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Can Polycentrism Stimulate the Provision of Social Services of General Interest?

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Abstract

This paper aims to discuss the extent to which polycentrism as a strategic vision impacts on the provision of three selected Social Services of General Interest (SSGI). A multivariate cross-section OLS regression model is used to estimate the relative impact of polycentrism on the provision of SSGI. This study uses Eurostat and ESPON data. The findings indicate that polycentrism on a national level appears to have no impact on low, medium or high centrality services. The GDP/capita has the strongest impact on the SSGI provision on low and medium centrality services. The findings indicate the presence of spatial patterns in the SSGI provision. The findings raise the question to what extent polycentrism and the Cohesion Policy will achieve the policy ambitions.

Keywords: Social Services of General Interest, polycentrism, centrality levels.

I. Introduction

Since the launch of the European Spatial Development Perspective (ESDP) in 1999, polycentric development is seen as a means to counterbalance the European core that promotes an unbalanced European spatial development, by the creation of several dynamic zones of global economic integration, well distributed over the territory (CEC, 1999). It was widely adopted as a strategy to achieve the policy goal of territorial cohesion (Faludi, 2006; Zonneveld & Waterhout, 2005; Baudelle & Castagne`de, 2002). The concept of polycentrism is related to a normative agenda on achieving two European policy goals: social and territorial cohesion and economic competitiveness (Governa & Salone, 2005; Waterhout, 2007). In fact, this concept was originally considered a "bridging concept", in the sense that could combine different interests of the member states around the policy objectives of cohesion and competitiveness. According to Waterhout (2002), the polycentrism concept allows both objectives to be considered.

While the concept itself is widely used, a definition remains elusive as it is employed for different phenomena and at different scales (Rauhut, 2017; Kloosterman & Musterd, 2001; Davoudi, 2003; Hague & Kirk, 2003). The lack of a clear conceptual definition of polycentrism is in line with the conceptual criticism, something pointed out by several scholars. (Davoudi, 2004; Faludi, 2005; Nadin & Dühr, 2005; Salez, 2009; Rauhut, 2017). Furthermore, the meaning of polycentrism has changed over time (Geppert, 2009). Several debates among scholars have focused on what polycentrism really is, how it can be measured and what benefits a polycentric development has (Faludi, 2015; van Meeteren et al., 2015; Green, 2007; Meijers & Sandberg, 2008).

It is recognised that the existence and significance of polycentrism depends on scale (Brezzi & Veneria, 2015; Shaw & Sykes, 2015; Rauhut, 2017; Decoville & Klein, 2014). The European Commission (2001) consider two levels at which polycentricity can occur: at the EU level and at regional level. Polycentricity can also occur at the national level (Brezzia & Veneri, 2015) and the agglomeration level (Tewdwr-Jones & Williams, 2001; Davoudi, 2002). To what extent it is possible to achieve polycentrism simultaneously at all the scales has also been debated (ESPON, 2005).

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Potential contradictions can be found; what is monocentric at one level can be polycentric at another one and vice versa (Hall & Pain, 2006; Taylor et al., 2003). The need to prove the theoretical basis of polycentrism with empirical studies is something that has been widely noted across the academic community (Davoudi, 2002; Meijers & Sandberg, 2008; Meijers 2008a; Wegener, 2013).

Several studies suggest a theoretical relationship between the services provision and the urban system configuration (Meijers, 2005, 2006; Faludi, 2005; Zonneveld & Waterhout, 2005; Meijers et al., 2007; Schmitt et al., 2015). The few empirical studies that analyse the impact polycentrism has on service provision all postulate that analysed services operate at the same level or scale (Meijers 2008b; Veneri & Burgalassi, 2012; Borges & Johansson 2013). According to *Central Place theory*, services provision is dependent on if whether service represents a low, medium or high centrality service (Milbert et al., 2013). It has been noted that low centrality services are well provided in both urban and rural regions, and that medium centrality services are well provided in urban regions but not in rural regions. High centrality services are well provided in urban regions, but tend to be poor in rural regions (Rauhut & Komornicki, 2015). It can therefore be assumed that polycentrism will have a different impact on different services depending on the level of centrality of services. Although the findings in Palma et al. (2015) provide some empirical support for this hypothesis, the data and analytical tools are underdeveloped.

The ESDP was published in 1999 almost two decades after the concept was adopted, yet the empirical basis is still rather weak. As a normative policy with cohesion and competitiveness objectives, it still needs a solid empirical demonstration. Some of the gaps between the theoretical assumptions and empirical evidence around the concept of polycentrism will be addressed in this paper. This paper aims to discuss the extent to which polycentrism as a strategic vision impacts on the provision of three selected Social Services of General Interest (SSGI), at three different centrality levels and in 25 European countries. The three services selected are the number of pharmacies per 100,000 inhabitants, the number of hospital beds per 100,000 inhabitants, and the number of universities and university colleges per 500,000 inhabitants. This paper will answer two questions: (a) does polycentrism have a positive impact on the provision of the three SSGIs analysed, regardless if it is a low, medium or high centrality service? and (b) does polycentrism have a different impact on the provision of SSGIs in different parts of Europe?

II. Social Services of General Interest

Before proceeding, a few words on an issue of definition need to be stated. *Services of General Economic Interest* (SGEI) were briefly mentioned in Article 86 of the Rome Treaty, 25th March 1957; the broader notion of *Services of General Interest* (SGI) was only developed in relation to the Treaty of Amsterdam, 2nd October 1997. The term Social Services of General Interest (SSGI) only emerged in the Presidency Conclusions of the Laeken European Council meeting 14th and 15th December 2001 (Smith & Rauhut, 2015; Humer, 2016). Indeed, SGI and its social sub-category *Social Services of General Interest* (SSGI) have attained a level of recognition at the EU level that remains puzzling. Unlike SGI and SGEI however, SSGI currently supports no legally binding definition – there is no Treaty basis for SSGI and the Member States (MSs) cannot agree on its boundaries (Milstein, 2015; van de Gronden, 2011; Bauby, 2013). Broadly speaking, SSGI are seen as measures addressing risk and vulnerabilities in life (European Commission, 2007) which facilitate social inclusion and the safeguarding of fundamental rights (European Commission, 2010).

It is widely accepted to conceptualise (S)SGI within a politically shaped context out of EU legislation and policy agenda (Fassmann et al., 2015). From an EU understanding, SGI is not equivalent to public services, but follows a distinct logic (Bjørnsen et al., 2015). Theoretically, public goods and services are considered to have collective motives and be in public hands. SGI, however, are explicitly understood as services that can be organised and produced by not only public, but also private actors. SGI therefore stands as its own category or normative definition of a group of services. There is no exhaustive list of what services SGI or SSGI encompass but in a wider understanding,

SSGI are found within Beveridge's 'five pillars or welfare' - education, healthcare, the labour market, housing and social benefits (Humer, 2014).

III. Conceptual Framework and Hypotheses

The political context is central to any explanation of how SGI provision functions, the drivers it is dependent on and the actors who co-shape it. The actual provision of SGI is achieved through the dialogue between supplying/producing actors – be they of a public, commercial or civil character – and of demanding/consuming actors – that again can be public or private bodies, households or individuals. How this dialogue takes place is to a large extent a matter of the context of the policy framework and practices (Humer et al., 2015). In this respect, SGI provision is an outcome of a social welfare policy, particularly when it comes to producing, financing and assigning, and an outcome of spatial planning policy when it comes to organising locations, and access and distribution of SGI (Humer, 2014).

While policy systems have a prime role with regards to SGI provision, they are nevertheless dependent on several drivers that cannot be fully controlled through policy steering. When it comes to SGI provision, the most important drivers are demography, society, economy and environment (Humer et al., 2015). Aspects of these four drivers can influence the policy arena for SGI provision in many ways. Demographic structures and processes shape, for example, the quantities and qualities on the demand side. It makes a difference whether SGI provision is for a young or old population, or a population with migration background, etc. Furthermore, societal values impact on the policy options as well as the understanding of what are good standards of SGI provision. Macro and micro economic potentials set the limits of SGI provision in respect to financial constraints (Humer, 2016).

As conditions change over time or in different regions, policy options for SGI provision change or become possible, different modes of organisation and different demands are apparent. In this respect, monocentric or polycentric structures have an influence on the actual provision of SGI but cannot be considered to be a driver as such.

Although polycentrism is a scale-dependent concept, the aspect of scale has not yet been the focus of SGI related research so far. Milbert et al. (2013) refer to Central Place Theory concerning the spatial organisation of SGI. SGI requiring different degrees of specialisation and outreach should be located in different hierarchies of places. While ubiquitous services like pharmacies and kindergartens are provided in places of lower hierarchy levels, more specific SSGI such as labour market agencies, hospitals or tertiary educational facilities are most efficiently placed in cities of medium to higher centrality within the hierarchical system of settlements.

Scale and spatial hierarchy may act to bridge the conceptual discussion of SSGI and polycentrism. However, it depends on the scale – sub-local to supra-national – if a territory is polycentric in character (Brezzi & Veneria, 2015; Shaw & Sykes, 2015, Tewdwr-Jones & Williams, 2001; Davoudi, 2002, ESPON 2005; Rauhut, 2017). In this study, polycentrism is analysed from a national perspective, while various SSGI of differing centrality levels are introduced. This should allow for a scale-sensitive test in which we keep the scale of polycentrism stable at a national level, but introduce SSGI of low, medium and high centrality incrementally.

From this discussion, it is possible to construct empirically testable hypotheses. They are:

Hypothesis 1: Polycentrism at the national level will have a positive impact on low centrality services as these services are provided everywhere.

Hypothesis 2: Polycentrism at the national level will have a positive impact on medium centrality services as these services need specialisation and economies of scale to operate.

Hypothesis 3: Polycentrism at the national level will have a positive impact on high centrality services as these services are so specialised.

IV. Data and Method

The empirical analysis in this paper is set at a national level. The data availability imposes several data constraints and is the main factor for this decision. Since the ESDP, the pursuit of polycentric development is one of the major spatial objectives of a large group of Member States (ESPON, 2005) and the formal competencies on territorial development lies with them, and not at the EU level. In addition to this operational viewpoint, the relevance of the national scale in designing European policies is recognised by Meijers and Waterhout (2007). The national approach may thus become particularly relevant to the debate regarding spatial development.

A multivariate cross-section OLS regression model is be used to estimate the relative impact on three chosen SSGI's (pharmacies per 100,000 inhabitants, hospital beds per 100,000 inhabitants, and universities per 500,000 inhabitants.). This method is chosen as it enables us to control for a subset of explanatory variables and examine the effect of a selected independent variable when estimating the effect of polycentrism on SSGI provision.

Macro data collected from Eurostat is used and covers the year 2010. Eurostat has harmonised the data from the national statistics offices to enable comparisons between the countries. The data for two of the dependent variables (pharmacies per 100,000 inhabitants and universities per 500,000 inhabitants) was collected and constructed for this paper (see the appendix for a discussion on the methodology).

Table 1 below lists the analysed countries. From the 28 EU-28 plus EFTA-4 area, 24 EU countries and Norway were analysed for this study. A main selection criterion was the spatial dimension of the countries. To analyse the effects of polycentrism in countries such as Cyprus, Liechtenstein, Luxembourg and Malta, which each consist of only one or two NUTS3 regions, is less meaningful to do. They are simply geographically too small for the concept of polycentrism to make sense from a multi-scale perspective. Croatia, Iceland and Switzerland are also excluded as they are not covered in the study by Meijer and Sandberg (2008). The 25 countries under investigation have contained between five (Estonia) and 412 (Germany) NUTS3 regions.

Table 1: The analysed countries and classification codes (dummy variables)

Country	Dummy	Country	Dummy	Country	Dummy	Country	Dummy
BE	C	GR	S	HU	E	SI	E
BG	E	ES	S	NL	C	SK	E
CZ	E	FR	C	AT	C	FI	N
DK	N	IT	S	PL	E	SE	N
DE	C	LV	E	PT	S	UK	C
EE	E	LT	E	RO	E	NO	N
IE	- -						

Note: C= Core; E= Eastern Europe; N= Northern Europe; S= Southern Europe

The independent variables chosen in this study are: GDP/capita, population density, a polycentrism index, and variables of interaction are created by multiplying GDP/capita with a dummy for where in Europe the country is located. The dummies are listed in Table 1.

Variables such as GDP/capita and population density do not require any explanation, but the dummies and the variables of interaction do. A dummy is used for measuring qualitative differences in the variables and the main rule is to use one dummy less than the number of categories (Ramanathan, 1995). Medical care, educational systems and kindergartens are very much related to the functions of the welfare state and different welfare regimes exist in Europe (Esping-Andersen,

1990; 1996). Some of the welfare regimes identified in the scientific literature are related to GDP/capita and different levels of welfare provision can be explained by different levels of GDP/capita (Vogel, 2003). Borges and Johansson (2012) also found GDP/capita to be a major determinant for the provision of health and medical care and education. In line with these findings and on the basis of the existing typologies (Nadin & Stead, 2008) we have constructed four dummy variables: one dummy for Eastern Europe (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia), one for the Northern Europe (Denmark, Finland, Norway and Sweden), one for Southern Europe (Greece, Italy, Portugal and Spain), and one for Central Europe (Belgium, Germany, France, the Netherlands, Austria and the UK).

The dummy for the Nordic countries responds well to characteristics in their welfare systems and so does the dummy for the southern countries. The dummy for the East European former communist countries mirrors the transition economies and the welfare challenges these countries are facing. The dummy for the Core European countries overlaps to large extent with the countries included in the 'Pentagon'. When multiplying the dummies with GDP/capita, a variable of interaction is constructed in order to highlight the qualitative differences in the welfare provision related to different levels of GDP/capita.

In order to control for qualitative differences in different parts of Europe, variables of interaction will also be made for population density and polycentrism. The same dummies will be used.

Several attempts to quantify polycentrism have been made. ESPON (2005, 2007) presents two completely different indices on polycentrism, Meijer and Sandberg (2008) present a third. Although the indices rank the included countries in completely different ways, Borges and Johansson (2012) notice that some correlation exists between the index by Meijer and Sandberg (2008) and the index by ESPON (2007). In the analysis by Borges and Johansson (2012) the three different indices are discussed in a context of SSGI generally, and the health ~~and~~ care sector as well as the educational sector in particular. The conclusion from their bivariate analysis is that the index by Meijer and Sandberg (2008) appears to produce the most robust results (Borges & Johansson, 2012). The index by Meijer and Sandberg analyses the national level, while the indices by ESPON (2005, 2007) analyse regional and agglomeration levels, i.e., sub-national levels. Based on the findings on robustness by Borges and Johansson (2012) and Rauhut (2017), the index by Meijer and Sandberg (SMPI: Sandberg-Meijer Polycentricity Index) will be used as a proxy variable for measuring polycentrism in this study.

The dependent variables analysed in this paper operate at different levels of centrality. Therefore, we can assume that the impact of polycentrism will be different depending on the services analysed. A two dimensional ranking in line with Christaller's 'Central Place Theory' and Maslow's 'Hierarchy of Needs' is made by Milbert et al. (2013). Following Christaller, low centrality level services – such as, pharmacies, kindergartens, and primary and secondary schools – should be very accessible in all kind of territories, while high centrality level services – such as universities and specialised hospitals – will not be very accessible in all kind of territories. The middle centrality level services – such as hospitals and employment agencies – are to some extent also accessible in rural areas. Hence, it can be assumed that the closer a rural area is to a city or urban area, the more middle centrality level services will be available to the population in this kind of territory. The conclusion is that polycentrism will have little impact on the low centrality services as they are provided locally, while polycentrism may have a (significant) impact on medium and high centrality services.

In this study, the number of pharmacies per 100,000 inhabitants is considered a low centrality SSGI (dependent variable 1). A medium centrality SSGI is the number of hospital beds per 100,000 inhabitants (dependent variable 2), and the number of universities per 500,000 inhabitants is considered a high centrality SSGI in this study (dependent variable 3).

Based upon the theoretical framework and the methodological considerations discussed in this chapter, two basic models can be specified. One is a *restrictive* model, comprising the variables discussed in the conceptual framework that have an impact on the demand and supply functions of SSGI provision: GDP/capita as a proxy for economic factors, population density as a proxy for demographic factors and polycentrism as a proxy for territorial factors. Hence, the restricted model is specified as:

$$Y = a_1 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon \quad \text{(a)}$$

The second model is an *extended* model, including the three main variables (GDP/capita, population density and polycentrism), as well as variables of interaction. The variables of interaction are calculated with dummies for Northern, Eastern and Southern Europe as well as for the European core countries in combinations with GDP/capita, population density and polycentrism. Hence, the extended models are specified as:

$$Y = a_1 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 D_1 + \beta_5 X_{1*} D_1 + \beta_6 X_{2*} D_1 + \beta_7 X_{3*} D_1 + \varepsilon \quad \text{(b)}$$
$$Y = a_1 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 D_2 + \beta_5 X_{1*} D_2 + \beta_6 X_{2*} D_2 + \beta_7 X_{3*} D_2 + \varepsilon \quad \text{(c)}$$
$$Y = a_1 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 D_3 + \beta_5 X_{1*} D_3 + \beta_6 X_{2*} D_3 + \beta_7 X_{3*} D_3 + \varepsilon \quad \text{(d)}$$
$$Y = a_1 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 D_n + \beta_5 X_{1*} D_4 + \beta_6 X_{2*} D_4 + \beta_7 X_{3*} D_4 + \varepsilon \quad \text{(e)}$$

For each dependent variable, the a-e models will be operationalised into 15 regressions: 1a-e, 2a-e and 3a-e. Models 1a, 2a and 3a are the restricted models, while the other models are extended.

The natural logarithm has been calculated for the variables and consequently the coefficients will express elasticities.

V. Estimations and Results

With one exception, the number of pharmacies per 100,000 inhabitants has a statistically significant coefficient for the impact of changes in the GDP/cap (see Table 2). The model, which controls for the Nordic countries (1b), does not display any statistically significant coefficients at all. Both the proxy-variable for measuring polycentrism (SMPI) and population density have no statistically significant coefficients in any of the models 1a-e.

As the SMPI variable shows no statistically significant coefficient, the zero hypothesis cannot be rejected, and hence the first hypothesis is false. It appears that aspects other than the presence of polycentrism determine low-centrality services such as pharmacies.

Table 3 shows the regression results for the medium centrality service, number of hospital beds per 100,000 inhabitants. The extended model 2b, controlling for the Nordic countries, has a positive statistically significant coefficient for the SMPI outside the Nordic countries. The result indicates that when polycentrism increases by one percent, the number of hospital beds per 100,000 inhabitants increases by about 0.5 percent. The extended model 2e, controlling for the European core countries, displays statistically significant negative coefficient for the countries outside the European core countries. When the GDP/capita increases one percent, the number of hospital beds per 100,000 inhabitants decreases almost 0.325 percent. The dummy for the European core countries has a statistically significant coefficient, which indicates that aspects not included or specified in the model poses a significant impact on the number of hospital beds per 100,000 inhabitants. As the SMPI-variable displays a statistically significant coefficient for model 2b for the 21 non-Nordic countries, the second hypothesis cannot be rejected. In other words, it appears to be partly true that a medium-centrality service such as hospital beds is determined by the presence of polycentrism.

None of the coefficients in models 3a-3e displays any statistically significant coefficients. This result means that the third hypothesis is rejected and hence other determinants than polycentrism will have an impact on high centrality services as these services are so specialised. In other words,

polycentrism does not have any impact on the supply of a higher centrality service, such as higher education.

Table 2: The number of pharmacies per 100,000 inhabitants 2010.

	Model 1a	Model 1b	Model 1c	Model 1d	Model 1e
Constant	10.098*	4.742	4.402	13.278*	15.989**
	(2.279)	(.977)	(.986)	(2.548)	(2.957)
ln GDP/cap	-.585**	-.099	-.487*	-1.659**	-.780**
	(-3.075)	(-.363)	(-2.812)	(.976)	(-3.395)
ln Popdens	.023	-.411	-.078	-.254	-.136
	(.121)	(-1.394)	(-.447)	(-.959)	(-.539)
ln SMPI	-.087	.049	.181	.337	-.288
	(-.440)	(.247)	(.898)	(.900)	(-1.347)
North		.756			
		(.098)			
North*ln GDP/cap		.196			
		(.024)			
North*ln Popdens		-.428			
		(-.542)			
North*ln SMPI		-1.337			
		(-.125)			
South			9.734		
			(.918)		
South*ln GDP/cap			14.275		
			(1.380)		
South*ln Popdens			-2.985		
			(-1.121)		
South*ln SMPI			-20.596		
			(-1.690)		
East				-6.547	
				(-.687)	
East*ln GDP/cap				8.519	
				(1.443)	
East*ln Popdens				-.933	
				(-.688)	
East*ln SMPI				-2.303	
				(-.294)	
Core					6.079
					(.239)
Core*ln GDP/cap					-14.292
					(-1.944)
Core*ln Popdens					-1.045
					(-.602)
Core*ln SMPI					15.665
					(1.978)
Adj. R2	0.220	0.435	0.398	0.344	0.286
d.f.	21	18	18	18	18
F-value	3.262*	3.615**	3.263*	2.802*	2.605

Note: ***, ** and *: Statistically significant at 0.1%, 1% and 5% levels respectively. Figures in parentheses are t-values.

Before concluding the regression results, a *F*-test for the how well the models fit was conducted.[1] Only seven of the fifteen tested models pass the test: 1a, 1b, 1c, 1d, 2a, 2e and 3d. The

[1] Most *F*-tests arise by considering a decomposition of the variability in a collection of data in terms of sums of squares. The test statistics in an *F*-test is the ratio of two scaled sums of squares reflecting different sources of variability. These sums of squares are constructed so that the statistic tends to be greater when the null hypothesis is not true. In order for the statistic to follow the *F*-distribution under the null hypothesis, the sums

results of the *F*-test do not affect the conclusion of how polycentrism influences the number of pharmacies per 100,000 as four of the five regression models display a statistically acceptable level of fit. None of the regression models 3a-e displayed any statistically significant coefficients. Only model 3d passes the *F*-test, and this model confirms the third hypothesis. Again, the conclusion remains unchanged by the *F*-test.

Table 3: Number of hospital beds per 100,000 inhabitants 2010.

	Model 2a	Model 2b	Model 2c	Model 2d	Model 2e
Constant	3.818	1.460	5.014	.705	6.831*
	(1.531)	(.454)	(1.798)	(.215)	(2.437)
ln GDP/cap	-.355	-.029	-.385	-.520	-.325**
	(-1.932)	(-.094)	(-2.073)	(-.930)	(-3.021)
ln Popdens	.019	-.278	.102	-.101	-.199
	(.102)	(-.830)	(.547)	(-.355)	(-.887)
ln SMPI	.386	.502*	.281	.775	.263
	(2.018)	(2.218)	(1.301)	(1.921)	(1.382)
North		2.649			
		(.303)			
North*ln GDP/cap		-14.687			
		(-1.610)			
North*ln Popdens		-.307			
		(-.342)			
North*ln SMPI		11.888			
		(.979)			
South			11.918		
			(1.049)		
South*ln GDP/cap			4.596		
			(.415)		
South*ln Popdens			-.117		
			(-.041)		
South*ln SMPI			-16.715		
			(-1.280)		
East				5.475	
				(.526)	
East*ln GDP/cap				3.305	
				(.520)	
East*ln Popdens				.342	
				(.234)	
East*ln SMPI				-9.296	
				(-1.100)	
Core					-45.164*
					(-2.280)
Core*ln GDP/cap					-.978
					(-.150)
Core*ln Popdens					-1.922
					(-1.246)
Core*ln SMPI					3.429
					(.487)
Adj. R2	0.274	0.270	0.308	0.239	0.436
d.f.	21	18	18	18	18
F-value	4.012*	2.266	2.528	2.077	4.090**

Note: ***, ** and *: Statistically significant at 0.1%, 1% and 5% levels respectively. Figures in parentheses are t-values.

of squares should be statistically independent, and each should follow a scaled chi-squared distribution. The latter condition is guaranteed if the data values are independent and normally distributed with a common variance (Ramanathan, 1995).

Only two of the five models (2a and 2e) analysing the determinants on the number of hospital beds per 100,000 inhabitants pass the *F*-test. As model 2b was the only regression that confirmed the impact of polycentrism on the medium level service (the number of hospital beds per 100,000 inhabitants), the failure of model 2b to pass the *F*-test results in no empirical evidence to support the impact of polycentrism on the analysed medium-level service. Therefore, hypothesis two has been rejected.

Table 4: The number of universities per 500,000 inhabitants 2010.

	Model 3a	Model 3b	Model 3c	Model 3d	Model 3e
Constant	9.961	8. 892	12.890	1.495	11.340
	(1.656)	(1.137)	(1.892)	(.217)	(1.486)
ln GDP/cap	-.373	-.272	-.386	-.159	-.347
	(-1.922)	(-.827)	(-1.943)	(-.310)	(-1.426)
ln Popdens	-.379	-.627	-.284	-.296	-.390
	(-1.973)	(-1.755)	(-1.420)	(-1.126)	(-1.454)
ln SMPI	-.108	-.070	-.231	.106	-.172
	(-.536)	(-.292)	(-1.001)	(.287)	(-.761)
North		-6.435			
		(-.691)			
North*ln GDP/cap		-1.777			
		(-.183)			
North*ln Popdens		1.389			
		(-1.452)			
North*ln SMPI		6.724			
		(.520)			
South			7.267		
			(.598)		
South*ln GDP/cap			-15.956		
			(-1.346)		
South*ln Popdens			.066		
			(.022)		
South*ln SMPI			8.330		
			(.597)		
East				-1.461	
				(-.153)	
East*ln GDP/cap				6.397	
				(1.094)	
East*ln Popdens				-1.387	
				(-1.026)	
East*ln SMPI				-3.239	
				(-.417)	
Core					-35.218
					(-1.376)
Core*ln GDP/cap					-9.019
					(-1.157))
Core*ln Popdens					1.416
					(.771)
Core*ln SMPI					7.510
					(.895)
Adj. R2	0.190	0.171	0.209	0.357	0.199
d.f.	21	18	18	18	18
F-value	2.881	1.709	1.906	2.903*	1.991

Note: ***, ** and *: Statistically significant at 0.1%, 1% and 5% levels respectively. Figures in parentheses are t-values.

VI. The Policy Dilemma of Polycentrism

Despite empirical attempts to study the impact of polycentrism as a long-term strategic vision of SSGI, they remain rare and the lack of empirical evidence continues. Some evidence gaps have,

however, been filled by this study. When comparing the findings from previous research with the estimates and results provided in this paper, several conclusions can be drawn. The first is that scale matters, something that has been previously noted (Brezzia & Veneria, 2015; Shaw & Sykes, 2015; Tewdwr-Jones & Williams, 2001; Davoudi, 2002).

Secondly, the findings also support the predictions by Milbert et al. (2013) in their theoretical discussion. Depending on the centrality level of the service analysed, the results will differ. No empirical evidence is however provided by this study to support that the medium centrality service hospital beds per 100,000 inhabitants are positively influenced by polycentrism. While Palma et al. (2015) found empirical evidence for polycentricity having an impact on medium-level services, this finding is in line with what Borges and Johansson (2012) found in their explorative study. The findings in this study appear to contradict those of Meijer (2008), who discussed the provision of cultural, leisure and sport facilities. This result is not surprising for three reasons: (1) Meijer (2008) analyses only the Netherlands, while the analysis in this paper cover 25 countries; (2) Hospital beds are a medium-level service, but it is a bold assumption to consider cultural, leisure and sports facilities as medium-level services; and (3) although the definition of what a SSGI is may be somewhat blurred, cultural, leisure and sports facilities cannot be considered equivalent to healthcare services.

Finally, the high centrality service of universities per 500,000 inhabitants indicates no correlation to polycentrism. This finding may be surprising, but neither Borges and Johansson (2012), nor Palma et al. (2015) did find any empirical evidence that polycentric urban structures had an impact on education (which is a very wide indicator).

Following the conceptual idea of the SGI drivers model by Humer et al. (2015), the calculated results remind us to better distinguish between *drivers* of SGI provision and territorial (and temporal) *contexts.* From our independent variables, GPD/cap and population density represent economic and socio-demographic drivers while polycentrism is – interpreting the SGI drivers model – actually not a driver, but more a contextual feature in which the drivers express different attributes. This perspective is most supported by the results for the low centrality – say ubiquitous – SSGI in the form of the number of pharmacies per 100,000 inhabitants; it is correlated rather to GDP/cap than to polycentric structures on national level.

The policy implications of these findings are interesting indeed. Polycentrism is postulated to achieve improvements and contribute to good service provision. A key pillar in the Cohesion Policy is the creation of polycentric regions, a concept that has been criticised in the scientific literature (Davoudi, 2003; Faludi, 2005; Meijers, 2008). So far there is no empirical evidence that a polycentric development is able to deliver on its political promises (Rauhut, 2017). While political processes and planning processes are slow, firms require fast decisions and foreign direct investment (FDI) is mobile. The result is that FDI goes to areas located close to the market, with good access to available labour of the correct type and good opportunities for quick returns on investment, that is, cities and urban agglomerations (Tewdwr-Jones & Mourato, 2005). The service provision, including SSGI, focuses on where the business and consumers are, i.e. in cities and urban agglomerations.

The services of general interest are one of the indicators, used in defining the notion of territorial cohesion written down in the Lisbon Treaty as the third dimension of cohesion, side by side with economic and social cohesion. Farrugia and Gallina (2008) attempted to quantify the notion of territorial cohesion through the intermediary of its three main objectives: (1) equal access to services of general interest over the entire territory, (2) avoiding territorial inequalities, and (3) polycentric territorial systems in urban and rural areas, i.e. ensuring the development capacities for all the inhabitants. The results from this study provide no empirical support for this; in the contrary, the obtained results here indicate a policy failure.

One of the most important elements of territorial cohesion is to ensure the adequate access to the SGI, also on the peripheral, rural areas, subject to depopulation, and isolated (like islands and

mountainous areas). The Territorial Agenda 2020 addresses this (European Union, 2011). Continuing the work on the territorial dimension of the development policies, the Polish Presidency of the EU aimed at a strengthening of the territorial dimension in the European cohesion policy (Böhme et al., 2011; Zaucha et al., 2014). This document was a continuation of the stipulations from the TA2020, and its objective was, as well, the territorialisation of the Europa 2020, adopted in parallel. The effect of this Report was the distinction of five territorial keys, which could serve as the indicators, and at the same time as measures of territorialisation of the development policies. One of these territorial keys is constituted by the services of general interest.

As the SSGI remains a responsibility of the EU Member States, a policy dilemma arises. SGI, including SSGI, is one of the keys to development and territorial cohesion. Simultaneously, territorial cohesion is subordinated to economic growth in the EU Member States. Also in prosperous countries, such as Austria and Sweden, national politicians appear to do little to mitigate, or even counteract the process of declining populations in peripheral areas. Nor do they try to mitigate or counteract the declining provision of SSGI in peripheral and remote regions. Despite lofty policy declarations, the future for the regions trapped in a bad provision of SGI appears quite gloomy (Gruber et al, 2017).

Spatial patterns are especially evident when it comes to the drivers of SSGI provision, demography and economy. The economic indicator GDP/cap poses a statistically significant impact on the number of pharmacies in Central Europe (model 1a, 1c, 1d and 1e), and on the analysed countries outside the Central Europe (model 2e). The finding that GDP/cap impacts health services is in line with the findings by Borges and Johansson (2012) and Palma et al. (2015). These findings suggest that GDP/cap matters for the SSGI provision, while polycentrism does not. This raises the question if polycentrism and the Cohesion Policy will achieve the postulates of the policy ambitions.

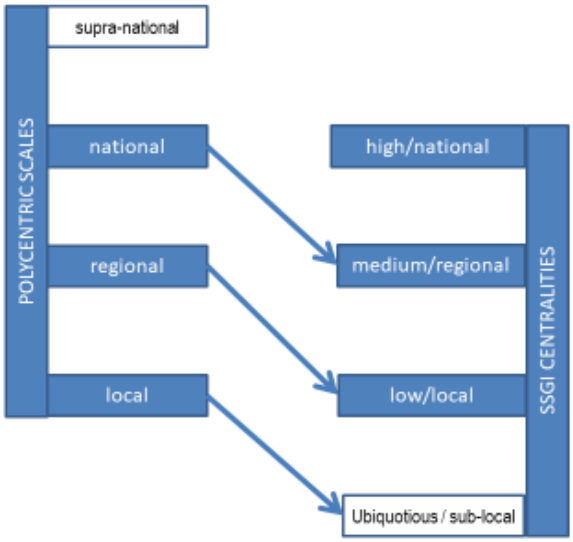
VII. Concluding remarks

This paper aims to discuss the extent to which polycentrism as a strategic vision impacts on the provision of three selected SSGI in 25 European countries. Two questions were proposed to be answered: (1) Does polycentrism have a positive impact on the provision of the three analysed SSGIs regardless if it is a low, medium or high centrality service? (2) Does polycentrism have a different impact on the provision of SSGIs in different parts of Europe? The first question can be answered in a very simple way: no impact was found regarding low and high centrality services. One of the models indicated a possible impact of polycentrism (on the national level) on medium centrality services, but the model did not pass the *F*-test.

When it comes to the second question, spatial patterns are visible. In the case of low centrality services – the number of pharmacies per 100,000 inhabitants – the influence is inverted, i.e., the absence of polycentrism impacts the provision of this particular service in the Nordic countries (model 1b). In the analysis of hospital beds, polycentrism indicates a possible impact in general – but only when the Nordic countries are controlled for (model 2b).

Reflecting the results conceptually, polycentrism on a national scale is, relatively speaking, most important for the SSGI of regional outreach, in this case hospitals. So we should approach the initial co-discussion of polycentrism, scales and SSGI-centralities in such a way that we might have a one-step-difference when matching the scales and centralities (see Figure 1). Polycentrism on a national level implies a well-distributed pattern of second-ranked, regionally important cities, disfavouring single, prime capital cities. Consequently, polycentric patterns on a regional level – not included in this empirical study – should then exert an influence on the provision of low-centrality SSGI. Following the same logic but scaling upwards, SSGI of the highest centrality and national importance – such as tertiary education – would then be influenced by polycentrism on supra-national level.

Figure 1: Polycentric scale and Centrality Levels of SSGI (own elaboration)



The debate on the hierarchically shifted relationship between polycentrism, scales and SSGI centralities is only hypothetical at this stage. Further empirical evidence would be needed, for which reliable indicators for polycentrism on regional as well as supra-national level would be necessary also. From the SSGI side, a combination of input and output indicators could further enhance the models (Marques da Costa et al., 2013). As this study has shown, single SSGI indicators of a varied character cannot fully unfold the potential impact of polycentrism. Further studies should, for example, include the number of kindergartens and specialist hospitals and relate them to the respective output indicators (number of clients/users) or, similarly, the number of treated patients should be related to the number of hospital beds. A future hypothesis could then be whether polycentrism creates more SSGI (in terms of output), but enables a more efficient production of SSGI (in terms of less facilities needed to accomplish a certain number of output).

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Appendix

This annex describes the methodology used when developing the two indicators of the number of pharmacies per 100,000 inhabitants and the number of universities per 500,000 inhabitants. Both indicators are developed by relating two types of information, population and social services data. While the population data is available in the Eurostat database, for the social services information several data sources were used to gather the required information.

The data on the number of pharmacies was collected from the 2014 annual report of the Pharmaceutical Group of the European Union (PGEU). This document is available in the library sector of the PGEU's website. Through this source we were able to collect data for almost all the countries included in the analysis, with the exception of Lithuania and Latvia. For these two countries the data was gathered in the report Baltic Statistics on Medicines 2010-2012, edited by Estonian State Agency of Medicines.

The information on the number of universities came from a main data source provided by ERAWATCH, a European web-based service presenting information on national and regional research policies, actors, organisations and programmes. This web-service is jointly run by European Commission's Directorates-General for Research and the Joint Research Centre – Institute for Prospective Technological Studies. The information on Ireland, Denmark and Lithuania was missing and hence national sources were used.

With all the data collected, the indicators were related to the inhabitants of each country, and used to provide insights into population coverage by the referred services. Some methodological weaknesses, however, can be identified, especially in relation to the 'university' indicator. While the service provided by pharmacies is quite similar between all of them, the service provided by each university could vary due to the field of study (e.g., sciences, health, or technology), the type of institution (university education, polytechnic education), the nature of institutions (public, private) or due to the dimension and capacity of each institution. Other information such as the number of places in higher education could be more adequate, but this data is unavailable. Despites the weakness of the indicator, it allows the study of the impact of polycentric urban structures assuming that higher shares of universities per inhabitant means higher access to higher education services.

The pharmacies represent a low centrality level service and together with the pharmacist's knowledge about the appropriate use of pharmaceuticals assume a significant role in the healthcare of population. The higher the share of pharmacies per inhabitant is, the higher accessibility will be expected.

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