A C T A U N I V E R S I T A T I S L O D Z I E N S I S
FOLIA OECONOMICA 241, 2010

Krzysztof Kompa[*], *Dorota Witkowska*[**]

EVALUATION OF THE DEVELOPMENT LEVEL OF THE EUROPEAN UNION STATES IN YEARS 1990–2006

Abstract. The aim of the paper is evaluation of the socio – economic development level of the European Union members. The research concerns 23 states being members of the European Union in 2005 (Malta and Cyprus were excluded from the analysis). Investigation covers the period from 1990 to 2006. The synthetic taxonomic measures are evaluated, based on the 21 economic and social indicators, for all 17 years. Changes of the development level of investigated states are analyzed applying trend function. The EU countries are also classified according to the value of the taxonomic measures and Human Development Index.

Key words: socio – economic development, the European Union, synthetic taxonomic measures, Human Development Index.

1. INTRODUCTION

The European Union is founded upon numerous treaties and has undergone expansions that has taken it from 6 member states in 1951 to 27 since 2007. The 2004 enlargement of the European Union (EU) was the largest single expansion of the EU, both in terms of territory and population, yet was (at the time) the smallest in terms of gross domestic product (GDP). The simultaneous accessions concerned: Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia. Seven of these were members of the former eastern bloc, with one from the former Yugoslavia and the remaining two being Mediterranean islands. Although to join the European Union a country must meet the Copenhagen criteria, defined at the 1993 Copenhagen European Council, the new state members are characterized by different cultural, political and economic background. Therefore it is necessary to monitor the socio-economic level of the member states development, applying aggregated measures.

Human Development Index (HDI) is the best known indicator that is used by United Nations to evaluate and compare the level of development of countries. The HDI combines three basic dimensions:

[*] Ph.D., Warsaw University of Life Sciences.
[**] Professor, Warsaw University of Life Sciences.

– knowledge and education, measured by the adult literacy rate and the combined primary, secondary, and tertiary gross enrollment ratio,
– life expectancy at birth, as an index of population health and longevity,
– standard of living, measured by the natural logarithm of GDP per capita at purchasing power parity (PPP) in US dollars.

According to HDI value, states are recognized as high, medium and low developed countries. Since the level of development in Europe is relatively high in comparison with other regions, all European Union members belong to the group of high developed countries and the variability of this measure is pretty small.

The aim of the research is evaluation of the socio – economic development level of the European Union members, and classification the EU states into groups containing similar countries, in terms of the aggregated measures.

2. DIAGNOSTIC VARIABLES AND SYNTHETIC MEASURES CONSTRUCTION

Evaluation of the socio-economic development must be provided applying specially constructed measures that describe different aspects of the human life and activity. Therefore the socio – economic indicators are widely discussed in literature (see: Noll H.H. [2003], Wskaźniki Społeczne [1990], Berbeka [2006])). In our research we consider diagnostic variables that describe six groups of indicators and are denoted as: G1 - living conditions, G2 - education, G3 - medical care and health, G4 - environmental protection, G5 - technical and economic infrastructure, and G6 - information society. To construct the synthetic measure, that describes the general socio-economic development level, 21 diagnostic variables (for details see Kompa [2009]) $\{x_j\} = \{x_1, \ldots, x_{21}\} = \{D1, ..., D7, S1, ..., S14\}$ are used[1]. Variables denoted by S are stimulants while variables denoted by D are de-stimulants. The former are variables whose rise in quantity indicate an increase of the socio - economic development level. The latter are variables whose decrease in quantity indicate an increase of development level.

Living conditions (G1) are represented by variables: $D1$ – population density (in number of inhabitants per km^2), $D2$ – total unemployment (in percentage of the labor force), $D3$ – long-term unemployment (in percentage of the total number of unemployed). Education (G2) is described by variables: $S1$ – expenditures

[1] Variability of x_j was measured by dispersion coefficients and they are bigger than 10% for each of variables. Statistical data come from *World Bank, OECD, European System of Social Indicators*, see Kęsicka [2008] and www.worldbank.org, www.oecd.org, www.gesis.org.

for public education (as percentage of GDP), *S*2 – the expected length of education (in years). Medical care and health (G3) are measured by variables: *S*3, *S*4 – number of beds in hospitals and number of doctors per 1000 inhabitants, respectively, *S*5, *S*6 – measles and DPT immunization, respectively (in percentage), *D*4 – number of tuberculosis cases reported, *S*7 – life expectancy at birth, total (years), *D*5 – infant mortality rate. Environmental protection (G4) is represented by variables: *D*6 - CO_2 emission (in tons per capita), *D*7 – concentration of PM_{10} (in micrograms per m^3). Technical and economic infrastructure (G5) is described by variables: *S*8 – energy consumption (in tones of oil equivalent (toe) per capita), *S*9 – motorways length (in km per km^2), *S*10 - GDP per capita (PPP in US$, constant prices); *S*11 – GNI - gross national income per capita (PPP in US$, current prices), *S*12 – households consumption per capita (in US$, current prices). Information society (G6) is measured by variables: *S*13 – access to the Internet, *S*14 – number of personal computers (both in number of users per 100 inhabitants).

The synthetic taxonomic measure (*SMR*) is evaluated for each country and every year of analysis, and it defines the distance between the benchmark and analyzed country in the level of the socio-economic development. The benchmark is defined as the hypothetical object that is characterized by maximal values of stimulants and minimal values of de-stimulants. Maximal and minimal values are estimated for every year separately (on the bases of all countries). Therefore, for the *i*-th country in *t*-th period of time, the value of the taxonomic measure SMR_{it} is defined as (see Hellwig [1968]):

$$SMR_{it} = 1 - \frac{q_{it}}{\overline{q}_t + 2 \cdot S_{qt}} \quad i = 1,2,...,n;\ t = 1,2,...,T \tag{1}$$

where q_{it} is the distance of the *i*-th object from the benchmark:

$$q_{it} = \sqrt{\frac{1}{k}\sum_{j=1}^{k}(z_{jt}^{i} - z_{jt}^{0})^2} \tag{2}$$

evaluated for standardized variables z_{jt}^{0}, z_{jt}^{i} that describe the benchmark and the *i*-th investigated state, respectively. The benchmark is defined as:

$$z_{jt}^{0} = \begin{cases} \min\limits_{i=1,2,...n} \left\{ z_{jt}^{i} \right\} for\ x_{jt}^{i} \in D \\ \max\limits_{i=1,2,...n} \left\{ z_{jt}^{i} \right\} for\ x_{jt}^{i} \in S \end{cases} \tag{3}$$

where for each period t and the j-th variable: $z_{jt}^{i} = \dfrac{x_{jt}^{i} - \overline{x}_{jt}}{S_{jt}^{x}}$ – standardized variables, x_{jt}^{i}, $\overline{x}_{jt}$, S_{jt}^{x} – observations of for the i-th country, average and standard deviation, respectively. D and S are sets of de-stimulants and stimulants, respectively, k – count of variables employed for the measure construction. Other symbols denote: $\overline{q}_t$, S_{qt} – the average and the standard deviation of distances q_{it}, respectively:

$$\overline{q}_t = \frac{1}{n}\sum_{i=1}^{n} q_{it} \tag{4}$$

$$S_{qt} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(q_{it} - \overline{q}_t)^2} \tag{5}$$

We also analyze each of distinguished aspects of the socio-economic development, that are introduced to the aggregated measure *SMR*, separately. Therefore, applying formulas (1) – (5) we construct "partial" measures for each of six groups of variables G1, G2,..., G6, denoting them as: SMR_{it}^{1}, SMR_{it}^{2},..., SMR_{it}^{6}. Since the analysis is provided for n = 23 countries and T = 17 years we also evaluate averages and standard deviation of taxonomic measures:

$$SMR_t = \frac{1}{n}\sum_{i=1}^{n} SMR_{it} \tag{6}$$

$$S_{SMRt} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(SMR_{it} - SMR_t)^2} \tag{7}$$

$$SMR_i = \frac{1}{T}\sum_{t=1}^{T} SMR_{it} \tag{8}$$

Relation (6) describes the average level of development of all considered European Union states in the t-th period, while relation (8) describes the average, considering 17 years of analysis, development level of the i-th state. Dynamic analysis of the level of development is provided applying the linear trend function:

$$SMR_{it} = \alpha_0 + \alpha_1 t + \varepsilon_t \tag{9}$$

estimated using OLS method for t – time variable (t = 1, 2,..., 17). Parameter estimates and values of t-Student statistic together with determination coefficient evaluated for taxonomic measures: SMR_{it}, SMR_{it}^1, SMR_{it}^2,..., SMR_{it}^6 are presented in the Appendix.

On the basis of the SMR_{it} value it is possible to classify all countries into homogenous groups in terms of the level of socio-economic development. We distinguish four classes of states that are characterized by (see: Malina [2004], Nowak [1990]):

I – very high level of development for $SMR_{it} \geq SMR_t + S_{SMRt}$;

II – high level of development for $SMR_t + S_{SMRt} > SMR_{it} \geq SMR_t$;

III – average level of development for $SMR_t > SMR_{it} \geq SMR_t - S_{SMRt}$;

IV – low level of development for $SMR_{it} < SMR_t - S_{SMRt}$.

3. EMPIRICAL RESULTS

The research concerns 23 states being members of the European Union in 2005 (Malta and Cyprus were excluded[2] from the analysis). Investigation covers the period from 1990 to 2006. It is worth mentioning that positive and significant trend coefficient α_1 means that the socio – economic situation of investigated EU member improves year by year in comparison to other states taking into consideration. However the opposite situation i.e. negative trend does not mean that the situation in particular country is getting worse, especially that the slope evaluated for the average of countries is also negative and significant (see Table 1).

As it can be noticed in Table 1, positive and significant trend coefficients of the synthetic taxonomic measure SMR_{it} are observed only for five countries: Estonia, Spain, Ireland, Slovenia and Italy. Analyzing trend of the partial synthetic measures SMR_{it}^l (l = 1, 2,..., 6), one can see that the improvement of general situation in Italy, Spain and Ireland is caused by the better situation of living condition (G1), medical care (G3) and access to informatics (G6). And for the last mentioned state also by improvement in technical and economic infrastructure (G5) as it is also visible for Estonia and Slovenia. Considering these two countries, they also improved environmental protection (G4) although in Slove-

[2] There is lack of reliable data for these countries.

nia health care (G3) is not significantly better in comparison with the situation observed in other EU members however it improved situation in education (G2).

Table 1. Signs of the slope in linear trend function of SMR_{it} , SMR_{it}^1 , SMR_{it}^2 ,..., SMR_{it}^6

States	State	SMR_{it}^1	SMR_{it}^2	SMR_{it}^3	SMR_{it}^4	SMR_{it}^5	SMR_{it}^6	SMR_{it}
Austria	A	0	–	–	–	0	+	–
Belgium	B	+	0	–	–	–	+	0
Czech Republic	CZ	–	0	+	+	–	0	–
Denmark	DK	+	0	0	0	–	+	0
Estonia	EST	–	0	+	+	+	+	+
Finland	FIN	0	0	–	–	0	–	0
France	F	0	–	0	–	–	+	–
Greece	GR	–	+	+	+	0	–	–
Spain	E	+	–	+	–	0	+	+
Holland	NL	0	–	+	–	0	+	–
Ireland	IRL	+	0	+	–	+	+	+
Lithuania	LT	+	0	–	+	–	0	–
Latvia	LV	+	+	–	+	–	+	0
Luxemburg	LUX	0	0	+	–	0	+	0
Germany	D	–	–	+	0	–	+	–
Poland	PL	–	0	+	0	0	0	–
Portugal	P	0	0	+	+	–	–	0
Slovak Republic	SK	–	–	0	+	–	+	–
Slovenia	SLO	–	+	–	+	+	+	+
Hungary	H	0	0	+	+	0	0	–
Italy	I	+	0	+	–	0	+	+
Sweden	S	0	0	–	–	–	+	–
Great Britain	GB	+	–	–	0	0	+	–
average SMR_t^l		0	–	0	0	0	+	–

Source: Own calculation. Note, negative or positive sign means that the trend coefficient is significant for certain aspect or general level of the socio-economic development. Zero means that the parameter is not significant.

It is worth mentioning that among 23 analyzed countries only Hungary has no negative trend parameters for all six groups of variables although for four aspects the parameters are not significant. Also for Poland we observe insignificant parameters for G2, G4, G5 and G6. For both countries medical care was improved and in Hungary also the environment protection. In Poland the indica-

tor describing living condition decreased and that was probably caused by high unemployment and high rate of long-term unemployment. However both countries are characterized by negative trend coefficient for the general development measures SMR_{it}. The biggest number of positive trend coefficients for partial measures SMR_{it}^1,..., SMR_{it}^6 are found out for Estonia, Ireland, Latvia and Slovenia.

Considering different aspects of socio-economic development, the biggest improvement is observed in the group G6 since number of personal computers and Internet users increased in 16 states, and negative sign of the trend coefficient is observed only for Finland, Greece and Portugal. In contrary only 3 countries (Estonia, Ireland and Slovenia) improved technical and economic infrastructure (G5). Also 3 EU members (Greece, Latvia and Slovenia) increased level of education (G2). One can notice that 10 states are characterized by negative trend for environmental protection (G4), and all of them are countries that - in general opinion - pay much attention to the nature protection. That result does not mean that the situation in these countries is getting worse but that other states pays more and more attention to the environment care. To confirm that statement one should notice that some countries, that were not used to take care of the environment in the past, are characterized by the positive values of the trend coefficient. It is especially visible for "new" EU states from among only Poland has insignificant trend parameter. Considering health care (G3), there are 12 countries that improved its situation and for the living condition (G1) its level increased for 8 countries.

The EU countries are classified, according to the value of the taxonomic measures SMR_{it} and Human Development Index, to four classes from the most developed – class I to the least developed – class IV. Since we investigate 17 years only selected results[3] are presented in Table2. For HDI we compare situation in 1990 to 2005 and 2006 while for *SMR* we additionally compare the indicator that is an average evaluated for 17 years SMR_i.

Applying HDI, the group of best developed countries contains only one country that is represented by Holland in 1990 and Ireland in 2005 and 2006. The group of well developed states is the biggest and consists of 13 countries while the average development level is represented by 3 countries, and the poor development – by 6 states. Among new EU members only Czech Republic and Slovenia are recognized as belonging to the third class, and the rest of them are the fourth class members. It is also worth mentioning that two last classes contain the same states although the position of countries slightly differs. Also both first groups are very similar. The only difference in investigated three years

[3] Some results are also presented in Kompa [2009], Kompa, Witkowska [2009].

(HDI classification in Table 2) consists in position of Holland and Ireland that either belong to the first or to the second class.

Table 2. Classification of EU states into four classes due to value of taxonomic measure

No.	No. of class	SMR_{it}			SMR_i	HDI		
		1990	2005	2006		1990	2005	2006
1.	I	S	DK	DK	S	NL	IRL	IRL
2.		FIN	S	FIN	DK	F	S	NL
3.		DK	B	S	FIN	FIN	NL	S
4.		B	FIN	B	B	S	FIN	LUX
5.		NL	NL	LUX	NL	B	F	F
6.		D	LUX	NL	D	A	DK	FIN
7.	II	A	F	D	LUX	DK	E	DK
8.		F	D	F	F	E	A	A
9.		LUX	IRL	A	A	I	B	E
10.		GB	GB	GB	GB	LUX	GB	B
11.	III	CZ	I	IRL	I	D	LUX	GR
12.		I	A	I	IRL	GB	I	I
13.		E	E	E	CZ	GR	D	GB
14.		IRL	SLO	SLO	SLO	IRL	GR	D
15.		SK	CZ	CZ	E	P	SLO	SLO
16.		GR	EST	EST	P	SLO	P	P
17.		H	GR	H	H	CZ	CZ	CZ
18.		EST	H	P	GR	LT	H	H
19.		SLO	P	GR	EST	EST	PL	PL
20.	IV	P	LT	SK	SK	H	SK	SK
21.		LT	SK	LT	LT	PL	LT	EST
22.		LV	LV	LV	PL	LV	EST	LT
23.		PL	PL	PL	LV		LV	LV

Source: Own calculation and Human Development Report [2008] Human development indices [2009]. Data about Slovak Republic were not available in 1990.

The synthetic taxonomic measure (1) is characterized by bigger variability therefore classes contain different states in analyzed years. The best developed EU states are Scandinavian countries because Sweden, Finland and Denmark always belong to the first class. France, Austria and Great Britain are always recognized as well developed countries. Italy and Ireland improved their position moving from the third (in 1990) to the second (in 2005 and 2006) class. Czech Republic, Slovenia, Estonia, Hungary, Italy and Spain are classified to the third class. The least developed countries are: Poland, Lithuania and Latvia. It is worth mentioning that all states that became European Union members in 2004 are recognized as average or low developed countries.

4. CONCLUSION

Application of aggregated measures let us evaluate and compare the socio-economic level of development in European Union states. Both indicators i.e. HDI and *SMR* classify investigated countries in similar way. Although Human Development Index (evaluated by United Nations) is characterized by small variability for EU countries (– the variability coefficient is less than 4% for 2006) and it seems to be the worse measure than *SMR* that takes into account more aspects of the socio-economic development and it is characterized by variability coefficient that equals to 50%. Also the first position of Ireland in years 2005 and 2006 in the country ranking made due to HDI values seems to be exaggerated. Although it is visible that Ireland together with Italy improved the socio-economic situation.

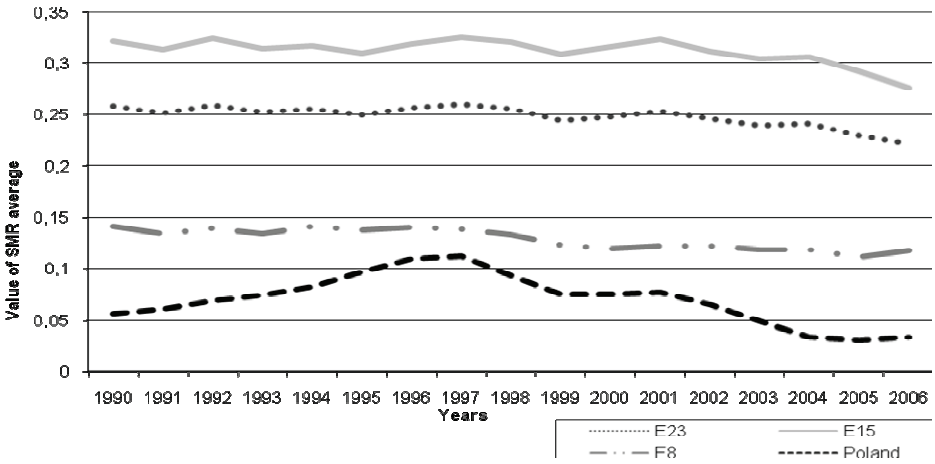

Figure 1. Comparison of average taxonomic measures

Source: own calculation.

The comparison of the changes in socio-economic development of countries is presented at Fig. 1. Plots represent averages (6) evaluated for all 23 EU states, for 15 "old", and 8 "new" EU countries, and Poland. New European Union members are characterized by lower level of development (than other EU states) although they have been improving their situation systematically. Slovenia and Estonia seem to made bigger progress than other post-communist states. Although positive changes are visible for all of them in at least two groups of socio-economic indicators (only for Poland the slop was positive for G3, negative for G1 and G6, and insignificant for other aspects). The improvement is mostly visible in medical care, an environment protection and access to informatics.

REFERENCES

Berbeka J., Poziom życia ludności a wzrost gospodarczy w krajach Unii Europejskiej, Wydawnictwo Akademii Ekonomicznej w Krakowie, Kraków 2006.

Hellwig Z., Zastosowanie metody taksonomicznej do typologicznego podziału krajów ze względu na poziom ich rozwoju oraz zasoby i strukturę kwalifikowanych kadr, Przegląd Statystyczny, 1968.

Human Development Report, United Nations Development Programme (UNDP), [2008]

Human development indices, United Nations Development Programme. http://hdr.undp.org/en/media/ HDI_2008_EN_Tables.pdf. Retrieved on 26 March 2009.

Kęsicka N., Zastosowanie wybranych mierników taksonomicznych do oceny poziomu rozwoju społeczno-gospodarczego krajów Unii Europejskiej, praca magisterska przygotowana pod kierunkiem D. Witkowskiej, SGGW, Warszawa, 2008.

Kompa K., Budowa mierników agregatowych do oceny poziomu rozwoju społeczno-gospodarczego, Ekonomika i organizacja gospodarki żywnościowej, Zeszyty Naukowe SGGW w Warszawie, 2009, przyjęty do druku.

Kompa K., Witkowska D., Comparison of the Socio-Economic Development Level of European Union States: the Distance Measures Application, Sejmik Młodych Informatyków, 2009 (maszynopis).

Kompa K., Witkowska D., Zastosowanie wybranych mierników syntetyczny do porównań poziomu rozwoju społeczno-gospodarczego w krajach Unii Europejskiej, SKAD, 2009, (maszynopis).

Malina A., Wielowymiarowa analiza przestrzennego zróżnicowania struktury gospodarki Polski według województw, Wydawnictwo Akademii Ekonomicznej w Krakowie, Kraków 2004.

Noll H.H., European System of Social Indicators, ZUMA – Center of Survey Research and Methodology Social Indicators Department, Mannheim, Germany 2003.

Nowak E., Metody taksonomiczne w klasyfikacji obiektów społeczno - gospodarczych, PAN, Warszawa 1990.

Wskaźniki Społeczne", Polskie Towarzystwo Statystyczne, Główny Urząd Statystyczny, Warszawa 1990.

Zeliaś A., Metody statystyczne, Polskie wydawnictwo Ekonomiczne, Warszawa 2000.

Krzysztof Kopa, Dorota Witkowska

OCENA POZIOMU ROZWOJU KRAJÓW UNII EUROPEJSKIEJ W LATACH 1990–2006

Celem opracowania jest ocena poziomu rozwoju społeczno-gospodarczego krajów Unii Europejskiej. Badania dotyczą 23 krajów będących członkami UE w 2005 roku (z analiz wyłączono Maltę i Cypr). Rozważania oparto na danych pochodzących z okresu 1990–2006, na podstawie których oszacowano syntetyczne mierniki taksonomiczne uwzględniające w swej konstrukcji 21 cech społeczno-ekonomicznych. Na podstawie wyznaczonych wskaźników oraz Human Development Index dokonano klasyfikacji krajów do grup typologicznych. Przeprowadzono dynamiczną analizę sytuacji poszczególnych krajów, wykorzystując w tym celu szeregi czasowe utworzone z wyznaczonych mierników agregatowych.

Słowa kluczowe: rozwój społeczno-ekonomiczny, Unia Europejska, taksonomiczne mierniki syntetyczne, Human Development Index.

APPENDIX

Table A1. Parameter estimates, t- Statistics and R^2 of trend function estimated for SMR_{it}

State		B	CZ	EST	FIN	GR	NL
parameter	intercept	0.3744	0.2560	0.1102	0.4356	0.1572	0.3890
estimate	slope	–0.0010	–0.0043	0.0025	–0.0046	–0.0021	–0.0028
t-Statistic	$\hat{\alpha}_0$	21.1191	23.4983	11.5638	89.8492	25.0983	78.9004
	$\hat{\alpha}_1$	–0.5717	–4.0252	2.6607	–9.7773	–3.3583	–5.7412
R^2		0.0213	0.5193	0.3206	0.8644	0.4292	0.6872
State		A	DK	F	E	IRL	LV
parameter	intercept	0.4147	0.4019	0.3823	0.1599	0.1714	0.0312
estimate	slope	–0.0081	0.0010	–0.0040	0.0037	0.0061	–0.0016
t-Statistic	$\hat{\alpha}_0$	24.1547	30.2020	56.3365	15.3067	18.3277	2.3573
	$\hat{\alpha}_1$	–4.8425	0.7964	–6.0877	3.5981	6.7181	–1.2119
R^2		0.6099	0.0406	0.7119	0.4633	0.7506	0.0892
State		LT	LUX	PL	SK	H	S
parameter	intercept	0.0940	0.3625	0.0860	0.1894	0.1695	0.4783
estimate	slope	–0.0012	–0.0015	–0.0023	–0.0078	–0.0015	–0.0053
t-Statistic	$\hat{\alpha}_0$	16.7112	29.4205	7.5268	27.7347	26.9648	48.3024
	$\hat{\alpha}_1$	–2.1865	–1.2798	–2.0979	–11.6914	–2.5116	–5.5288
R^2		0.2417	0.0984	0.2269	0.9011	0.2961	0.6708
State		D	P	SLO	I	GB	SMR_t
parameter	intercept	0.4015	0.1709	0.1813	0.2051	0.3341	0.2590
estimate	slope	–0.0050	0.0002	0.0022	0.0030	–0.0037	–0.0017
t-Statistic	$\hat{\alpha}_0$	43.7823	9.3549	16.5755	29.0189	49.5235	76.8766
	$\hat{\alpha}_1$	–5.5710	0.1216	2.0716	4.2841	–5.6369	–5.0493
R^2		0.6742	0.0010	0.2225	0.5503	0.6793	0.6296

Source: Own calculation.

Table A2. Parameter estimates, t– Statistics and R^2 of trend function estimated for SMR_{it}^{l} (l = 1,..., 6)

G1	State	B	CZ	EST	FIN	GR	NL
parameter	estimate	0.0050	–0.0293	–0.0165	0.0088	–0.0094	0.0013
t-Statistic		2.5346	–8.0401	–5.1038	1.2815	–4.1954	1.2407
G2	R^2	0.2999	0.8117	0.6346	0.0987	0.5399	0.0931
parameter	estimate	–0.0011	0.0033	0.0032	–0.0034	0.0171	–0.0194
t-Statistic		–0.1303	0.5716	0.8305	–0.5017	4.1251	–6.7496
G3	R^2	0.0011	0.0213	0.0440	0.0165	0.5315	0.7523
parameter	estimate	–0.0071	0.0073	0.0061	–0.0065	0.0047	0.0055
t-Statistic		–1.9149	3.7106	2.5493	–4.2556	2.3506	5.0252
G4	R^2	0.1964	0.4786	0.3023	0.5470	0.2692	0.6274
parameter	estimate	–0.0068	0.0185	0.0058	–0.0192	0.0068	–0.0105
t-Statistic		–1.7801	3.7318	2.1405	–5.3590	1.8442	–4.5717
G5	R^2	0.1744	0.4814	0.2340	0.6569	0.1848	0.5822
parameter	estimate	–0.0043	–0.0030	0.0027	0.0003	0.0001	–0.0013
t-Statistic		–2.7174	–5.1061	3.2310	0.6828	0.2914	–0.8892
G6	R^2	0.3299	0.6348	0.4104	0.0301	0.0056	0.0501
parameter	estimate	0.0099	–0.0011	0.0199	–0.0142	–0.0112	0.0185
t-Statistic		4.2232	–0.7627	7.4523	–4.1498	–6.6625	4.9075
	R^2	0.5432	0.0373	0.7873	0.5345	0.7474	0.6162
G1	State	A	DK	F	E	IRL	LV
parameter	estimate	–0.0015	0.0114	–0.0024	0.0328	0.0437	0.0052
t-Statistic		–1.2909	5.1077	–1.1403	4.7262	10.2925	2.4969
G2	R^2	0.1000	0.6349	0.0798	0.5982	0.8760	0.2936
parameter	estimate	–0.0198	–0.0016	–0.0146	–0.0082	–0.0052	0.0237
t-Statistic		–7.1548	–0.3199	–5.5275	–3.7081	–1.1966	4.4449
G3	R^2	0.7734	0.0068	0.6707	0.4783	0.0871	0.5684
parameter	estimate	–0.0144	0.0013	–0.0032	0.0152	0.0055	–0.0191
t-Statistic		–2.6417	0.4188	–1.4128	7.3230	1.4548	–4.5937
G4	R^2	0.3175	0.0116	0.1174	0.7814	0.1237	0.5845
parameter	estimate	–0.0221	0.0026	–0.0055	–0.0149	–0.0122	0.0255
t-Statistic		–10.1830	0.6152	–2.8901	–4.9835	–2.5605	10.6491
G5	R^2	0.8736	0.0246	0.3577	0.6234	0.3042	0.8832
parameter	estimate	–0.0005	–0.0034	–0.0027	0.0001	0.0067	–0.0018
t-Statistic		–0.4907	–2.6068	–3.8808	0.1866	4.2298	–2.8952
G6	R^2	0.0158	0.3118	0.5010	0.0023	0.5440	0.3585
parameter	estimate	0.0178	0.0221	0.0110	0.0090	0.0079	0.0085
t-Statistic		3.8658	3.8469	4.8909	4.3745	2.5356	3.9605
	R^2	0.4991	0.4966	0.6146	0.5606	0.3000	0.5112

Source: Own calculation.

Table A3. Parameter estimates, t– Statistics and R^2 of trend function estimated for SMR_{it}^{l} (l = 1,..., 6)

G1	State	LT	LUX	PL	SK	H	S
parameter	estimate	0.0206	0.0022	–0.0235	–0.0296	–0.0038	–0.0001
t-Statistic		6.8478	0.9537	–4.8988	–10.2906	–1.3586	–0.0142
G2	R^2	0.7576	0.0572	0.6154	0.8759	0.1096	0.0000
parameter	estimate	–0.0033	–0.0037	–0.0036	–0.0185	–0.0029	0.0008
t-Statistic		–1.1408	–0.8374	–1.1349	–3.4541	–0.9472	0.1379
G3	R^2	0.0798	0.0447	0.0791	0.4430	0.0564	0.0013
parameter	estimate	–0.0054	0.0040	0.0086	–0.0012	0.0061	–0.0094
t-Statistic		–2.7430	2.2035	4.0094	–0.3889	3.6482	–3.1970
G4	R^2	0.3340	0.2445	0.5173	0.0100	0.4701	0.4052
parameter	estimate	0.0307	–0.0054	0.0005	0.0142	0.0068	–0.0069
t-Statistic		9.6453	–1.8837	0.2399	5.5027	3.3703	–5.3938
G5	R^2	0.8612	0.1913	0.0038	0.6687	0.4309	0.6598
parameter	estimate	–0.0033	–0.0006	–0.0001	–0.0022	0.0000	–0.0039
t-Statistic		–3.6817	–1.7275	–0.1142	–5.4706	0.0499	–7.5667
G6	R^2	0.4747	0.1659	0.0009	0.6661	0.0002	0.7924
parameter	estimate	0.0003	0.0287	0.0016	0.0111	–0.0006	0.0151
t-Statistic		0.2942	9.8467	1.5189	7.3578	–0.7369	2.3620
	R^2	0.0057	0.8660	0.1333	0.7830	0.0349	0.2711
G1	State	D	P	SLO	I	GB	SMR_t^l
parameter	estimate	–0.0152	–0.0035	–0.0115	0.0093	0.0104	0.0002
t-Statistic		–11.7863	–0.7869	–3.3269	3.0981	5.7958	0.2263
G2	R^2	0.9025	0.0396	0.4246	0.3902	0.6913	0.0034
parameter	estimate	–0.0097	–0.0053	0.0119	–0.0025	–0.0144	–0.0033
t-Statistic		–3.4910	–1.5589	4.5652	–0.6831	–3.7731	–3.9829
G3	R^2	0.4483	0.1394	0.5815	0.0302	0.4869	0.5140
parameter	estimate	0.0080	0.0148	–0.0030	0.0107	–0.0124	0.0007
t-Statistic		2.0049	7.1227	–1.9042	3.8372	–7.7471	0.8777
G4	R^2	0.2113	0.7718	0.1947	0.4954	0.8000	0.0489
parameter	estimate	–0.0043	0.0179	0.0138	–0.0059	–0.0049	0.0011
t-Statistic		–1.5075	4.3881	17.8176	–2.8851	–1.6544	0.7890
G5	R^2	0.1316	0.5621	0.9549	0.3569	0.1543	0.0399
parameter	estimate	–0.0053	–0.0005	0.0018	0.0000	–0.0006	–0.0010
t-Statistic		–5.2931	–0.5807	2.1726	–0.0044	–0.5682	–1.6610
G6	R^2	0.6513	0.0220	0.2394	0.0000	0.0211	0.1553
parameter	estimate	0.0121	–0.0053	0.0193	0.0166	0.0189	0.0094
t-Statistic		3.1067	–2.1479	9.9787	5.8294	6.8000	5.2924
	R^2	0.3915	0.2352	0.8691	0.6938	0.7551	0.6512

Source: Own calculation.