Spatio-temporal decomposition of the growth of communal budgets expenses on culture in Poland in 2003-2016. Implementation of the SSANOVA model

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Abstract

Political transformation and decentralisation of public administration in Poland had a significant impact on the cultural sector and forms of its organization and financing (cover these expenses from own income).The main aim of the article is to analyse changes of the expenditure on the culture of selected four groups: libraries, community cultural centers, heritage and monuments protection, and others (in example galleries and Artistic Exhibition Offices) and also the sum of communal budgets in individual provinces in the years 2003- 2016. The analysis used a multidimensional sample of 16x4x14 (space – categories - time). To illustrate the diversity of the communal expenditure on culture in particular years of the analysis was made using the dynamic modification of Knudsen's regression model of share transfers proposed by Berzeg (SSANOVA model). The results of the analysis indicate. The general trend of expenditure growth for culture in the years 2003-2016 is responsible for an average of 61,2% of the rate of changes in spending expenditure on culture on individual voivodships and their categories. Individual structural effects differ significantly depending on the category of expenditure. The volatility of the temporal effects of the national component indicates a clear reduction of expenses - 2011/2010 by more than 3%, an even greater negative change is visible in more than 10% in 2015/2014. Dynamic analysis provides additional information on trends in changes in the areas of economic and social activity under study.

1   Introduction

In most countries, the provision of cultural services is divided between the public and the private sector. The public sphere is also divided into different administrative levels – the central level, regional and country levels, and local municipalities (Håkonsen and Løyland, 2013). Studies of various aspects of local cultural policy and local cultural spending can be grouped in two recent examples. Most of the studies analyse local cultural expenditures as a whole, i.e. as an aggregate of all cultural expenditures in the municipality (Depalo and Fideli, 2011; Benito, Bastida and Vicente, 2013; Werck, Heyndels and Geyes, 2008). In addition, some studies analyse a specific local or regional cultural institution, such as an opera house

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(Schultze and Ursprung, 2000) or a theatre (Getzner, 2004). In this study, the author will combine the two examples mentioned above and begin with by analysing the aggregated expenditures of communal budgets in Poland on culture and national heritage for the economic background, then conduct an analyses of four groups of cultural expenses of communes budgets (global, libraries, community cultural centers, monuments and heritage protection).

The main purpose of the changes in the field of culture after the systemic transformation was the introduction of mechanisms supporting the efficient and fair management of public resources, the introduction of changes in the competences of the public administration relating to the organisation of the financing process for culture, and the introduction of new solutions in the financing, organisation and management of cultural institutions such as the decentralisation of cultural institution management, increasing autonomy of cultural institutions, and the development of legal frameworks for patronage and sponsorship in this area (Wrona, 2011).

One of the most important changes in management processes and financing in self-government units was the transmission of the cultural tasks to the communes as obligatory own tasks. On one hand it gave to it gave to a great scope of the financial autonomy to Polish communes, but on the other hand those changes forced the communes to supply the financial background of all transmitted tasks from the own incomes. This situation caused a great variety of the communal revenues for the culture and national heritage protection correlated with the communal wealth and the way how local politicians treat the cultural goods with respect to socio-economic categories. So the tryouts of quantitative evaluations of this category of communal revenues have been carried out with the consideration of spatial-sectional and time range. This multidimensional approach let to evaluate and estimate the level of the regional development according to the referential area and to analyse the tempo and the structure of changes. One of the methods used to such analysis are methods of so-called the Shift-Share Analysis (SSA) and its modifications enlarged of the time dimension (Knudsen, 2000; Berzeg, 1998). Those methods were widely used in other researches of financing the public sector and regional analysis (Jewczak and Żółtaszek, 2011; Theil and Gosh, 1980).

In this research, the multidimensional data of the Polish communal cultural expenditures by the regions(NUTS 2, voivodships) on the different types of cultural goods and services in the period of fourteen years (2003-2016) has been completed. It allows using more complex methods of the analysis with dynamic aspects.

The collected sample of statistic data consider the information about cultural revenues of Polish communes (by the regions) in the years 2003-2016 diversified into four groups of expenditures: for libraries, for community cultural centres, for heritage and monuments protection, and others (in example galleries and Artistic Exhibition Offices). The statistical information considers the multidimensional data about communal expenses in 16 regions to 4 categories of cultural goods and services in 14 year periods (2003-2016). That structure and the large quantity of statistical samples (16x4x14 observations) allows using the SSANOVA panel model as a tool to analyse the communal cultural expenditures in Poland.

2   Analysis of expense on culture of Polish communal budgets in years 2003-2016

The expenses on culture of Polish communal budgets had been growing since year 2003 till 2014 (Table 1).

Table 1. The total cultural expenditures of communal budgets in years 2003, 2011, 2016 (in thousands PLN) and its percentage in total expenditures (in %).

Regions	2003	%	2011	%	2016	%
Poland	1911065	3	5245835	3.8	5274949	3.3
Dolnośląskie	189685	4	521547	4.0	565099	4.6
Kujawsko-Pomorskie	84684	2	251269	3.3	234337	2.6
Lubelskie	89524	3	288593	5.0	257979	3.6
Lubuskie	47068	2	174989	6.8	129841	2.4
Łódzkie	117137	3	332941	4.4	319139	3.4
Małopolskie	164627	3	428639	4.9	466831	3.9
Mazowieckie	288558	3	791225	3.7	890024	3.4
Opolskie	47996	2	140163	6.0	133599	3.9
Podkarpackie	89300	2	238897	2.6	227789	2.3
Podlaskie	52939	3	150123	2.9	133809	2.5
Pomorskie	109283	3	383461	4.6	358286	3.9
Śląskie	267808	3	538853	3.2	567693	2.8
Świętokrzyskie	42068	3	144005	2.9	116290	2.3
Warmińsko-Mazurskie	62228	3	167994	2.4	157335	1.8
Wielkopolskie	170770	3	439382	3.5	475477	3.1
Zachodniopomorskie	87340	3	253353	4.0	241421	3.1

After that year the slightly deprecation of cultural expenditures has been noticed. In the first year of analysis the amount of cultural expenditures of Polish communes stands at the level of 19,11065 billion of PLN and reached the level of 52,74949 billion PLN in the last estimated year. The highest level of budgetary afford of communal budgets has been reached in the year 2014 (62,43012 billion PLN).

In the years 2003 – 2016 the highest level of cultural expenditures was noticed for the communes in the Mazowieckie and Śląskie regions. The cultural afford of communal budgets in Mazowieckie was highest in the year 2016 and reached 8,90024 billion PLN, where the communes in Śląskie region reached the highest amount of 8,31339 billion PLN in the year 2014.The year to year changes of cultural expenditures of Polish communes has been decreasing since the year 2011. The percentage of the cultural expenses in total budgetary expenses of communes in the analysed periodhave reached the average level of 2 to 4% and was highest in the communes of Dolnośląskie region in 2014.

3   Methodology

For the study of spatio-temporal relations, the tools that consider the specificity of the analysed phenomenon or process are considered to be the main in areas of great social importance. Among them, a group of methods for analysing shift-share deserves particular attention. These tools fall within the scope of spatial statistics and econometrics. They are multidimensional in space-sector-time. This approach allows the assessment and examination of the level of a given area against the background of the reference area. It also allows you to account for the dynamics and structure of changes. Generally, two different models are considered - the Berzeg's model and its dynamic modification - Knudsen's model (Marimor and Ziliboti, 1998).

This study presents and discusses the results of the estimation of three SSA structural and geographic models:

1. ANOVA 2 – full, static decomposition of cultural expenditures growth in whole period 2003-2016 (with two factors without interaction):

$$tx_{ri.}=a_0+\Sigma_i a_i s_i+\Sigma_r b_r w_r+\varepsilon_{rit},$$

   enabling the decomposition of the total increase in expenditure on culture (the symbols $s_i$and w_r were marked with zero-one variables indicating individual categories of expenditure on culture and on individual regions):

$$tx_{16/3}=[(x_{2016}-x_{2003})/x_{2003}]$$

on 4 sectoral effects (components) ai (by cultural expenses categories) and on 16 regional effects.

2. Berzeg's model - dynamic decomposition of the cultural expenditures growth, which explains (decomposes) the variable growth rate in subsequent years $tx_t=[(x_t-x_{t-1})/x_t]$ including the division into components by 4 types of expenditure and 16 regions with permanent effect of the temporal dimension (intercept):

$$tx_{rit}=a_0+\Sigma_i a_i.s_i+\Sigma_r b_r w_r+\varepsilon_{rit}.$$

3. Knudsen's model − dynamic decomposition of the cultural expenditure growth, which explains (decomposes) the variable growth rate in subsequent years $tx_t=[(x_t-x_{t-1})/x_t]$, including the division into components by 4 types of expenditures and 16 regions with a variable effect of the temporal dimension, i.e. with different values of the total growth parameter (differentiation of the intercept) in individual years:

$$tx_{rit}=\Sigma_t a_{0t}+\Sigma_i a_i.s_i+\Sigma_r b_r w_r+\varepsilon_{rit}.$$

The results of the estimation of selected models allow analysis as well total growth, as more detailed analysis of the effects of sectoral changes (according to culture expenditure groups) and regional competitiveness (comparative advantage) of regions.

4   The results of the empirical analysis

The general trend of expenditure growth for culture in the years 2003-2016 is responsible for an average of 61,2% of the rate of changes in spending expenditure on culture on individual voivodships and their categories. Individual structural effects differ significantly depending on the category of expenditure (Table 2). A similar assessment of regional growth to the national average is provided by the Lubelskie Region, with the exception here being the assessment for the Mazowieckie Region (5,59) far above the values of the other assessments, among which there are also negative values (Łódzkie, Podlasie, Śląskie). In the case of the assessment of the parameters of the structure of the type of communal expenditure on culture, one should notice a positive increase in the protection of monuments and a negative value (decrease) in the average rate of expenditure on libraries and cultural centers (in the period 2003-2016).

In ANOVA 2 model, from 14 consecutive annual observations, we can create a 13 element decomposed variable (annual growth rate). The possibilities of comparing results confirm the values of ratings from the Berzeg's model (Table 3) multiplied by the number of effective observations (here: 13), which are shown in the fifth column of the scoreboard. However, it could be noted that the results point to other objects reaching high or low values.

In terms of regional growth throughout the 2003/2016/2015 sample period, regions: Wielkopolskie (16,47%), Świętokrzyskie (16,37%) and Lubelskie (13,72%) have the highest values. Also, the domestic factor indicates an increase in expenditure on culture by about 79% compared to about 161% from the static model. Also in the case of assessments of growth components by expenditure groups, significant differences should be noted, especially in the assessment of the pace of changes in expenditure on the monuments and heritage protection: a positive value from the ANOVA2 model and a negative one from the Berzeg's model.

Table 2. Results of estimation of the static model ANOVA 2 decomposition of the growth rate of expenditure on culture by 4 groups of expenses and 16 voivodships in Poland in the period 2003-2016.

	Parameter	Evaluation	In %	t-stat	p-value
Domestic Factor	A0	1.6122	161.22	1.11	0.27
Libraries	A1	-1.4017	-140.17	-1.49	0.14
Cultural Centres	A2	-0.5953	-59.53	-0.63	0.53
Heritage Protection	A3	1.9607	196.07	2.08	0.04
Others	A4	-0.0121	Res.		
Dolnośląskie	B1	0.17	-0.06	0.32	-0.29
Kujawsko-Pomorskie	B2	0.17	-0.03	0.10	0.00
Lubelskie	B3	0.22	0.12	0.20	0.04
Lubuskie	B4	0.07	-0.17	0.20	0.01
Łódzkie	B5	0.26	0.12	0.06	0.04
Małopolskie	B6	0.02	-0.13	0.25	0.08
Mazowieckie	B7	0.15	-0.23	0.11	0.02
Opolskie	B8	0.04	-0.19	0.07	0.09
Podkarpackie	B9	0.26	0.01	-0.01	-0.03
Podlaskie	B10	0.04	0.02	0.00	0.08
Pomorskie	B11	-0.03	0.15	0.15	0.00
Śląskie	B12	0.14	-0.05	0.25	-0.11
Świętokrzyskie	B13	0.06	-0.09	0.09	-0.06
Warmińsko-Mazurskie	B14	0.07	-0.08	0.17	0.03
Wielkopolskie	B15	0.13	0.07	0.01	0.10
Zachodniopomorskie	B16	0.05	-0.06	-0.08	0.00

Table 3. Results of estimating the dynamic Berzeg's model the decomposition of the growth rate of expenditure on culture by 4 groups of expenses and 16 regions in Poland in 2004/2003 - 2016/2015.

	Parameter	Evaluation	In %	%*13	t-stat	p-value
Domestic Factor	A0	0.0605	**6.05**	**78.63**	9.46	0.00
Libraries	A1	-0.0150	-1.50	-19.50	-4.03	0.00
Cultural Centres	A2	-0.0081	-0.81	-10.52	-2.50	0.02
Heritage Protection	A3	-0.0198	-1.98	-25.71	-3.24	0.00
Others	A4	0.0527	5.27	68.45	Res.	
Dolnośląskie	B1	0.0036	0.36	4.73	0.50	0.62
Kujawsko-Pomorskie	B2	-0.0049	-0.49	-6.41	-0.55	0.58
Lubelskie	B3	0.0106	1.06	13.72	1.21	0.23
Lubuskie	B4	-0.0148	-1.48	-19.22	-1.48	0.14
Łódzkie	B5	-0.0026	-0.26	-3.36	-0.31	0.76
Małopolskie	B6	0.0059	0.59	7.68	0.77	0.45
Mazowieckie	B7	-0.0015	-0.15	-1.99	-0.22	0.83
Opolskie	B8	-0.0028	-0.28	-3.63	-0.27	0.79
Podkarpackie	B9	-0.0054	-0.54	-7.00	-0.60	0.55
Podlaskie	B10	0.0007	0.07	0.97	0.07	0.94
Pomorskie	B11	0.0056	0.56	7.25	0.69	0.49
Śląskie	B12	-0.0194	-1.94	-25.28	-2.66	0.01
Świętokrzyskie	B13	0.0126	1.26	16.37	1.18	0.24
Warmińsko-Mazurskie	B14	-0.0052	-0.52	-6.72	-0.52	0.60
Wielkopolskie	B15	0.0127	1.27	16.49	1.63	0.11
Zachodniopomorskie	B16	-0.0099	-0.99	-12.88	Res.	

The results from the Knudsen's model (Table 4) shown above, in addition to the sectoral components (expenditure and regional groups, additionally give the possibility to draw conclusions about trends of changes in the studied areas of economic and social activity.) In particular, attention should be paid to taking into account the variability of temporal effects of the national component. The volatility of the temporal effects of the national component indicates a clear reduction of expenses - 2011/2010 by more than 3%, an even greater negative change is visible in more than 10% in 2015/2014. The values of t-stat and p-value statistics also prove the advantages of the Knudsen model. Most assessments of the

components of changes over time and sectoral components are here statistically significantly different from zero at a 5% level of significance.

Table 4. Results of the estimation of the Knudsen dynamic model of the decomposition of the growth rate of expenditure on culture by 4 groups of expenditures and 16 regions in Poland in 2004/2003 - 2016/2015.

	Parameter	Evaluation	In %	%*13	t-stat	p-value
Domestic Factor	A0	0.0605	**6.05**	**78.63**	9.46	0.00
Libraries	A1	-0.0150	-1.50	-19.50	-4.03	0.00
Cultural Centres	A2	-0.0081	-0.81	-10.52	-2.50	0.02
Heritage Protection	A3	-0.0198	-1.98	-25.71	-3.24	0.00
Others	A4	0.0527	5.27	68.45	Res.	
Dolnośląskie	B1	0.0036	0.36	4.73	0.50	0.62
Kujawsko-Pomorskie	B2	-0.0049	-0.49	-6.41	-0.55	0.58
Lubelskie	B3	0.0106	1.06	13.72	1.21	0.23
Lubuskie	B4	-0.0148	-1.48	-19.22	-1.48	0.14
Łódzkie	B5	-0.0026	-0.26	-3.36	-0.31	0.76
Małopolskie	B6	0.0059	0.59	7.68	0.77	0.45
Mazowieckie	B7	-0.0015	-0.15	-1.99	-0.22	0.83
Opolskie	B8	-0.0028	-0.28	-3.63	-0.27	0.79
Podkarpackie	B9	-0.0054	-0.54	-7.00	-0.60	0.55
Podlaskie	B10	0.0007	0.07	0.97	0.07	0.94
Pomorskie	B11	0.0056	0.56	7.25	0.69	0.49
Śląskie	B12	-0.0194	-1.94	-25.28	-2.66	0.01
Świętokrzyskie	B13	0.0126	1.26	16.37	1.18	0.24
Warmińsko-Mazurskie	B14	-0.0052	-0.52	-6.72	-0.52	0.60
Wielkopolskie	B15	0.0127	1.27	16.49	1.63	0.11
Zachodniopomorskie	B16	-0.0099	-0.99	-12.88	Res.	

Conclusions

The highest expenditures on culture and heritage protection were taken by the communes in Mazowieckie Region which seems to be the richest ones. It could be also confirmed by the empirical study carried out with the help of the static SSA model - the regional growth assessment for the communes of this region significantly exceeded the values of the

assessments for communes from other regions. The results of the assessment of the parameters of the generic structure of municipalities' expenditure on culture are also interesting, where a positive increase in the average expenditure rate was noted only for expenditure on the protection of monuments and national heritage. This may mean that the municipalities are trying to strengthen their cultural potential in order to increase the tourist attractiveness.

However, using the Berzeg's model, significantly different results were obtained than in the case of the static SSA model. These differences were visible both in terms of the growth of the regional national factor, and in particular in the case of assessments of growth components according to the groups' expenditure on communal budgets for culture.

The most reliable results were obtained by estimating the Knudsen's model, as evidenced by the t-stat and p-value values. The analysis of the results of this estimation revealed that in the case of assessments of components of regional growth, the communes in the Wielkopolskie, Świętokrzyskie, Lubelskie, Małopolskie and Dolnośląskie regions received positive evaluation values. In the case of this method, the downward trend in changes in the value of assessments of the national component was clearly visible. It means, that both Berzeg's and Knudsen's models are reliable tools to analyse the changes in public expenditures on culture, as well as in other genres of public sector (Jewczak and Żółtaszek, 2011).

References

Benito, B., Bastida, F. & Vicente, C. (2013). Municipal elections and cultural expenditure. *Journal of Cultural Economics*, *vol. 37*, pp. 3-32.

Berzeg, K., (1984) A note on statistical approaches to shift-share analysis. *Journal of Regional Science*, *vol. 24*, issue 2, pp. 277-285.

Depalo, D. & Fideli, S. (2011). *Heterogenecity in the Cultural Expenditures of Municipalities. Evidence from Italian Data (1998-2006)*. Working Paper no. 139, Sapienza University of Rome.

Getzner, M. (2004). Exploring voter preferences in cultural policy: a case study for Austria.*Empirica, vol. 31*(1), pp. 27-42.

Håkonsen, L. & Løyland, K. (2013). Local government allocation of cultural services, *ACEI working papers series*, p. 2, ACEI, *http://www.culturaleconomics.org/awp/AWP-06-2013.pdf.*

Jewczak, M. & Żółtaszek, A., (2011). Spatial and dynamic analysis of health care expenditures in OECD countries. *Folia Oeconomica, no. 252/2011*, 143-158.

Knudsen, D., (2000). Shift-share analysis: further examination of models for the description of economic change. *Socio-Economic Planning Sciences, vol. 34*, pp. 177-198.

Marimon, R. & Zilibotti, F., (1998). Actual versus virtual employment in Europe. Is Spain different? *European Economic Review*, *vol. 42*, 123–153.

Shulze, G. & Ursprung, H., (2000). La donna e mobile − or is she? Voter preferences and public support for the performing arts. *Public Choice*, *vol. 102*, 131-149.

Theil, H. & Gosh, R., (1980). A comparison of Shift-Share and RAS Adjustment. *Regional Science and Urban Economics*, *no. 10.*

Werck, K., Heyndels, B. & Geys, B., (2008). The impact of 'central places' on spatial spending patterns: evidence from Flemish local government cultural expenditures. *Journal of Cultural Economics*, *vol. 32*, 35-58.

Wrona, T., (2011). Doświadczenia 20 lat samorządu terytorialnego − stan finansów samorządowych. *Samorząd Terytorialny*, *no 7-8*, 5.