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Fiscal Burden in the European Union Member States

Abstract. The main purpose of the article is to assess impact of the last global financial crisis on the level of fiscal burden in Central European countries compared to old members of the EU. In the research, we consider fiscal burden as multidimensional phenomenon, which should be analyzed with multiple criteria analysis tools. Thus, classic taxonomic approach based on zero unitarisation method was applied, to create synthetic measure of the fiscal burden in the EU countries in 2004-2015. Member states' ranking was elaborated based on synthetic measure, and changes of the level of the fiscal burden during and after the crisis were assessed. The research confirmed lower level of the fiscal burden in Central Europe, than in EU-15, and that this disparity has only increased after the last financial crisis.
Keywords: Fiscal Burden; EU Member States; Multiple Criteria Analysis; Classic Taxonomic Approach; Synthetic Measure
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Податковий тягар у країнах-членах Європейського Союзу
Анотація. Головною метою статті є оцінка впливу глобальної фінансової кризи на рівень податкового тягаря у країнах Центральної Європи порівняно зі старими членами ЄС. У дослідженні податковий тягар розглянуто як багатовимірний феномен, вивчення якого вимагає застосування багатокритеріального аналізу. Для комплексного визначення податкового тягаря в країнах ЄС у період з 2004 до 2015 року було використано традиційний таксономічний підхід. Оцінено характер змін рівня податкового тягаря під час кризи та після її завершення. Було підтверджено нижчий рівень податкового тягаря у країнах Центральної Європи у порівнянні зі старими членами Європейського Союзу, а також продемонстровано, що внаслідок світової фінансової кризи цей дисбаланс лише зріс.
Ключові слова: податковий тягар; країни-члени ЄС; багатокритеріальний аналіз; традиційний таксономічний підхід; синтетичні показники.

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Анотация. Целью статьи является оценка влияния глобального финансового кризиса на уровень налогового бремени в странах Центральной Европы в сравнении со старыми членами ЕС. В исследовании налоговое бремя рассматривается как многомерный феномен, для изучения которого необходимо применение многокритериального анализа. Для комплексного определения налогового бремени в странах ЕС в период с 2004 по 2015 год был применён традиционный таксономический подход. Определены колебания уровня налогового бремени во время кризиса и после его завершения. Нашел подтверждение тезис о более низком уровне налогового бремени в странах Центральной Европы в сравнении со старыми членами Европейского Союза, подтвержден дальнейший рост такого дисбаланса.
Ключевые слова: налоговое бремя; страны-члены ЕС; многокритериальный анализ; традиционный таксономический подход; синтетические показатели.

1. Introduction and Literature Review

Developed countries demonstrated almost continuous growth in economic activity of the state throughout several last decades. This increased activity and its high budget costs resulted in many cases in growth of fiscal burden (Tanzi & Schuknecht, 1995; 1997 [1; 2, 154-168]). This trend has been strengthened as a result of the last global financial crisis, which has destabilized fiscal systems of some European economies (Barrios, Langedijk & Pench, 2010 [3]; Baran, 2014 [4, 9-23]; Mackiewicz-Lyziak, 2015 [5, 53-71]). Both theory and empirical research confirm that in the long term the lack of prudent fiscal policy and high fiscal burden can threaten both sustainability of economy, and public welfare (Fehr & Kindermann, 2015 [6, 64-77]; De Quatrebarbes et al., 2016 [7, 76-92]; Duncan & Peter, 2016 [8, 762-783]; Majerova, 2016 [9, 339-255]; Araujo & Arvate, 2016 [10, 25-47]; Gumus, 2016 [11, 637-650]; Azzimonti et al., 2016 [12, 45-61]).

The main objective of the paper is to assess influence of the last global financial crisis on the fiscal burden in Central European economies (EU-13) that joined the EU after 2004, compared to old member states (EU-15). In the research, multiple criteria analysis tools were applied. The analysis was conducted for 2004, 2009, and 2015. The first year of the research is the year of the biggest EU enlargement amid economic prosperity. Analysis of 2009 provides information on state of economy under the crisis. And 2015 represents contemporary situation. We used data form Eurostat for 28 EU member states. Current research continues previous studies by the author (Balcerzak, 2013 [13, 241-256]).

2. Financial Burden as a Multiple Criteria Analysis Problem

The fiscal burden is a complex and multiple criteria phenomenon (Kirchler, 2007 [14]; Simkova, 2015 [15, 95-109]). On the one hand, it is defined by long-term factors, such as structure of public expenditure (share of fixed expenditures in the budged of a country), level of long-term interference of governments in economies, economic model (welfare state or individualistic market economy). On the other hand, current fiscal situation is affected by short term cyclical factors associated with an impact by automatic stabilizers, or need for discretionary fiscal stabilization actions. Thus, in order to measure it with quantitative methods, a wide range of indicators must be considered.

Based on the previous research by the author, a set of six final diagnostic variables was proposed for measuring the fiscal burden in the European countries. The set of preliminary

variables assessed with formal statistical criteria of information value is given by Balcerzak (2013) [13, 241-256]. The variables are split into two groups: stimulants and destimulants (see Table 1). We assume that growth of stimulants leads to increas of the fiscal burden. Destimulants have opposite effect.

Variables presented in table 1 fulfill the formal information value criteria for diagnostic variables used in taxonomic analysis. It is assumed that high information value variables should be characterized by three formal statistical criteria: a) high level of variation; b) high information value; c) low level of correlation (Hellwig, 1972 [16, 69-90]). The specific description of the criteria is provided by Balcerzak (2016) [17, 11-27; 18, 7-17].

Tab. 1: **Diagnostic variables for measurement of the fiscal burden**

	Variable	Variable characteristics
x_{1t}	Total government expenditures (as a percentage of GDP)	Stimulant – high level of government expenditures in the long term can become a threat to financial stability and increases the fiscal burden.
x_{2t}	General government net lending/net borrowing (as a percentage of GDP)	Destimulant – low level of government deficit enables to carry out effective anti-cyclical fiscal policy. It decreases the risk of tax increase due to fiscal adjustments.
x_{3t}	Government consolidated gross debt (as a percentage of GDP)	Stimulant – high level of government debt is the main factor for increase of the fiscal burden. During fiscal consolidation episodes, government usually tend to increase the level of taxation. The cases for decrease of expenditures are rare.
x_{4t}	Taxes on production and imports less subsidies (as a percentage of GDP)	Stimulant – high level of taxation can become an obstacle for increase of government revenues, it increases the fiscal burden.
x_{5t}	Current taxes on income, wealth (as a percentage of GDP)	Stimulant – high level of taxation can become an obstacle in increasing government revenues, it increases the fiscal burden.
x_{6t}	Social benefits (as a percentage of GDP)	Stimulant – high redistribution activity can force government to increase revenues. Thus, it increases the fiscal burden.

Source: Own work based on Balcerzak (2013) [13, 241-256]

3. Dynamic Multiple Criteria Analysis with Application of Synthetic Measure

As it was pointed in the previous part, the fiscal burden should be considered as a complex multiple criteria phenomenon (Hellwig, 1972 [19, 115-134]; Olczyk, 2014 [20, 21-43]; Renigier-Bilozor & Bilozor, 2015 [21, 139-157]; Janton-Drozdowska & Majewska, 2015 [22, 61-83]; 2016 [23, 97-119], Malkowska & Gluszak, 2016 [24, 269-283]; Watrobowski et al., 2016 [25, 101-125]). Therefore, a classic taxonomic approach for organizing and sharing of objects based on normalization of variables with zero unitarisation method can be applied in our research (Kukula & Bogocz, 2014 [26, 5-13]; Balcerzak, 2009 [27, 711-739]; Balcerzak, 2015 [28, 190-210]; Lyszczarz, 2016 [29, 169-185]; Nermend, 2009 [30, 76-79]). In the research, we constantly reference to data from 2004, 2009 and 2015, which is a condition for obtaining comparability of the results in time. In the analysis, we are ranking the countries according to the level of fiscal burden, moving from the highest values to the lowest ones.

The stimulants were normalized with the equation 1 and the destimulants - with the equation 2:

$$z_{ijt} = \frac{x_{ijt} - \min_{it}\{x_{ijt}\}}{\max_{it}\{x_{ijt}\} - \min_{it}\{x_{ijt}\}}, \quad (1)$$

where

$$(i = 1, 2...n); (j = 1, 2...m); (t = 1, 2...l), z_{ij} \in [0, 1],$$

$$z_{ijt} = \frac{\max_{it}\{x_{ijt}\} - x_{ijt}}{\max_{it}\{x_{ijt}\} - \min_{it}\{x_{ijt}\}}, \quad (2)$$

where

$$(i = 1, 2...n); (j = 1, 2...m); (t = 1, 2...l), z_{ij} \in [0, 1],$$

Assessment of a synthetic measure of fiscal burden ($SMFB_{it}$), which characterizes all the objects, was obtained with the equation 3:

$$SMFB_{it} = \frac{1}{m}\sum_{j=1}^{m} z_{ijt} \quad (3)$$

where

$$(i = 1, 2...n); (j = 1, 2...m); (t = 1, 2...l); SMFB_i \in [0, 1]; z_{ij} \in [0, 1].$$

The rankings of the countries are given in the table 2.

The results from the table 2 show that the Central European countries are characterised by relatively low level of the fiscal burden. Only Hungary was rated among ten countries with the highest level of $SMFB_{it}$. The research confirms the influence of the global financial crisis on the EU economies. Greece faced bankruptcy, in 2004 was ninth in the rating. However, in 2009 and 2015 it obtained the highest value of $SMFB_{it}$ in the EU.

These conclusions are further confirmed, when we analyse average level of $SMFB_{it}$ for EU-13 and EU-15 (see Figure 1),

Tab. 2: **The result of ranking the countries based on the synthetic measure of the fiscal burden**

Year	2004		2009		2015	
No	Country	$SMFB_{it}$	Country	$SMFB_{it}$	Country	$SMFB_{it}$
1	SE	0.538	GR	0.597	GR	0.632
2	DK	0.514	FR	0.581	FR	0.590
3	AT	0.505	DK	0.570	DK	0.578
4	FR	0.489	BE	0.552	IT	0.564
5	BE	0.466	SE	0.537	BE	0.554
6	IT	0.448	IT	0.534	FI	0.553
7	DE	0.423	AT	0.533	AT	0.510
8	HU	0.419	PT	0.472	SE	0.498
9	GR	0.409	HU	0.466	PT	0.495
10	HR	0.376	UK	0.461	HR	0.420
11	PT	0.364	DE	0.450	HU	0.406
12	FI	0.364	FI	0.450	SI	0.404
13	PL	0.340	IE	0.444	UK	0.401
14	LU	0.328	NL	0.407	ES	0.392
15	SI	0.323	HR	0.386	NL	0.389
16	MT	0.312	SI	0.366	DE	0.378
17	NL	0.312	ES	0.363	CY	0.344
18	UK	0.303	LU	0.363	SK	0.318
19	CY	0.261	PL	0.351	MT	0.305
20	CZ	0.253	LT	0.340	LU	0.293
21	ES	0.215	MT	0.328	PL	0.282
22	SK	0.213	CY	0.322	IE	0.238
23	BG	0.190	SK	0.319	CZ	0.233
24	IE	0.135	CZ	0.293	BG	0.229
25	LT	0.129	LV	0.286	EE	0.194
26	LV	0.114	EE	0.279	LV	0.182
27	RO	0.094	RO	0.254	RO	0.166
28	EE	0.090	BG	0.212	LT	0.148

Source: Elaborated by the author based on Eurostat data

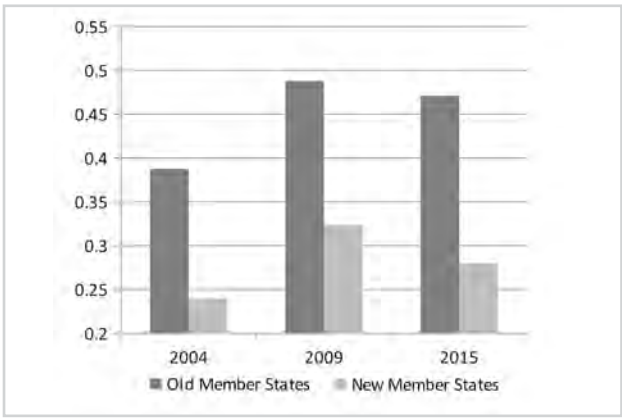

Fig. 1: **The average level of the synthetic measure of fiscal burden for new (EU-13) and old member states (EU-15) in 2004, 2009, and 2015**
Source: Elaborated by the author based on Eurostat data

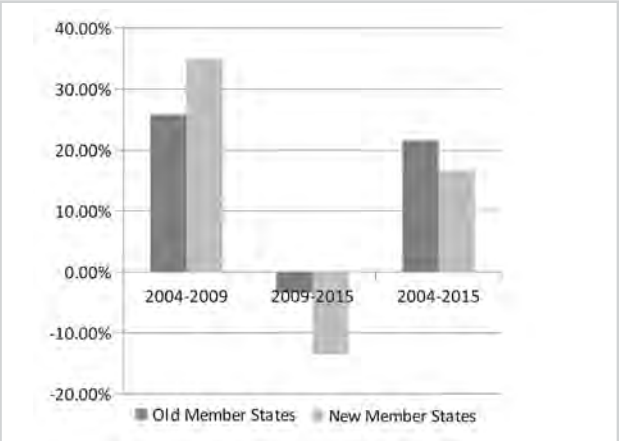

Fig. 2: **The average percentage change of the value of synthetic measure of fiscal burden for new (EU-13) and old member states (EU-15) in 2004-2009, 2009-2015, and 2004-2015**
Source: Elaborated by the author based on Eurostat data

and average percentage changes of the values of $SMFB_{it}$ for EU-13 and EU-15 (see Figure 2). In Figure 1, we see high heterogeneity between two groups of countries with much higher average value of $SMFB_{it}$ in EU-15.

Disparity between EU-13 and EU-15 was strengthened during the crisis (see Figure 2). In 2004-2009 the average percentage increase of the value of $SMFB_{it}$ for EU-13 was 34%, whereas for EU-15 it was only 25%. However, EU-15 started from much higher level in 2004. Additionally, the average decrease of the value of $SMFB_{it}$ in 2009-2015 was four times higher for EU-13 than for EU-15. As a result, for the whole period under review the average growth of the value of $SMFB_{it}$ for EU-15 was equal to 21.16%, whereas for EU-13 it was only 16.7%, and it started form the lower level.

4. Conclusions

The objective of the research was to assess the influence of the last global financial crisis on the fiscal burden in Central European countries compared to old members of the EU. We confirmed a noticeably higher average level of the fiscal burden in the EU-15, which was additionally increased after global financial crisis. What is more, after the crisis the situation of EU-15 was improving at a lower rate, than in EU-13.

References

1. Tanzi, V., & Schunkecht, L. (1995). *The Growth of Government and the Reform of the State in Industrial Countries*. IMF Working Paper 95/130. Washington: International Monetary Fund. Retrieved from http://EconPapers.repec.org/RePEc:imf:imfwpa:95/130
2. Tanzi, V., & Schunkecht, L. (1997). Reconsidering the Fiscal Role of Governemnt: International Perspective. *Papers and Proceedings of the Hundred and Fourth Annual Meeting of the American Economic Association American Economic Review, 87*(2), 154-168. Retrieved from http://www.jstor.org/stable/2950906
3. Barrios, S., Langedijk, S., & Pench, L. (2010). EU Fiscal Consolidations after the Financial Crisis. Lessons from Past Experiences. European *Economy Economic Paper 418*. Brussels: European Commission.
4. Baran, B. (2014). Budgetary Discipline and Internal Devaluation - Estonian Method to Overcome the Crisis. *Equilibrium. Quarterly Journal of Economics and Economic Policy*, *9*(2), 9-23. doi: https://doi.org/10.12775/EQUIL.2014.008
5. Mackiewicz-Lyziak, J. (2015). Fiscal Sustainability in CEE Countries - the Case of the Czech Republic, Hungary and Poland. *Equilibrium. Quarterly Journal of Economics and Economic Policy*, *10*(2), 53-71. doi: https://doi.org/10.12775/EQUIL.2015.013
6. Fehr, H., & Kindermann, F. (2015). Taxing Capital along the Transition - Not a Bad Idea After All? *Journal of Economic Dynamics and Control, 51*, 64-77. doi: https://doi.org/10.1016/j.jedc.2014.09.024
7. De Quatrebarbes, C., Boccanfuso, D., & Savard, L. (2016). Beyond representative households: The macro-micro impact analysis of VAT designs applied to Niger. *Economic Modeling, 57*, 76-92. doi: https://doi.org/10.1016/j.econmod.2016.03.018
8. Duncan, D., & Peter, K. S. (2016). Unequal inequalities: Do progressive taxes reduce income inequality? *International Tax and Public Finance, 23*(4), 762-783. doi: https://doi.org/10.1007/s10797-016-9412-5
9. Majerova, I. (2016). The Impact of Some Variables on the VAT Gap in the Member States of the European Union, *Oeconomia Copernicana, 7*(3), 339-355. Retrieved from http://www.apcz.pl/czasopisma/index.php/OeC/article/view/OeC.2016.020
10. Araujo, L., & Arvate, P. (2016). Institutional Quality and Capital Taxation. *International Tax and Public Finance, 23*(1), 25-47. doi: https://doi.org/10.1007/s10797-014-9346-8
11. Gumus, I. (2016). Fiscal Uncertainty and Currency Crises. *Review of Development Economics, 20*(3), 637-650. doi: https://doi.org/10.1111/rode.12136
12. Azzimonti, M., Battaglini, M., & Coate, S. (2016). The costs and benefits of balanced budget rules: Lessons from a political economy model of fiscal policy. *Journal of Public Economics, 136*, 45-61. doi: https://doi.org/10.1016/j.jpubeco.2016.03.001
13. Balcerzak, A. P. (2013). The Level of Fiscal Burden in Poland after the Global Financial Crisis in Comparison to Other Countries of the European Union. In W. Olkowska (Ed.). *Economics and Finance in the Process of Market Economy Development. Global and Local Aspects* (pp. 241-256). Olsztyn: Wydawnictwo Uczelniane WSIiE (In Polish).
14. Kirchler, E. (2007). *The economic psychology of tax behaviour*. Cambridge: Cambridge University Press.
15. Simkova, N. (2015). The Hierarchical Clustering of Tax Burden in the EU 27. *Journal of Competitiveness*, *7*(3), 95-109. doi: https://doi.org/10.7441/joc.2015.03.07
16. Hellwig, Z. (1972). On the Optimal Choice of Predictors. In Z. Gostkowski (Ed.). *Towards a System of Human Capital Resources Indicators for Less Developed Countries*. *Papers Prepared for a UNESCO Research Project* (pp. 69-90). Wroclaw: Ossolineum, Polish Academy of Sciences Press.
17. Balcerzak, A. P. (2016). Multiple-criteria Evaluation of Quality of Human Capital in the European Union Countries. *Economics & Sociology, 9*(2), 11-27. Retrieved from http://bazekon.icm.edu.pl/bazekon/element/bwmeta1.element.ekon-element-000171434742
18. Balcerzak, A. P. (2016). Technological Potential of European Economy. Proposition of Measurement with Application of Multiple Criteria Decision Analysis. *Montenegrin Journal of Economics, 12*(3), 7-17. Retrieved from https://repozytorium.umk.pl/bitstream/handle/item/3733/2016,%20Technological_Potential_Montenegrin.pdf?sequence=1
19. Hellwig, Z. (1972). Procedure of Evaluating High-Level Manpower Data and Typology of Countries by Means of the Taxonomic Method. In: Z. Gostowski (Ed.). *Towards a System of Human Resources Indicators for Less Developed Countries, Papers Prepared for a UNESCO Research Project* (pp. 115-134). Wroclaw: Ossolineum, Polish Academy of Sciences Press.
20. Olczyk, M. (2014). Structural Heterogeneity Between EU 15 and 12 New EU Members - the Obstacle to Lisbon Strategy Implementation?, *Equilibrium. Quarterly Journal of Economics and Economic Policy, 9*(4), 21-43. doi: https://doi.org/10.12775/EQUIL.2014.023
21. Renigier-Bilozor, M., & Bilozor, A. (2015). Optimization of the Variables Selection in the Process of Real Estate Markets Rating. Oeconomia Copernicana, 6(4), 139-157. doi: https://doi.org/10.12775/OeC.2015.033
22. Janton-Drozdowska, E., & Majewska, M. (2015). Social Capital as a Key Driver of Productivity Growth of the Economy: Across-countries Comparison. *Equilibrium. Quarterly Journal of Economics and Economic Policy, 10*(4), 61-83, doi: https://doi.org/10.12775/EQUIL.2015.035
23. Janton-Drozdowska, E., & Majewska, M. (2016). Investment Attractiveness of Central and Eastern European Countries in the Light of New Locational Advantages Development. *Equilibrium. Quarterly Journal of Economics and Economic Policy, 11*(1), 97-119. doi: https://doi.org/10.12775/EQUIL.2016.005
24. Malkowska, A., & Gluszak, M. (2016). Pro-investment Local Policies in the Area of Real Estate Economics - Similarities and Differences in the Strategies Used by Communes. *Oeconomia Copernicana, 7*(2), 269-283. Retrieved from http://www.apcz.pl/czasopisma/index.php/OeC/article/view/OeC.2016.016
25. Watrobski, J., Jankowski, J., & Ziemba, P. (2016). Multistage Performance Modelling in Digital Marketing Management. *Economics & Sociology, 9*(2), 101-125. Retrieved from http://www.economics-sociology.eu/files/ES_9_2_Watrobski_Jankowski_Ziemba.pdf
26. Kukula K., & Bogocz, D. (2014). Zero Unitarisation Method and its Application in Ranking Research in Agriculture. *Economic and Regional Studies, 7*(3), 5-13. Retrieved from http://www.pswbp.pl/index.php/pl/o-uczelni/pliki-do-pobrania/func-startdown/2340
27. Balcerzak, A. P. (2009). Effectiveness of the Institutional System Related to the Potential of the Knowledge Based Economy. *Ekonomista, 6*, 711-739. Retrieved from https://www.researchgate.net/publication/298853601_EFFECTIVENESS_OF_THE_INSTITUTIONAL_SYSTEM_RELATED_TO_THE_POTENTIAL_OF_THE_KNOWLEDGE_BASED_ECONOMY
28. Balcerzak, A. P. (2015). Europe 2020 Strategy and Structural Diversity Between Old and New Member States. Application of Zero-unitarizatin Method for Dynamic Analysis in the Years 2004-2013. *Economics & Sociology, 8*(2), 190-210. Retrieved from http://www.economics-sociology.eu/files/ES_8_2_Balcerzak.pdf
29. Lyszczarz, B. (2016). Public-private Mix and Performance of Health Care Systems in CEE and CIS Countries. *Oeconomia Copernicana*, *7*(2), 169-185. doi: https://doi.org/doi.org/10.12775/OeC.2016.011
30. Nermend, K. (2009). *Vector Calculus in Regional Development Analysis. Comparative Regional Analysis Using the Example of Poland*. Berlin: Physica-Verlag.

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