Lithuanian Centre for Social Sciences

Institute of Economics and Rural Development

Structural Changes in the EU Agricultural System: The Sustainability Prism and Energy-induced Effects

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Structural changes in the EU agriculture, forestry, and fishing economic activity

- Gross Value Added (GVA)
- Employment
- Greenhouse gas (GHG) emissions from fuel combustion

Structural changes
in the EU agriculture, forestry, and fishing economic activity

Research period:
2008–2018

Methodological framework:
- ✓ **Shift-share analysis**
- ✓ Decoupling analysis
- ✓ Hierarchical cluster analysis

Shift-share analysis

$$GR_{ij} = GR + (GR_i - GR) + \left(GR_{ij} - GR_i\right)$$

GR_{ij} – the actual growth rate of the investigated structural change measure in i^{th} economic activity of the j^{th} member state,
GR – the growth rate of the EU economic system,
GR_i – the growth rate for the i^{th} economic activity of the EU economic system.

$$\Delta CM_{ij} = EU_{ij} + EA_{ij} + MS_{ij}$$

ΔCM_{ij} – the actual change of the investigated structural change measure in i^{th} economic activity of the j^{th} member state over the selected period,
EU_{ij} – the EU economy growth effect for the i^{th} economic activity of the j^{th} member state, i.e. the change at the rate of the EU economy (GR).
EA_{ij} denotes economic activity mix effect for the i^{th} economic activity of the j^{th} member state, i.e. (GR_i – GR) growth rate shows negative or positive impact of member state specialization in individual economic activities that could exceed or stay below the growth rate of the EU economy.
MS_{ij} refers to the member state effect for the i^{th} economic activity of the j^{th} member state and demonstrates the degree of the possible change in member state estimating the $\left(GR_{ij} - GR_i\right)$ growth rate that shows the development dynamics taking into consideration the economic system of the individual member state and the shifts in the structure of economic activities.

Results of the shift-share analysis: GVA

Country	GVA, million euro (2015=100)				Country	GVA, million euro (2015=100)			
	EU_{ij}	EA_{ij}	MS_{ij}	ΔCM_{ij}		EU_{ij}	EA_{ij}	MS_{ij}	ΔCM_{ij}
BE	282.40	-186.57	-377.63	-281.81	**LT**	114.45	-75.61	-10.59	28.24
BG	255.79	-168.99	-359.49	-272.70	**LU**	12.12	-8.01	-19.44	-15.33
CZ	348.32	-230.12	585.02	703.21	**HU**	558.16	-368.76	-717.14	-527.74
DK	229.33	-151.51	187.50	265.32	**MT**	7.47	-4.94	25.15	27.69
DE	2718.88	-1796.29	-9436.53	-8513.95	**NL**	1160.21	-766.52	849.10	1242.79
EE	58.93	-38.94	-246.72	-226.72	**AT**	435.99	-288.05	120.00	267.95
IE	194.50	-128.50	521.80	587.80	**PL**	1082.48	-715.17	-886.52	-519.20
GR	640.31	-423.04	847.45	1064.72	**PT**	382.24	-252.54	69.03	198.74
ES	2845.17	-1879.73	4501.75	5467.20	**RO**	744.07	-491.59	1568.71	1821.20
FR	3428.39	-2265.05	1776.11	2939.45	**SI**	83.94	-55.46	131.81	160.29
HR	221.05	-146.04	-653.47	-578.46	**SK**	158.67	-104.83	720.10	773.94
IT	3560.79	-2352.52	-950.29	257.98	**FI**	433.54	-286.43	675.89	823.00
CY	43.73	-28.89	-79.16	-64.32	**SE**	624.23	-412.41	146.32	358.14
LV	76.28	-50.40	69.29	95.17	**UK**	1669.65	-1103.09	421.36	987.92

Results of the shift-share analysis: employment

Country	Employment, thousand persons				Country	Employment, thousand persons			
	EU_{ij}	EA_{ij}	MS_{ij}	ΔCM_{ij}		EU_{ij}	EA_{ij}	MS_{ij}	ΔCM_{ij}
BE	2.55	-14.85	1.99	-10.30	**LT**	4.22	-24.52	4.28	-16.02
BG	27.11	-157.60	18.32	-112.17	**LU**	0.15	-0.85	0.37	-0.34
CZ	6.26	-36.39	25.59	-4.54	**HU**	6.66	-38.72	41.89	9.83
DK	2.73	-15.85	10.28	-2.84	**MT**	0.09	-0.55	0.43	-0.02
DE	24.18	-140.58	67.39	-49.00	**NL**	7.69	-44.72	29.03	-8.00
EE	0.92	-5.35	0.93	-3.50	**AT**	7.52	-43.75	-11.00	-47.22
IE	4.26	-24.78	12.27	-8.25	**PL**	80.84	-469.96	-240.08	-629.20
GR	19.49	-113.28	71.00	-22.80	**PT**	21.36	-124.18	-56.99	-159.81
ES	30.22	-175.71	123.78	-21.70	**RO**	107.04	-622.28	-380.26	-895.50
FR	29.33	-170.53	98.20	-43.00	**SI**	3.06	-17.80	4.72	-10.01
HR	8.36	-48.61	-83.29	-123.54	**SK**	3.01	-17.51	4.84	-9.66
IT	35.40	-205.81	146.41	-24.00	**FI**	4.20	-24.39	-6.00	-26.20
CY	0.63	-3.65	0.83	-2.19	**SE**	3.40	-19.77	24.87	8.50
LV	2.93	-17.06	-0.48	-14.60	**UK**	13.77	-80.07	97.25	30.95

Results of the shift-share analysis: GHG emissions for fuel combustion

Country	GHG emissions for fuel combustion, thousand tonnes				Country	GHG emissions for fuel combustion, thousand tonnes			
	EU_{ij}	EA_{ij}	MS_{ij}	ΔCM_{ij}		EU_{ij}	EA_{ij}	MS_{ij}	ΔCM_{ij}
BE	-352.54	291.81	461.54	400.80	**LT**	-42.13	34.87	-5.57	-12.83
BG	-92.30	76.40	3.45	-12.45	**LU**	-5.09	4.22	-3.40	-4.28
CZ	-225.56	186.70	7.78	-31.08	**HU**	-214.76	177.76	330.58	293.58
DK	-369.92	306.19	-481.93	-545.66	**MT**	-3.39	2.80	0.08	-0.50
DE	-1082.05	895.63	358.41	171.98	**NL**	-1907.79	1579.09	-781.94	-1110.63
EE	-37.66	31.17	35.76	29.27	**AT**	-203.08	168.09	-165.59	-200.58
IE	-185.69	153.70	-330.50	-362.49	**PL**	-2064.24	1708.59	1180.15	824.50
GR	-489.92	405.51	-2154.55	-2238.96	**PT**	-212.16	175.60	59.36	22.81
ES	-1897.40	1570.49	1302.43	975.53	**RO**	-119.78	99.14	866.44	845.80
FR	-2230.02	1845.81	-758.55	-1142.76	**SI**	-47.24	39.10	-15.54	-23.68
HR	-147.46	122.05	-92.38	-117.79	**SK**	-75.15	62.20	-42.36	-55.31
IT	-1500.44	1241.93	79.44	-179.07	**FI**	-284.74	235.68	-228.44	-277.50
CY	-15.38	12.73	-4.43	-7.08	**SE**	-300.91	249.07	-385.42	-437.26
LV	-67.63	55.98	114.59	102.94	**UK**	-822.65	680.92	650.60	508.87

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Decoupling analysis

- GVA elasticity of employment (E_L)
- GVA elasticity of GHG emissions from fuel combustion (E_{EFC})

ΔGVA > 0

- ✓ expansive negative decoupling,
- ✓ expansive coupling,
- ✓ weak decoupling,
- ✓ strong decoupling.

ΔGVA < 0

- ✓ recessive decoupling,
- ✓ recessive coupling,
- ✓ weak negative decoupling,
- ✓ strong negative decoupling.

The combination of elasticity and GVA change values allows us to classify member states into 8 relevant groups

Results of the decoupling analysis

		Strong decoupling (elasticity < 0)	**Weak decoupling (elasticity ϵ [0, 0.8])**	**Expansive coupling (elasticity ϵ [0.8, 1.2])**	**Expansive negative decoupling (elasticity > 1.2)**
ΔGVA>0	**E_L**	CZ, DK, IE, GR, ES, FR, IT, LV, LT, MT, NL, AT, PT, RO, Sl, SK, FI	-	-	SE, UK
	E_{EFC}	CZ, DK, IE, GR,FR, IT, LT, MT, NL, AT, Sl, SK, FI, SE	ES, PT	-	LV, RO, UK
		Strong negative decoupling (elasticity < 0)	**Weak negative decoupling (elasticity ϵ [0, 0.8])**	**Recessive coupling (elasticity ϵ [0.8, 1.2])**	**Recessive decoupling (elasticity > 1.2)**
ΔGVA<0	**E_L**	HU	DE, EE, LU	CY	BE, BG, HR, PL
	E_{EFC}	BE, DE, EE, HU, PL	BG, HR, CY	LU	-

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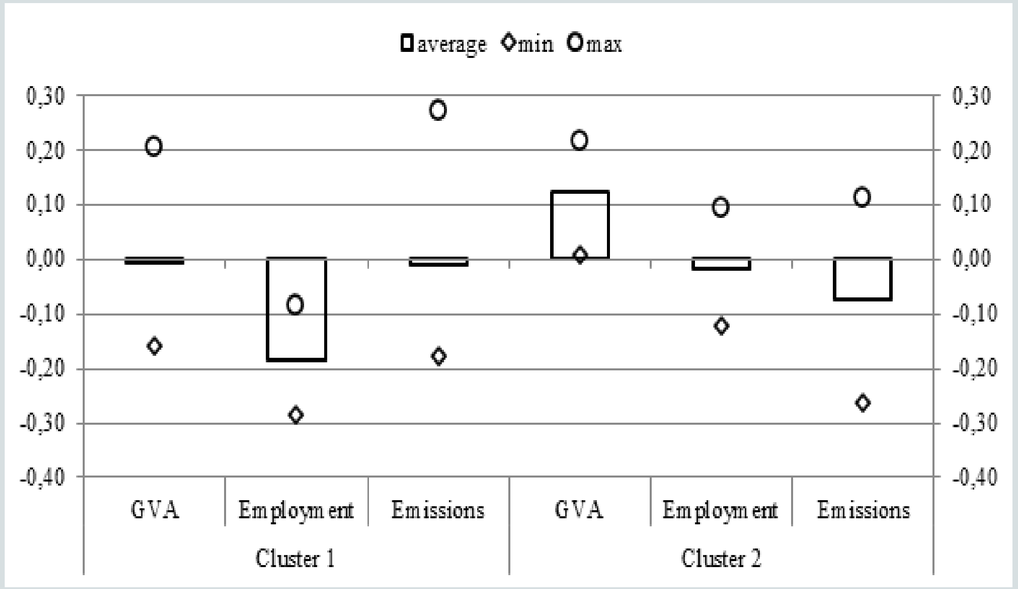
Hierarchical cluster analysis

- ✓ The clustering relies on the actual growth rates (GR_{ij}) of GVA, employment, and GHG emissions from fuel combustion.
- ✓ The study employs centroid clustering applying squared Euclidian distance for standardized actual growth rates.
- ✓ The number of clusters was set using agglomeration schedule coefficients and the dendrogram linkages.

Results of the hierarchical cluster analysis

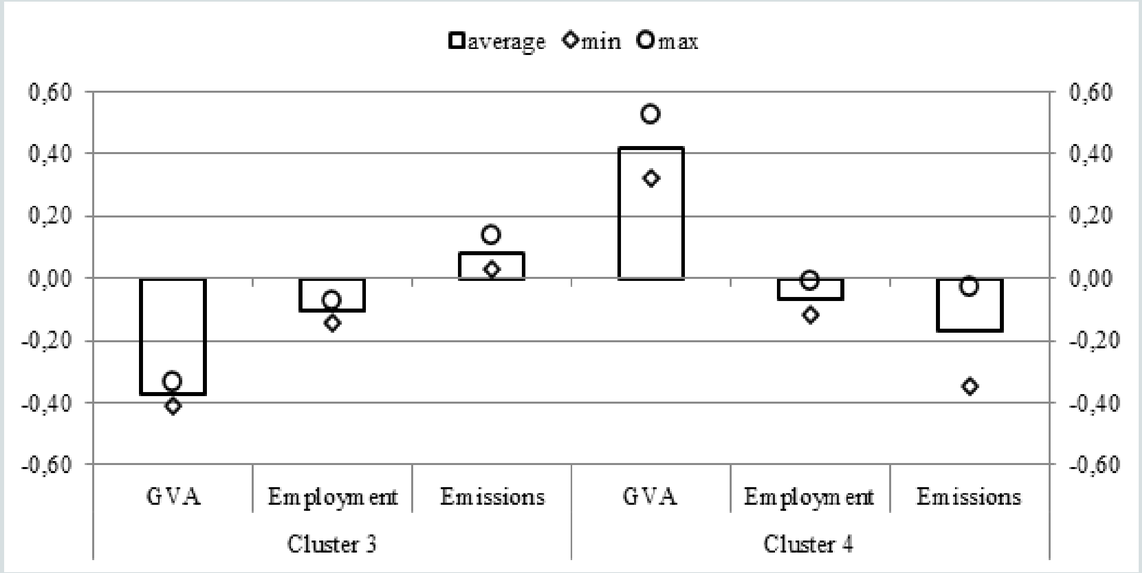


Cluster 1: Belgium, Bulgaria, Cyprus, Latvia, Lithuania, Luxemburg, Austria, Poland, Portugal, and Finland.

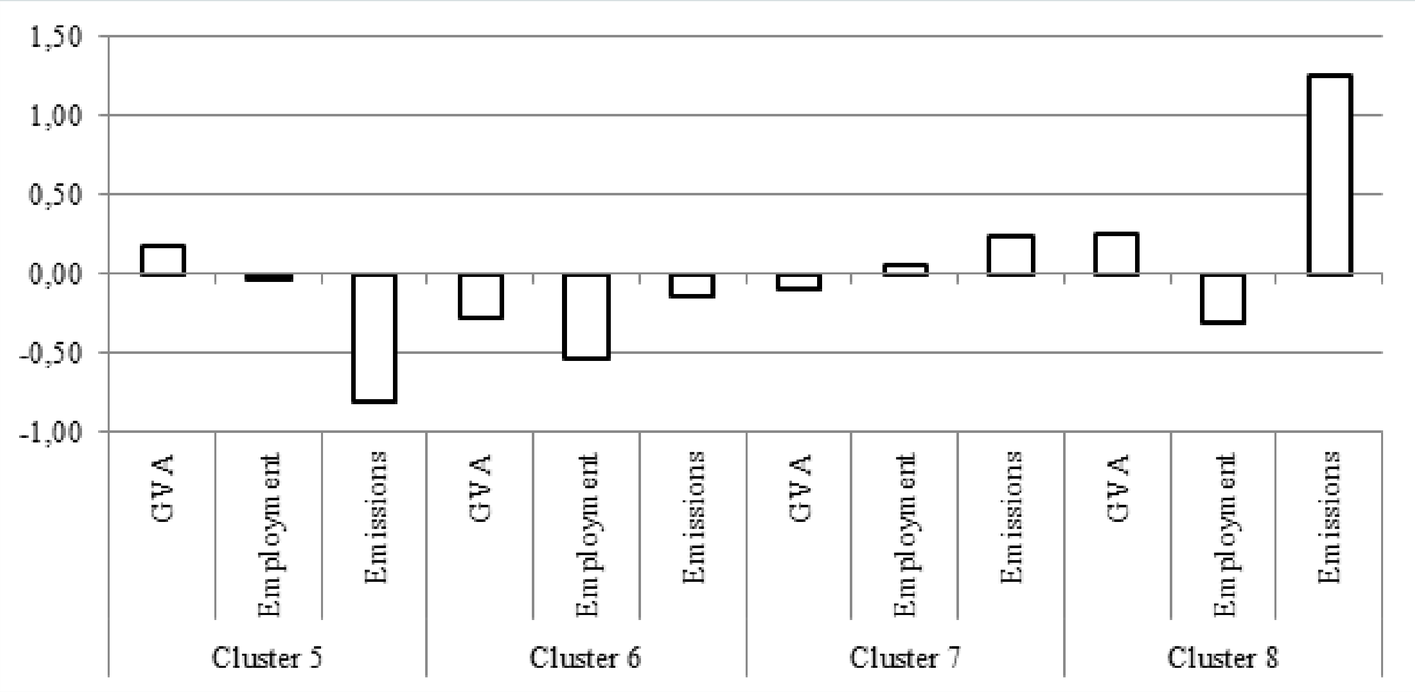
Cluster 2: Czech Republic, Denmark, Spain, France, Italy, the Netherlands, Slovenia, Sweden, and the United Kingdom

Cluster 3: Germany and Estonia.

Cluster 4: Ireland, Malta, and Slovakia.



Results of hierarchical cluster analysis



Cluster 5: Greece

Cluster 6: Croatia.

Cluster 7: Hungary.

Cruster 8: Romania.

Conclusions

The most recent data shows that the process of labour force outflow from agriculture remains a serious challenge, while the growth rate of GVA for agriculture, forestry, and fishing economic activity is below the pace of change of the EU economy. Results also demonstrate a lower decline in GHG emissions from fuel combustion in agriculture, forestry, and fishing economic activity, compared to the EU economy growth rate, and the corresponding challenges to benefit from climate change mitigation in this area.

The dominant share of member states demonstrate that the GVA growth is decoupled from the changes in employment and GHG emissions from fuel combustion. In case of employment, these results suggest that growing GVA does not contribute to higher employment in agriculture, forestry, and fishing economic activity and social dimension needs special policy measures. On the other hand, the decoupling of GVA growth from the increase in GHG emissions for fuel combustion shows progress towards more sustainable agricultural systems.

Conclusions

Clustering demonstrates the EU diversity and allows us to identify eight groups with differences in sustainable development patterns. Although results show the dramatic changes in countries that joined the EU later (for example, Croatia, Hungary, Romania), the general conclusions concerning the pace of structural changes in member states judging on the criterion of accession should be avoided, because countries demonstrate individual development patterns.

The combined assessment of the shift-share analysis and clustering as well as the decoupling analysis allow identifying countries with negative development patterns and the undesired contribution to the establishment of sustainable systems. These results could be used to foster additional research clusters, covering target member states, in order to develop specific measures and disseminate strategies allowing to deal with challenges in homogeneous groups of countries.

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