core industrial activities and, despite numerous ownership transformations, continuity of the largest manufacturing firms. Although most of them were taken over, restructured, and upgraded by foreign transnational corporations, technological regimes in many of these regions have persevered with surprising strength. In many cases, notwithstanding radical institutional changes during the communist period and post-communist transition, this continuity dates back to the beginning of the 20th century.

This argument contradicts Affuso et al. (2011), who state that Central European regions have increased their productivity primarily following the structural shift from lower value-added industries to higher value-added industries during the period 1995–2005). While this is true for some of the Czech regions, such a conclusion is far from general. Our results do not indicate any significant relationship between the intensity of the structural changes in the period 1987–2009 and present economic performance. Furthermore, the results have not shown any link between the extent of structural change and regions' vulnerability to external shocks. This is not to deny the importance of the FDI-led shift towards technology-intensive manufacturing industries and knowledge-intensive services. Nevertheless, there are many regions that have performed economically very well without any significant structural changes over the last 20 years, and there are also many regions that have maintained low per capita value added despite major restructuring of their production bases. The latter group also includes some structurally affected old industrial and peripheral regions, converted into export-oriented, low value-added production platforms of foreign-based TNCs.

To conclude with some more general implications, it is suggested that the factors of regional development examined in this article, as well as policies focusing on these factors, should not be seen in black and white. Industrial specialization is not a curse and economic diversity is not a destiny, as has become fashionable to believe. This is especially true when considering small-city regions such as those in this article.

Notes

1 For a description of the 'most likely case' research design and the possibilities for generalization, see Kofroň (2012).

2 Since 1989 most Czech manufacturing industries have undergone a combination of product downgrading and process upgrading towards less complex components but higher productivity (Blažek 2012).

3 Nomenclature statistique des activités économiques dans la Communauté européenne (Statistical Classification of Economic Activities in the European Community), a European industry standard classification system, which originally consisted of a 6-digit code.

4 The law stipulates the following conditions for obtaining support in manufacturing: a firm must either establish new production or expand existing production, and it must be an investment in tangible or intangible assets at least in the amount of CZK 50 million (EUR 1.81 million, of which at least CZK 25 million is to be invested in new machinery) in Regions I (economically weak and structurally affected regions) and a minimum of CZK 100 million (EUR 3.62 million, of which at least half is to be invested in new machinery) in other regions in Czechia. At least half of the minimum amount of investment is financed by equity. Investments must be performed within three years of the grant.

5 Unemployment volatility is also generally influenced by population size and position in an urban hierarchy (for empirical evidence in Central Europe, see Blažek & Netrdová 2011). Large cities and regions concentrate public services that may absorb unemployment increases.

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