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Michał Niewiadomski
ORCID: 0000-0002-3129-3331
Podhale State Vocational University in Nowy Targ
michal.niewiadomski@ppuz.edu.pl

Agata Niemczyk
ORCID: 0000-0002-5594-6296
Kraków University of Economics
agata.niemczyk@uek.krakow.pl

Paweł Zamora
ORCID: 0000-0001-8856-684X
Podhale State Vocational University in Nowy Targ
pawel.zamora@ppuz.edu.pl

Service turnover structures in selected Central European countries between 2015–2021: An analysis

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Abstract

Services constitute an important part of the economy. From an economic development standpoint, one of the most meaningful groups is high technology services. This study diagnoses changes of turnover in services structure. The spatial scope covers Central and Eastern European countries, the time range — the years 2015–2021. The article is theoretical and analytical in nature. Research methods typical for this type of studies were used: critical literature of the subject analysis and investigation of published empirical secondary data conducted with decision tree method.

Introduction

Services constitute an important part of the economy, an element of economic policy, and a subject of research. Perceiving them through the prism of the service sector refers to the introduction of a three-sector division of the economy, defining each of them and indicating the factors determining the inter-sectoral shifts of workers (Ilnicki, 2009, 25). The sector in question operates under certain conditions that shape it. Between 2015–2021, what has particularly influenced the structure of service turnover — especially high-tech services — not only in Poland, but also in the world, was the COVID-19 pandemic. The evolution of high-tech services makes many barriers to running business disappear. New solutions enabling remote work and communication are still used in the post-pandemic period. Replacing the classic form of work with systems of remote solutions was proven to contribute to the elimination of non-production limitations of enterprise management, which is reflected through changes in socio-economic structures.

Transformations of structures are related with patterns of development — they are the result of economic changes and affect the dynamics of economic development. In the study, changes in the structure of turnover in services were diagnosed. The spatial scope covers the countries of Central and Eastern Europe, the time range — the years 2015–2021. The following research question was posed: is there any homogeneity or heterogeneity in the structure of turnover in services in the studied countries over the period of seven years? The considerations undertaken in the work are of theoretical and empirical nature; research methods common for this type of studies were applied: critical analysis of the literature on the subject and analysis of published empirical secondary data using the decision trees method.

The role of services in the economy

Services are currently the subject of research in many scientific disciplines — economics, sociology, geography, etc. The service sector is the largest in the economic world in terms of added value and is especially important in highly developed economies. It covers a wide range of tangible and intangible services (from office cleaning, through concerts, to surgery). In the economy, we can distinguish the so-called primary sector, including agricultural and mining activities, the secondary sector, which covers production and economic activities that facilitate the creation of material goods from raw materials provided by the primary sector. The service sector, although classified as the third in terms of hierarchy, accounts for the largest part of global economic activity.

Unfortunately, the term "service" is not precisely defined; it does not cover all types of services, and so, for example, the World Trade Organization (WTO) uses

a list or catalog of services which, together with statistics on service turnover developed by the International Monetary Fund (IMF), is the basis of many economic analyses (Szymańska, 2015, 15).

The concept of a service can be defined in various ways. In economic theory, it is described as an activity performed or an intangible product. In the economic cycle, services are treated as a commodity and it is assumed that there is a process of producing services in which a specific object is involved as a key. The object may be living or non-living. A living object is most often a human being, while a non-living one — a machine. There are various reasons why defining services poses problems. There is great variety among service activities. Every month, newer and newer services designed to satisfy various human needs are created. The current reality, made even more challenging by Covid, does not help either, especially when some services are accompanied by material goods, and vice versa. The difficulty in defining services results from their characteristics, i.e., their immateriality, heterogeneity, inseparability, and impermanence.

According to Statistics Poland (Główny Urząd Statystyczny, 2021b), services include all activities performed for the benefit of economic units conducting activities of a productive nature, i.e., services for the purposes of production that do not directly create new material goods and all activities provided for the benefit of national economy units and for the benefit of the population, intended for individual, collective, and the general public consumption. A service is also any activity one party can offer another; it is intangible and does not lead to any property. Its production may or may not be related to a physical product (Kotler and Keller, 2011, 426).

Services cover more than two-thirds of the GDP of highly developed countries. They constitute a dynamically developing sector of economies, based on the use of human capital and characterized by a high saturation with new technologies.

In the economies of medium and highly developed countries, one can notice an increase in the importance of the service sector and the growing role of knowledge manifested in the creation of technological and social innovations. Theoretical considerations on the change in the role of individual economic sectors in economic growth are focused on the reasons for the reallocation of resources between sectors such as agriculture, processing industry and services. There are two main factors determining the progress of countries through the various stages of development: the increase in real national income per capita and the pace of growth in labor productivity in individual sectors, including the service sector.

When analyzing the services sector, it becomes crucial to explain the structure of international trade in services, which includes: production-related services provided through the use of physical inputs that belong to other entities (goods for processing purposes), maintenance and repair services, transport services provided by EU residents to non-residents of EU or vice versa, including passenger, freight, and ancillary services such as cargo handling, packing and repacking,

towing not covered by freight services, pilotage and navigational assistance to carriers, air traffic control, emergency services, broker fees, etc.; journeys which essentially involve goods and services that EU-citizen travelers purchase from non-EU residents, or vice versa; and other services, which include construction, insurance and pensions, finances, fees for the use of intellectual property not elsewhere included, telecommunication, computer and information, and other business services (which include research and development services, consultancy services related with management, technical, and other services related to trade, individual, cultural, and recreational services, as well as public administration services not elsewhere included) (Eurostat Statistics Explained, 2017).

For the purpose of the study, the following types of services were used: information and communication, activities related to accommodation and catering services, wholesale and retail trade, repair of motor vehicles and motorcycles, transport and storage, activities in the field of administration services and support activities, professional and scientific activities, as well as technical.

Conditions for the operation of the services sector, with particular emphasis on the COVID-19 pandemic — an outline of the problem

While the conditions for the functioning of economic entities in 2015, and especially in 2019, were characterized by stability, this cannot be said for the years 2020 and 2021, when the "peace" in many industries was disturbed by the pandemic. It cannot be denied that any entity operating in the market would like to conduct its activities in an environment free from elements of risk. The unpredictable COVID-19 epidemic, considered in some scientific sources to be the black swan of the business cycle (Zelek, 2021, 16), caused disillusionment in this respect, triggering an economic recession. The fact that the pandemic had a global impact on the economy was reflected in three sectors of the economy. This includes the services sector, the global collapse of which was mainly caused by a significant decline in activity, trade, and investment stemming from restrictions, low demand, and lower energy prices (European Central Bank, 2021). These are only examples of the effects of a number of factors related to the pandemic that are the subject of this study.

When analyzing the data for this period, it is considered that in 2020, the real GDP of the eurozone decreased by 6.6% (European Central Bank, 2021), and the annual total inflation rate decreased to 0.3%, from 1.2% in 2019. In developed countries, inflation fell to the level of 0.7%, which means it was by 0.7 percentage points lower than in 2019 and by 1.3 percentage points lower than in 2018. However, in emerging market economies, inflation remained at the level of 5.1% from

the previous year. For emerging Asian economies, inflation slightly decreased by 0.2 percentage points, to 3.1% (Główny Urząd Statystyczny, 2021a, 47). There was a decline in the growth rate of the volume of global trade in goods in 2020, which was negative and amounted to -5.4% (both export and import decreased by 5.4%), thus it was lower than the year before, when the value was at 5.1%.

For the countries of Central and Eastern Europe discussed here, inflation fell by 0.8 percentage points to the level of 5.4% (Statistics Poland, 2021a, 47). In individual countries in this region, the decline in GDP in 2020 amounted to (Gołębiowska, 2021, 1):

a) over 8% in Croatia — this is the third worst result in the entire European Union, a higher level of recession was recorded only in Spain and Italy,

b) ca. 5–6% in Hungary, Slovakia, Slovenia, and the Czech Republic,

c) ca. 4% in Romania and Bulgaria,

d) ca. 3% in Poland, Estonia, and Latvia,

e) less than 1% in Lithuania — this is the second best result in the entire European Union, after Ireland, which was the only member state to record economic growth.

These changes were accompanied by the changes in unemployment rate. In almost all Central and Eastern European countries — except Poland — the unemployment rate increased compared to the previous year. In individual countries, it amounted to:

a) ca. 8% in Croatia, Latvia, and Lithuania,

b) ca. 7% in Slovakia and Estonia,

c) ca. 4–5% in Bulgaria, Romania, Slovenia, and Hungary,

d) ca. 3% in Poland and the Czech Republic.

Not all industries have been equally restricted. The sectors most affected are wholesale and retail, accommodation and food services, transport and hospitality, and other sectors in which women tend to be over-represented (European Central Bank, 2021).

Another consequence of the COVID-19 pandemic in 2020 was the decline in the value of foreign direct investment (FDI) in the world. This value amounted to USD 998.9 billion, thus, it decreased by USD 531.3 billion (a decrease by 34.7% compared to the previous year). Foreign direct investments in developed countries in 2020 accounted for 31.3% of the global FDI inflow, and compared to 2019, they decreased by USD 436.8 billion (58.3%).

The socio-economic development of states depends on many elements such as political, economic and cultural factors, access to natural resources or communication routes. In addition, the development of new technologies results in: reduction of transport costs, increase in production processes' efficiency, introduction of modern services as well as increased access to education. Consequently, the economies of countries adopt different development patterns, which is reflected in the changes in their socio-economic structures.

The study examines the development patterns of Central European EU countries in the structure of trade in services between 2015–2021. For this purpose, the method of classification and regression trees was used.

Research methodology

The main advantage of the method used (classification and regression trees) is its direct interpretability — clear methodology of building regression trees. More importantly — this procedure allows for analysis based on quantitative and qualitative variables (Dudek, 2014, 108).

The regression tree is created by repeatedly performing the following steps on each node: finding the split point for each predictor, finding the best node split criterion, splitting a node using the best split found in the previous step (if the rules to stop splitting are not met).

The best split maximizes the split criterion $\Delta i\,(s, t)$. When the dependent variable Y is continuous, the split criterion constitutes the least squares deviation:

$$i(t)=\frac{\Sigma_{n\in q(t)} w_n f_n (y_n-\bar{y}(t))^2}{\Sigma_{n\in q(t)} w_n f_n} \qquad (1)$$

where

$$\bar{y}(t)=\frac{\Sigma_{n\in q(t)} w_n f_n y_n}{N_w(t)} \qquad (2)$$

Y — dependent variable
X — set of predictive variables
q (t) — training samples located in node t
w_n — case weight related to case n
f_n — frequency weight related to case n
s — split
t — node
s* — the best split

Tree development ends when at least one of the stopping rules is applied:

a) all cases in the node have identical values of the dependent variable;

b) all cases in the node have identical values for each predictor;

c) the tree depth reaches the maximum depth limit (imposed by the researcher);

d) as a result of node fragmentation, a slave node will be created, the size of which is smaller than its minimum size;

e) for the best split s* of the node t, the split determinant $\Delta I\,(s^*, t) = p(t)\Delta i(s^*,t)$ is smaller than the minimum criterion defined by the researcher.

The size of regression trees can be reduced by comparing the redistribution cost coefficients with the error coefficient computed on the test set using multiple

cross-validation (Bal-Domańska, 2012, 513). The decision tree for the purposes of the study was made using the Statistica software. For the structure of turnover in the services sector, the dependent variable constituted the dynamics of the gross value added of services in relation to 2014.

Regression tree for the structure of turnover in the service sector — research results

The data used for the study is sourced from the Eurostat database. On the basis of the obtained records, the structure of turnover in services was created, which consisted of the following variables: wholesale and retail trade, repair of motor vehicles and motorcycles; transportation and storage; activities related to accommodation and catering services; information and communication; professional, scientific and technical activities; activities in the field of administration services and supporting activities. The objects were divided into nodes using the regression trees method (Figure 1).

In order to simplify the presentation of the results, symbols (from U1 to U6) were assigned to the names of the variables, which were used to present the test results.

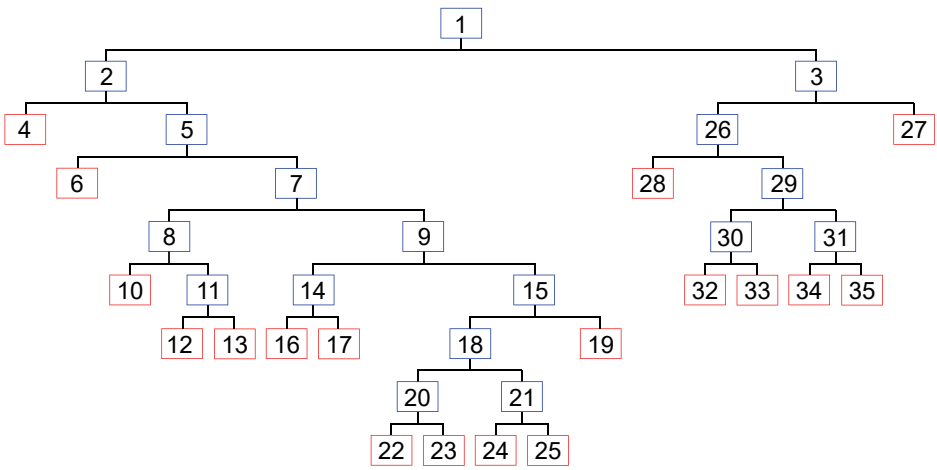

Figure 1. Regression tree for the structure of turnover in services in Central European countries of the European Union

Rectangles indicate the nodes and the numbers assigned to them. End nodes are marked in red.

Source: Own study based on EUROSTAT in 2021 in the Statistica program.

The graphic division of the obtained tree in numerical terms is presented in Table 1.

Table 1. Construction of a regression tree for the structure of turnover in services in Central European countries of the European Union

Node number	Left branch (number)	Right branch (number)	Node size	Average pace of gross value added of the service sector for the node	Variance of pace of gross value added of the service sector for the node	Splitting variable	Split point
1	2	3	77	0.268921	0.032922	U4*	0.072950
2	4	5	48	0.214440	0.017768	U3*	0.015650
3	26	27	29	0.359097	0.044960	U1*	0.683950
4			4	0.415275	0.004975		
5	6	7	44	0.196182	0.014930	U3*	0.017350
6			4	0.080050	0.005440		
7	8	9	40	0.207795	0.014396	U4*	0.059700
8	10	11	12	0.149133	0.010454	U1*	0.661200
9	14	15	28	0.232936	0.013978	U5*	0.051650
10			2	0.332400	0.002304		
11	12	13	10	0.112480	0.004024	U6*	0.031750
12			3	0.055900	0.000235		
13			7	0.136729	0.003687		
14	16	17	8	0.321188	0.013411	U4*	0.064750
15	18	19	20	0.197635	0.009844	U2*	0.115100
16			4	0.226575	0.005984		
17			4	0.415800	0.002935		
18	20	21	17	0.177576	0.008440	U6*	0.038300
19			3	0.311300	0.002598		
20	22	23	8	0.127163	0.004005	U1*	0.659150
21	24	25	9	0.222389	0.008115	U3*	0.019850
22			4	0.084525	0.001816		
23			4	0.169800	0.002557		
24			2	0.328800	0.000151		
25			7	0.191986	0.006231		
26	28	29	22	0.273223	0.025650	U3*	0.020450
27			7	0.628986	0.009633		
28			4	0.443950	0.013772		
29	30	31	18	0.235283	0.020373	U5*	0.081800
30	32	33	9	0.158144	0.007475	U5*	0.068150
31	34	35	9	0.312422	0.021371	U5*	0.100950
32			3	0.250900	0.001443		

Node number	Left branch (number)	Right branch (number)	Node size	Average pace of gross value added of the service sector for the node	Variance of pace of gross value added of the service sector for the node	Splitting variable	Split point
33			6	0.111767	0.004037		
34			6	0.400867	0.004648		
35			3	0.135533	0.007881		

*U1 — Wholesale and retail trade, repair of motor vehicles and motorcycles
*U2 — Transport and storage; *U3 — Accommodation and food service activities
*U4 — Information and communication; *U5 — Professional, scientific and technical activities
*U6 — Business administration and support activities

Source: Own study based on EUROSTAT in 2021 in the Statistica program.

The fourth node containing 4 observations was distinguished on the basis of the U4 variable constituting less than 7.29%. Additionally, the value of the U3 component was less than 1.56%.

Four observations belonged to node 6. It was characterized by similar parameters to the fourth group. The U4 component was lower than 7.29%, and the U3 variable was below 1.73%.

Node 10 consisted of 2 observations. Variable U1 was below 66.12% in the structure of trade in services, and U4 was below 7.29%. At the same time, the U3 component was higher than 1.73%.

Node 12 was made up of 3 observations for which the value of the U6 variable in the structure was below 3.17%, while the U1 component was above 66.12%.

Node 13 (7 observations) was composed of objects in which the value of the U6 variable was higher than 3.17%, and the value of the U1 component was over 66.12%. At the same time, the average value of the U4 variable was lower than 5.97%, and U3 was higher than 1.73%.

In nodes 16 (4 objects) and 17 (4 objects), the U4 component was above 5.97% but was not higher than 7.29%, while the U5 variable accounted for less than 5.16%. Additionally, these nodes were characterized by a higher value of the U3 component than 1.73%.

Node 19, which consisted of 3 observations, was characterized by the share of the U2 variable constituting on average above 11.51% and the U5 component exceeding 5.16%. At the same time, the variable U3 was higher than 1.73%, and the U4 component constituted over 5.97% but not more than 7.29%.

Node 22 (4 observations) was characterized by the U1 component value above 65.91%. The U6 variable was below 3.83%, at the same time the U2 variable was lower than 11.51%, and the share of U5 was higher than 5.16% in this node. At the same time, the U4 component accounted for over 5.97% but not more than 7.29%.

For node 23 composed of 4 objects, the share of the U1 variable was higher than 65.59%, while the U4 component was above 5.97%, but not more than 7.29%. Moreover, the variable U6 was less than 3.83% and the variable U2 was less than 11.51% at this node.

Nodes 24 (2 observations) and 25 (7 observations) had similar characteristics. The U3 component was higher than 1.73%, while the U2 variable was below 11.51%. Additionally, in nodes 24 and 25 the share of U4 was over 5.97%, but not more than 7.29%, while the U6 component was higher than 3.83%.

The highest mean value of the U1 variable was characteristic for node 27 (7 observations). The U4 component was above 7.29% in this node.

Node 28 (4 observations) had a lower value of the U1 variable than 68.39%. At the same time, the average value of the U3 component was below 2.04%, and the share of U4 was higher than 7.29.

Nodes 32 (3 observations) and 33 (6 observations) were characterized by similar mean values of the components. The U5 component for them was lower than 8.18%. Moreover, the variable U3 was over 2.04%, and U4 was over 7.29%.

In nodes 34 (6 observations) and 35 (3 observations), it was noted that the U5 component was higher than 8.18%. At the same time, the variable U3 accounted for over 2.04% and U4 was over 7.29%.

As a result of the division in the set of observations, 18 terminal nodes presented in Table 2 were obtained.

Table 2. Characteristics of variables in terminal nodes separated for the structure of turnover in services according to the rate of gross value added of services

Node number	Average values of the components of the structure of turnover in services (percentage values)					
	U1*	U2*	U3*	U4*	U5*	U6*
4	69.40	15.29	1.42	5.60	5.15	3.15
6	71.60	12.13	1.67	5.80	5.43	3.38
10	65.21	19.38	1.98	4.76	4.52	4.18
12	72.60	12.78	2.29	5.28	4.18	2.87
13	68.92	15.20	2.21	5.25	4.53	3.90
16	71.76	11.65	2.70	6.19	4.35	3.36
17	71.70	10.57	2.81	6.81	4.68	3.43
19	65.78	11.58	3.19	6.77	9.85	2.84
22	65.53	10.74	4.72	6.88	8.70	3.44
23	70.27	10.51	2.61	6.67	6.40	3.55
24	65.68	10.12	1.77	6.89	9.03	6.52
25	65.94	10.37	2.46	6.94	8.87	5.42
27	71.43	9.83	2.41	7.53	5.48	3.31
28	65.74	11.02	1.87	8.38	8.00	5.00

Node number	Average values of the components of the structure of turnover in services (percentage values)					
	U1*	U2*	U3*	U4*	U5*	U6*
32	65.24	8.87	7.21	8.40	6.48	3.80
33	64.52	10.55	4.64	7.90	7.59	4.82
34	64.30	10.57	2.81	7.91	8.57	5.84
35	61.74	10.29	2.21	7.60	11.46	6.70

*U1 — Wholesale and retail trade, repair of motor vehicles and motorcycles
*U2 — Transport and storage; *U3 — Accommodation and food service activities
*U4 — Information and communication; *U5 — Professional, scientific and technical activities
*U6 — Business administration and support activities

Source: Own study based on EUROSTAT in 2021 in the Statistica program.

Node separation allowed for the creation of more complex groups — classes (Table 2). The first class was built on data from nodes 27, 28, 32, and 3. Its main feature was share of the U4 component, which accounted more than 7.29 (nodes constituting Class I are marked in orange in Table 2).

The second class was also created, to which nodes 34 and 35 were assigned. The variable U5 share in this class was higher than 8.18 (nodes constituting Class II are marked in blue in Table 2).

A third class was formed and included nodes 4, 6, 10, 12, 13, 16, 17, 19, 22, 23, 24, and 25. Their observation did not show typical directions of change (nodes constituting Class III are marked in gray). In Class III, it is possible to identify nodes 19, 22, 24, and 25, where the average of the U5 variable was higher than 8.18 (values marked in yellow in Table 2).

Node 19 included observations of the structure of Slovenia in 2019–2021. In the specified years, the country did not manifest changes in structure towards a significantly higher or lower U5 variable share in the structure of services turnover. This was also true for the other variables — the country showed stability in structure in 2019–2021. In addition, this node was extracted on U2 variable basis. Therefore, it was assigned to Class III.

A similar situation occurred in node 22, which included structure observations for Slovenia in 2015–2017 and Croatia in 2016. In this node, structure of turnover in Slovenia's services did not change significantly — so the country was assigned to Class III. Croatia's economy, on the other hand, experienced changes because it moved to a node where the average share of the U4 variable was lower than 7.29. The country changed its class affiliation — in 2016, it moved from Class I to Class III. Additionally, node 22 was extracted based on the U1 variable.

Node 25 included the Czech Republic from 2015 to 2017, and during this period it did not show significant changes in the structure of services turnover. Despite the fairly high average variable U5 value (about 8.87), no significant changes were observed in its value in structure of turnover in services in the Czech

economy. A similar situation applied to Slovakia (in 2017–2018) and Poland (in 2018–2019). They belonged to node 25, and in the years under study, they did not manifest typical changes in the structure of turnover in services. It should be noted that node 25 was extracted based on variable U3.

Node 24 included 2 observations — Poland in 2020 and Slovakia in 2021. Poland throughout most of the studied period was characterized by similar average component values of turnover in services structure — that is why it was assigned to Class III (it did not manifest characteristic directions of changes in the variables). In Slovakia, the value of the U4 component fell by about 1.2 in 2021. It moved to Class III from Class I.

The variables that have been used as the characteristics of the first and second classes include services which encompass the broadly understood development of modern technologies. The component of information and communication includes, i.a., hardware, software, and technical means used for the purpose of communication (Eurostat Statistics Explained, 2016). On the other hand, the variable of professional, scientific, and technical activities concerns mainly sectors in which work requires high qualifications. These include, i.a., technical studies and analysis, scientific research and development, as well as professional services (Eurostat Statistics Explained, 2022).

The component of professional, scientific, and technical activity had the greatest impact on the rate of changes in the gross value added of services. The variable of wholesale and retail trade had a large predictive property, alongside repair of motor vehicles and motorcycles. The variables with a lower rank for changes in the rate of gross value added were: activities related to accommodation and catering services, information, as well as information and communication (Table 3).

Table 3. Significance of discriminant variables at the stage of creating a regression tree for the structure of turnover in the service sectors in Central European countries of the European Union

Variable	Significance
U5 — Professional, scientific and technical activity	100
U1 — Wholesale and retail trade; repair of motor vehicles and motorcycles	94
U3 — Activities related to accommodation and food service	76
U4 — Information and communication	71
U6 — Business administration and support activities	70
U2 — Transport and storage	58

Source: Own study based on EUROSTAT 2021 data in the Statistica program.

The analysis of the obtained regression tree showed that some countries (Bulgaria, the Czech Republic, Estonia, and Romania) migrated to classes characterized by higher values of the U5 and U4 variables (Table 4) in the last periods of the study. This proved the transformations taking place in the structures of service turnover in the analyzed economies.

Structural changes in turnovers of services aimed at increasing the share of variables relating to high-tech sectors were not observed in all of the countries studied. The structures in countries such as Latvia, Lithuania, Poland, and Slovenia did not show any significant changes in the components of the structure, including information and communication as well as professional, scientific, and technical activities. Additionally, the study showed that the Hungarian economy has transformed — an increase in the component of professional, scientific and technical activity was observed in the structure of turnover in services. In contrast, the Czech Republic migrated to a class with a higher share of the information and communication variable in the last years of the study.

The structure of turnover in services in Croatia did not show any significant changes compared to other analyzed economies. This country was characterized by relatively high average values of the information and communication component in 2015 and from 2017 to 2021.

Moreover, numerous migrations of Slovakia between the designated classes were observed. This means that the Slovak economy underwent transformations which were difficult to interpret.

Table 4. Variability of selected countries over time on the basis of classes distinguished using the regression trees method for the structure of turnover in services

Year / State	2015	2016	2017	2018	2019	2020	2021
Bulgaria	III	III	III	III	III	I	I
The Czech Republic	III	III	III	II	II	I	I
Estonia	III	III	III	III	III	I	I
Croatia	I	III	I	I	I	I	I
Latvia	III	III	III	III	III	III	III
Lithuania	III	III	III	III	III	III	III
Hungary	I	I	I	II	II	II	II
Poland	III	III	III	III	III	III	III
Romania	III	III	III	I	I	I	I
Slovenia	III	III	III	III	III	III	III
Slovakia	II	II	III	III	II	I	III

Signs I, II or III denote distinguished classes belonging to the country's observations for the year.

Source: Own study based on the research results.

Discussion

The conclusions that can be drawn from the research on the service sector of the post-pandemic market in Central and Eastern Europe constitute an important point in the discussion. There is a clear division of countries into those which have been hit hard by the crisis and are economically weaker (Southern and Eastern

Europe), and those which can easily afford the costs of the crisis due to the unequal flow of capital within the single market , as their safe haven status allows them to draw in funds from other EU and euro area countries (Northern and Western Europe) (Picek, 2020, 325–331). By following the effects of the COVID-19 pandemic, processes of economic renewal are noticed, among which the restructuring of economic sectors is a necessary, expected, and naturally appropriate, important point. As presented by Mączyńska and Pysz (2021, 233), the reorganization of the sectors will be aimed at not only sustainable development, diversification of production, changes in the consumer goods sector, digital labor market, but above all the digital economy (Table 5).

Table 5. Stages of the impact of a pandemic on the economy

Administrative limitations →	Staged restrictions removal →	Rebuilding the economy →	Business continuity — reorganization
1–3 months	3–6 months	12–24 months	—
freezing the economy	gradually eliminating restrictive bans	recovering from economic losses	the new economic reality
focusing efforts on pandemic reduction	opening/starting previously closed businesses	structural reforms	digital economy
mobility restriction, social distance, quarantine	low tendency to invest and consume	sectoral restructuration	sustainable development
restriction of business activities decline in population income and reduction in consumption	increasing health care spending	public investments	changing consumption/food habits — increasing demand for organic food
			increasing the role of remote work
			limitation on business travel
			limitation on business travel
Government support and stimulatory packages → → → fiscal, monetary, health policy → → →			

The arrows in the column headings indicate the transition from one stage to another.

These stages are accompanied by government support in the form of aid and stimulus packages regarding fiscal, proper or systemic policy. Therefore, arrows have been added to the last row of the table to represent the process during each of the four stages (from *Administrative Restriction* to *Business Continuity — Reorganization*).

Source: Mączyńska and Pysz, 2021, 233.

It is worth emphasizing that the conclusions from the analysis of the structure of turnover in services in Central European EU countries in 2015–2021, from the economic growth of the discussed areas stopped by the COVID-19 pandemic (but also the current war in Ukraine), can be used to shape the policy of reconstruction and restructuring of the post-pandemic realty. Such solutions should include intensive recovery programs, such as government plans to stimulate the economy, reconstruction plans, Recovery and Resilience Facility, Council country-specific recommendations, the Digital Compass (target of the EU for all populated areas to have 5G coverage by 2030). Changes in the structure of sectors and diversification of production are clearly visible today as a direction of change, as countries that had less diversified economies — e.g., those dependent on tourism — suffered the most (Carraro et al., 2022, 106).

Another important issue raised in the article is the level of development of the high-tech sectors in the discussed countries. The transformations taking place in this sector, initiated before the pandemic, accelerated dynamically as a result of global lockdowns. The research methodology includes such measures as: Frontier Technology Index ("gig economy"), index of digital economy and digital society, or a 'readiness index' (comprising five building blocks: ICT deployment, skills, R&D activity, industry activity, and access to finance). According to the research published by the UN (United Nations Conference on Trade and Development, 2021, 137) presented in Table 6, three of the countries discussed in this article are in the upper-middle value range, i.e. Romania, Bulgaria, and Croatia, while all the others belong to highly developed countries in this area. They rank low compared to the European Union, but are in the lead when compared to the world's economies (158 participating in the study), which are also numerously represented in the lower-middle and low categories.

Table 6. Results of the readiness for frontier technologies index (index score ranking — scale of 0 to 1)

Country name	Total score	Total ranking	Score group	ICT ranking	Skills ranking	R&D ranking	Industry ranking	Finance ranking
United States of America	1.00	1	high	14	17	2	20	2
Switzerland	0.97	2	high	7	13	13	3	3
United Kingdom	0.96	3	high	17	12	6	11	14
Sweden	0.96	4	high	1	7	16	15	16
Singapore	0.95	5	high	4	9	18	4	18
Netherlands	0.95	6	high	6	10	15	8	23
Republic of Korea	0.93	7	high	19	27	3	9	8

Country name	Total score	Total ranking	Score group	ICT ranking	Skills ranking	R&D ranking	Industry ranking	Finance ranking
Ireland	0.92	8	high	24	6	21	1	87
Germany	0.92	9	high	23	16	5	10	39
Denmark	0.92	10	high	2	4	25	21	5
Czechia	0.75	26	high	30	23	32	18	72
Poland	0.73	28	high	32	30	30	32	70
Estonia	0.72	29	high	15	20	59	31	61
Slovenia	0.69	33	high	28	15	62	29	84
Slovakia	0.69	36	high	21	47	44	23	59
Hungary	0.67	37	high	27	43	48	16	99
Lithuania	0.65	39	high	25	24	54	48	88
Latvia	0.65	40	high	20	29	75	37	92
Romania	0.60	45	upper-middle	44	70	34	38	115
Bulgaria	0.57	51	upper-middle	53	48	65	41	73
Croatia [the last UE country]	0.56	52	upper-middle	46	39	76	47	66
Albania [the last European country]	0.38	85	lower-middle	59	78	105	106	98
Dem. Rep. of the Congo [the last position]	0.00	158	low	154	138	153	125	155

Source: United Nations Conference on Trade and Development, 2021, 137.

Moreover, for the EU's Digital Economy and Society Index (European Commission, 2021), Europe's starting point for these changes is heterogeneity in the digital economy. In terms of services, the digital integration of technology (business digitization, e-commerce, AI, cloud services) and digital public services (eGovernment) (Carraro et al., 2022, 95) are taken into account. The discussed countries of Central and Eastern Europe are among the least developed in terms of this type of services (European Commission, 2021, 19).

During the discussed period, Poland recorded a regression in the scope of the analyzed group of services. Taking into account the losses caused by the pandemic in the euro area, countries such as Latvia, Slovenia and Slovakia (but also Estonia, Greece, Italy, Cyprus, Portugal) spent a relatively large part of their EU aid funds (RRF) on projects in the area of socio-economic resilience. By contrast, "Belgium, Germany, Ireland, Luxembourg, Malta, Austria and Finland have invested significantly more in green and/or digital transition" (Bańkowski et al., 2022, 17).

The technological gap will therefore widen, which will be reflected in the structure of the service sector (Carraro et al., 2022, 98).

Conclusions

On the basis of the obtained research results, the most favorable assessment of the structure of turnover in the service sector can be attributed to the following countries: Bulgaria, the Czech Republic, Estonia, and Romania. They have proven to belong to classes characterized by higher value in the components: information and communication, professional, scientific, and technical activity in the structure of turnover in services.

In countries such as Latvia, Lithuania, Poland, Slovenia, and Slovakia, undirected structural changes in the turnover of services have taken place. This fact can be attributed to the stagnation of their economies in terms of the development of high-tech services.

It was also concluded that wholesale and retail trade as well as repair of motor vehicles and motorcycles were still an important element of the service sector in the Central European countries of the EU, which was visible in the construction of the regression tree for turnover in services.

The obtained research results confirmed the high heterogeneity of the economies of the analyzed countries in terms of the level and pace of development of high-tech services, and thus in the structure of turnover in services. This made it possible to achieve the goal of the study, proving the complexity of the structure of turnover in services in the analyzed countries.

References

Bal-Domańska, B. (2012). Klasyfikacja podregionów Polski szczebla NUTS-3 ze względu na poziom rozwoju gospodarczego. *Problemy rozwoju regionalnego*, (244), 513.

Bańkowski, K., Bouabdallah, O., Domingues Semeano, J., Dorrucci, E., Freier, M., Jacquinot, P., Modery, W., Rodríguez-Vives, M., Valenta, V., Zorell, N. (2022). *The Economic Impact of Next Generation EU: A Euro Area Perspective*. Frankfurt am Main: European Central Bank.

Carraro, C., Coeuré, B., Dhand, O., Eichengreen, B., Mills, M., Rey, H., Sapir, A., Schwarzer, D. (2022). *A New Era for Europe: How the European Union Can Make the Most of its Pandemic Recovery, Pursue Sustainable Growth, and Promote Global Stability*. Luxembourg: Publications Office of the European Union. DOI: 10.2765/11297.

Dudek, G. (2014). Prognozowanie krótkoterminowe obciążeń systemów elektroenergetycznych z wykorzystaniem rozmytych drzew regresyjnych. *Przegląd Elektrotechniczny*, 90(4). DOI: 10.12915/pe.2014.04.24.

European Central Bank. (2021). *Raport Roczny EBC 2020*. Retrieved May 11, 2022 from https://www.ecb.europa.eu/pub/annual/html/ar2020~4960fb81ae.pl.html.

European Commission. (2021). *The Digital Economy and Society Index (DESI) 2021*. Retrieved May 28, 2022 from https://ec.europa.eu/newsroom/dae/redirection/document/80563.

Eurostat Statistics Explained. (2016). *Glossary: Information and Communication Technology (ICT)*. Retrieved May 22, 2022 from https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Information_and_communication_technology_(ICT).

Eurostat Statistics Explained. (2017). *Statystyka bilansu płatniczego*. Retrieved May 10, 2022 from https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Archive:Statystyka_bilansu_pC582atniczego&oldid=338611.

Eurostat Statistics Explained. (2022). *Professional, Scientific and Technical Activity Statistics — NACE Rev. 2*. Retrieved May 22, 2022 from https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Professional,_scientific_and_technical_activity_statistics_-_NACE_Rev._2#Structural_profile.

Główny Urząd Statystyczny. (2021a). *Macroeconomic Situation in Poland in the Context of the World Economic Processes in 2020*. Warszawa: Główny Urząd Statystyczny.

Główny Urząd Statystyczny. (2021b). *Statistical Yearbook of the Republic of Poland*. Warszawa: Główny Urząd Statystyczny.

Gołębiowska, M. (2021). Gospodarki Europy Środkowej: różne oblicza pandemii COVID-19. *Komentarze IEŚ*, 383(80). Retrieved May 22, 2022 from https://ies.lublin.pl/komentarze/gospodarki-europy-srodkowej-rozne-oblicza-pandemii-covid-19/.

Ilnicki, D. (2009). *Przestrzenne zróżnicowanie poziomu rozwoju usług w Polsce. Teoretyczne i praktyczne uwarunkowania badań*. Wrocław: Instytut Geografii i Rozwoju Regionalnego Uniwersytetu Wrocławskiego.

Kotler, P., Keller, K.L. (2011). *Marketing Management*. Harlow: Pearson Education.

Mączyńska, E., Pysz, P. (eds.). (2021). *Społeczna Gospodarka Rynkowa w dobie pandemii i postpandemii*. Warszawa: Polskie Towarzystwo Ekonomiczne, Fundacja Konrada Adenauera.

Picek, O. (2020). Spillover effects from Next Generation EU. *Intereconomics*, 55(5), 325–331. DOI: 10.1007/s10272-020-0923-z.

Szymańska, E. (2015). Development of service sector as origin of economic transformation. *Optimum. Studia Ekonomiczne*, 73(1), 97–109. DOI: 10.15290/ose.2015.01.73.09.

United Nations Conference on Trade and Development. (2021). *Technology and Innovation Report 2021: Catching Technological Waves — Innovation with Equity*. Geneva: United Nations. DOI: 10.18356/9789210056588.

Zelek, A. (2021). COVID — czarny łabędź koniunktury w perspektywie najbliższych 2 lat (rozważania słuchaczy Programu MBA). *Zeszyty Naukowe ZPSB Firma I Rynek*, 59(1), 7–18.