The structure of networks of international trade in art in OECD countries

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Abstract

The aim of the paper is to identify the structure of international trade in works of art in OECD countries using the network analysis method. The data was obtained from the OECD foreign trade database for the Harmonised System HS6 trade classification section 97 Works of art, collectors' items and antiques. The analysis was carried out in the UCINET program with the Netdraw data visualization package. The results obtained indicate a significant degree of centralization of international trade in works of art in OECD countries. The central places in the network are occupied by the United States, the United Kingdom, Germany and France, while peripheral positions are taken by: Chile, Czech Republic, Estonia, Hungary, Iceland, Poland, Slovak Republic, and Slovenia. Important nodes that mediate the network are the United States, Germany, Switzerland and the United Kingdom. The network of international trade in works of art in OECD countries has a core / periphery structure. The visualizations of the structure of egocentric networks (ego networks) for selected countries was presented, using the Netdraw program.

JEL classification codes: F6, F14, O57, Z11

Keywords: international trade, art, international trade in art, network analysis, international trade network (ITN), art economics

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1 Introduction

From a theoretical point of view, there are two kinds of flows of works of art between countries: legal and illegal. The subject of this paper is legal foreign trade in works of art indicated in foreign trade statistics and in accordance with applicable legal, national and international regulations. Illegal art trade, taking place in violation of the current legal order, for obvious reasons, can't be a subject to statistical measurement and empirical analysis.

The aim of the article is to identify the structure of international trade in works of art in OECD countries. The network analysis method is proposed to enable an in-depth presentation of trade relations between countries. It provides detailed information on the structure of the network of international trade in works of art. In the network approach, OECD countries will be considered as the elements of the network, while flows of foreign trade will present relations existing between them. Network analysis will enable multi-aspect and multi-level analysis of networks of multilateral trade relations in the considered group of countries. In particular, network analysis allows for the description of the network as a whole, understanding the strength of connections in the network structure, the identification of groups in the network and the analysis of the position of individual elements in the network. An important advantage of network analysis is the ability to visualize the structure of relations existing between individual network elements.

The paper is structured as follows. Section 2 presents a literature review in the field of international trade in works of art. Section 3 describes network analysis as a research methodology used in many fields of scientific research. Section 4 presents the data on which the analysis is based**.** Section 5 is devoted to presentation of empirical results, in particular it contains the results of the index analysis for various artifacts with dichotomization of the art export on different levels, the results of the core / periphery analysis and the results of analysis of egocentric (ego) networks. Lastly, section 6 presents the paper's conclusions.

2 LITERATURE REVIEW

The inspiration to take up the issue of international trade in works of art appeared after the suggestion of M. Blaug, regarding the need to undertake any scientific research in this field of

cultural economics [Blaug, 2001]. The economic literature on international art trade is rather scarce. An overview of literature on international trade in works of art allows to indicate several papers in this field. Bator's work on the illegal art trade takes up the issue of the development of art export prohibition [Bator, 1983]. Moreover, the literature for the matter in question has focused on the presentation of the problem in selected countries i.e.: in France [Marcillon 1990], in Spain [Capos and Soriano, 1990], in Switzerland [Kunitz 2001]. G. Schulze applied the existing trade theories to works of art [Schulze 1999]. A.C. Disdier, S.H. Tai L. Fontagne and T. Mayer have described bilateral trade of cultural goods [Disdier et al., 2009], including a wider range of goods, not only work of art. In recent years, S. Sakarya and D. Büyükarslan explored the role of an artist in the international demand [Sakarya, Büyükarslan, 2013]. The international art trade was also a subject of discussion from legal point of view, presenting international dimensions of export and import control [Nafziger J.A.R., Kirkwood Paterson R., 2014].

3 METHODOLOGY – NETWORK ANALYSIS

The origins of the network approach derive from the sociology of J. Moreno. Nowadays the method of network analysis is widely used in many scientific disciplines: sociology, psychology, anthropology, biology, political science, information technology, economic sciences and management. Theoretical and methodological issues connected with network analysis can be found in the numerous literature [Freeman, 1979; Bonacich, 1987; Wellman, Berkovitz, 1988; Wassermann, Faust, 1994; Borgatti et al. , 2002; Breiger, 2004; Huisman, van Duijn, 2005; Borgatti, 2005; Hanneman, Riddle, 2005; Newman, 2010; Borgatti, Kidwell, 2011; Prell, 2012].

The network approach identifies individual network elements - network nodes (actors, points) and relationships (ties / edges / lines) that occur between them. The network approach to the studied objects allows for multi-aspect understanding of the network structure. First, it enables holistic understanding of the network structure by identifying global properties of the network structure as a whole. Secondly - it enables the extraction of subgroups in the network, i.e. the identification of interconnected groups of network elements (eg. diades, triads, core/periphery structures, clicks). Thirdly - it allows to determine the position of individual elements in the network structure and network analysis from the point of view of each individual element

belonging to the network. Analysis at the node level includes an index analysis, within which indicators describing the network elements and their positions in the network structure are determined. A particular kind of analysis at the node level is the analysis of egocentric networks, conducted from the point of view of each individual element belonging to the network (ego).

Over the past two decades, the network approach is gaining more and more popularity in the analysis of socio-economic phenomena [Serrano, Bogunña, 2003; Martinez-Zarosso, 2003; Serrano et al., 2007; Bhattacharya et al., 2007; Fagiolo, 2010; Barigozzi et al., 2010; Kali, Ryers, 2010; Chaney, 2011; Benedictis, Tajoli, 2011; Duenas, Fagiolo, 2011, Abbate et al. 2012, de Benedictis et al. 2013]. The advantages of using the network method in relation to the analysis of international trade have already been noticed in the literature [Krempel, Plümper, 2003; Fagiolo, 2010; Barigozzi et al., 2010; Kali, Ryers, 2010; Chaney, 2011; Benedictis, Tajoli, 2011; Duenas, Fagiolo, 2011].

It seems that the implementation of the proposed methodological approach to the analysis of international trade in works of art can bring interesting cognitive results. In this approach, the International Trade Network (ITN), can be presented as a graph presenting export / import between countries. The application of network analysis to international trade in works of art will allow to learn about the structure of trade in these specific commodities. M. Zhou, G. Wu and H. presented the structure and formation of top networks in international trade in the period 2001–2010 [Zhou et al, 2016]. Cingolani et all. described countries'' positions in the international global value networks and proposed a three-faceted measure of centrality that captures a country's distinct roles at the upstream, midstream, and downstream stages of the international production process [Cingolani, et all, 2017]. Lovrić et all. use different procedures of social network analysis to demonstrate their applicability to the study of international trade of forest products [Lovrić et. All., 2018].

Network approach to the works of art was employed by T. Yogev and T. Grund to identify a network dynamics and market structure of art fairs [Yogev and Grund, 2012]. Using data on artists and galleries presenting at art fairs they studied the development of the art fair network over three years, 2005–2007. Morgner also treated art fairs as networks [Morgner, 2014] presenting their role with regard to the participating galleries and their interlinking within art fairs.

4 DATA

In order to perform analysis for this study, the data on foreign trade in works of art has been taken from the OECD statistical database (http://www.oecd-ilibrary.org/trade/trade-in-goods/). As an analysis subjects, OECD member countries appear as a country reporter and country partner. The object of trade is the categories of works of art adopted in the international nomenclature of foreign trade HS 6, section XXI Works of art, collectibles and antiques commodity group 97, under the same title, covering six categories of objects. The data was compiled in the form of square matrices, containing in the rows and columns the same elements (OECD countries), ordered in the same order. The 34 x 34 data matrix (34 OECD member countries) has contained data on the value of export of works of art that have undergone the dichotomization procedure at various levels. Network analysis has been carried out in the UCINET 6 program with Netdraw data visualization package [Borgatti, Everett, Freeman, 2002; Halgin, 2008]. The analyzed entities (countries) have be described from the point of view of their relationships in relation to other entities (international trade), and not in terms of their own attributes.

5 EMPIRICAL RESULTS

When applying the network approach to international trade in works of art, it should be assumed that individual OECD member countries will play the role of nodes (actors) in the network, while foreign trade will be treated as one- or two-way relations (ties) between countries. The network of international trade in works of art in OECD countries is presented in Fig. 1.

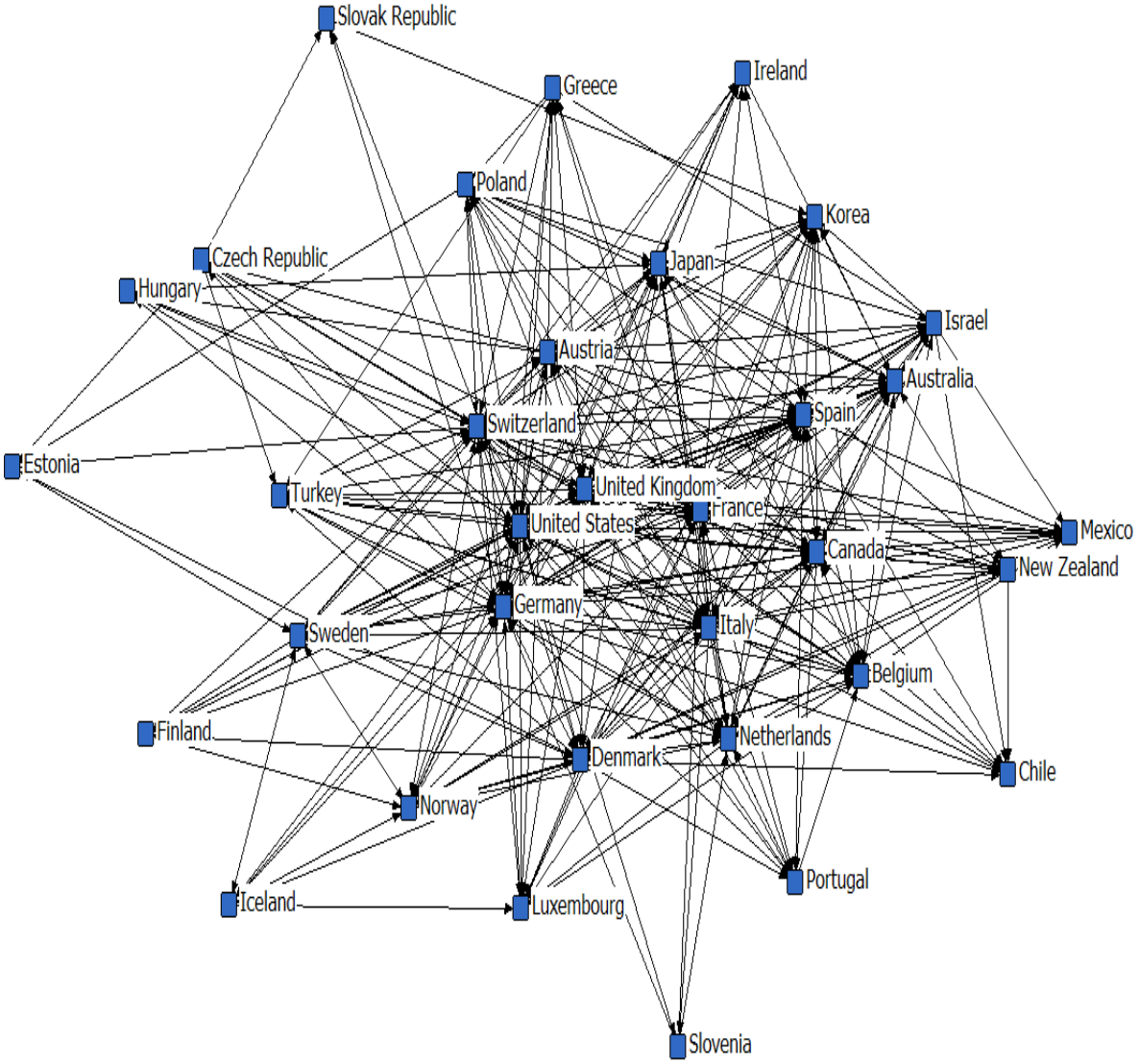

Fig. 1. Network of international trade in art for OECD countries after the dichotomization of art exports at the level of 100,000 €
Source: own study based on the UCINET 6 and Netdraw program.

After dichotomization of export data for works of art at the level of 100,000 euros, all OECD countries form one cohesive network of international trade. The properties of the network, as a whole, are determined by the synthetic network centralization measure, which determines the degree of centralization of the analyzed network in relation to the maximum centralized network of the "star" type. For the discussed network, it is equal 49.81%, which indicates a significant degree of network centralization in the area of art export links in OECD countries. The centrality indicators present the importance of individual objects (countries) in the network structure. Characteristics of the created network will be based on selected measures of network analysis, in particular: degree centrality, closseness centrality, information centrality indicators,

Freeman's mediation ratio (Freeman's betweennes), mediation of flow (flow betweenness), Bonacich's centrality indicator. The results of the index analysis for the network of international trade in works of art in OECD countries are summarized in Table 1.

Table 1. Results of network analysis for international trade in works of art in OECD countries after the dichotomization of art exports at the level of 100,000 €

Country	Degree		Closeness		Freeman's betweenness	Bonacich power
	number	normalized	in	out		
United States	32	96.970	94.286	97.059	200.562	32
Germany	31	93.939	86.842	89.189	105.400	29
United Kingdom	30	90.939	80.488	91.667	79.336	30
Switzerland	29	87.879	84.615	84.615	88.817	27
France	28	84.848	70.213	86.842	38.920	28
Austria	25	75.758	62.264	75000	15.412	22
Italy	25	75.758	66.000	80.488	18.728	25
Denmark	24	72.727	61.111	75.000	35.291	22
Canada	23	69.697	71.739	66.000	18.649	16
Netherlands	22	66.667	68.750	66.000	11.101	16
Spain	22	66.667	64.706	71.739	13.455	20
Belgium	20	60.606	67.347	67.347	8.339	17
Australia	19	57.576	70.213	62.264	6.787	13
Japan	19	57.576	68.750	62.264	9.515	13
Israel	18	54.545	58.929	66000	3.435	16
Korea	16	48.485	61.111	62.264	7.225	13
Sweden	16	48.485	60.000	61.111	14.204	12
Norway	15	45.455	64.706	58.929	6.957	10
Turkey	14	42.424	63.462	54.098	0.622	5
Poland	14	42.424	57.895	56.897	4.714	8
New Zealand	13	39.394	55.000	58.929	0.694	10
Portugal	12	36.364	58.929	56.897	0.000	8
Luxemburg	12	36.364	61.111	52.381	0.675	4
Mexico	11	33.333	58.929	52.381	0.000	4
Greece	10	30.303	55.000	57.895	0.091	9
Chile	9	27.273	56.897	50.769	0.000	2
Czech Republic	9	27.273	54.098	55.932	3.696	7
Ireland	9	27.273	56.897	52.381	0.091	7
Finland	8	24.242	56.897	52.381	0.091	3
Iceland	7	21.212	52.381	54.098	0.143	6
Hungary	6	18.182	52.381	53.226	0.000	4
Estonia	5	15.152	49.254	44.000	0.850	2
Slovenia	5	15.152	51.563	51.563	0.000	3
Slovak Republic	4	12.121	51.563	50.769	0.200	2

Source: own study based on the UCINET 6 program.

At the level of dichotomization of the export of works of art 100,000 €, one coherent network of OECD countries is created. The central places in the network are occupied by the United States, Germany, the United Kingdom, Switzerland and France. The next positions are taken by the following countries: Austria, Italy, Denmark, Canada, Netherlands, Spain, Belgium. The highest degree was obtained by the United States (32), which indicates the connection of this country with 32 other network nodes. The lowest level of the degree index (4) is characteristic for Slovak Republic. It is to be added that closeness indicators point out the peripheral position of Estonia, Slovenia, Slovak Republic, Hungary and Iceland in the presented network. The highest values of Freeman's betweeness coefficient have been obtained by the United States (200.5), Germany (105.4), Switzerland (88.8) and the United Kingdom (79.3). Taking into account Bonacich's alpha power indicators, the following order of countries was obtained, due to their central position in the network: the United States (32), the United Kingdom (30), Germany (29), France (28) and Switzerland (27). The network of international trade in OECD with works of art after the dichotomization of exports at the level of 4 million € is presented in Fig. 2.

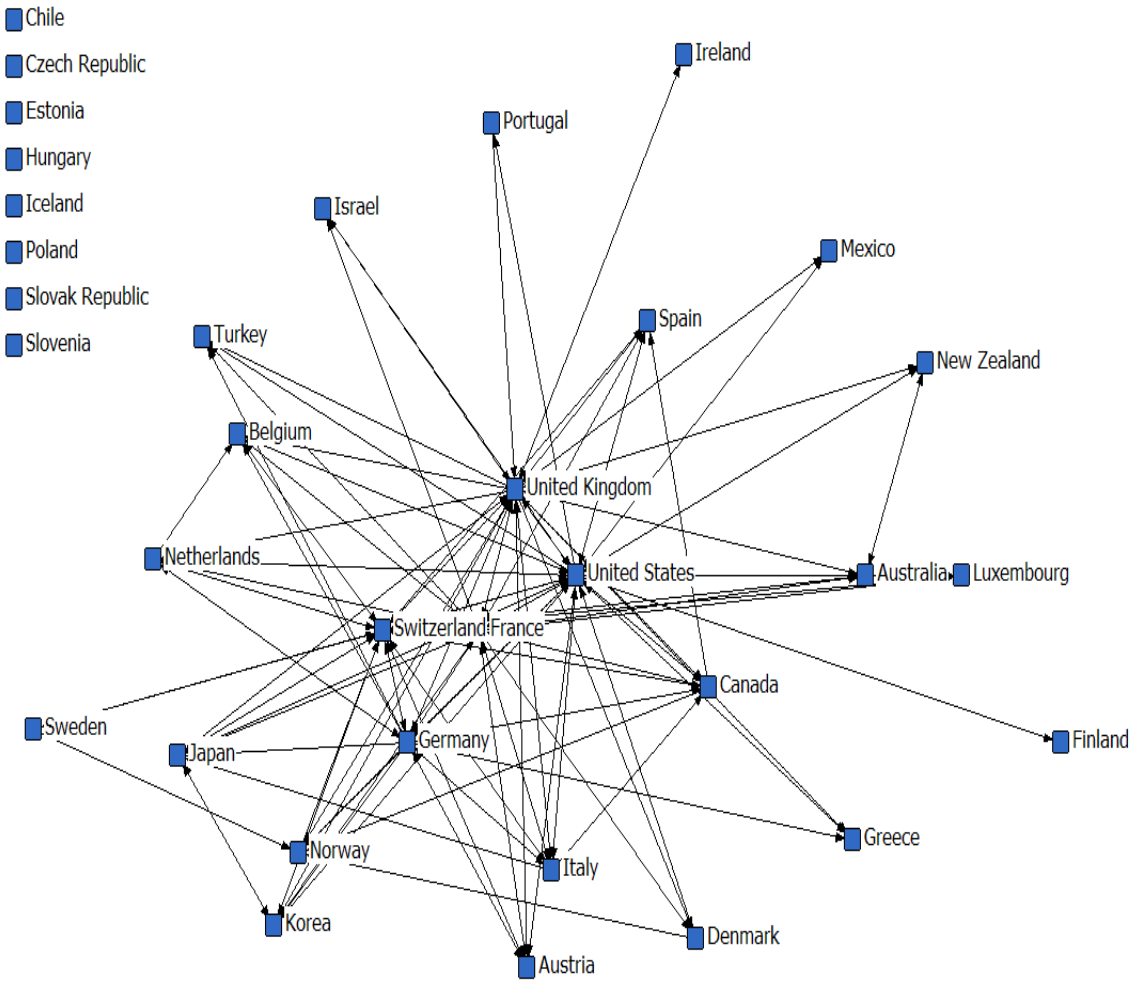

Fig. 2. Network for OECD countries in the field of international trade in works of art in OECD countries after the dichotomization of art exports at the level of 4 million €
Source: own study based on the UCINET 6 Netdraw program.

After the dichotomization of art exports at the level of 4 million euro, a coherent network consists of 28 OECD countries; the rest of countries lie outside the network, as isolated nodes: Chile, Czech Republic, Estonia, Hungary, Iceland, Poland, Slovak Republic, Slovenia. The central positions in the network under consideration are held by the United States (degree 24), the United Kingdom 22, France (17), Switzerland (16), Germany (14). Ireland and Finland are hanging nodes: Ireland is connected to the United Kingdom, Finland to the United States. The peripheral positions in the network are occupied by Mexico, Portugal, New Zealand, Greece, Luxembourg, Israel, Sweden. Network centralization is 59.85%.

An important aspect of the network analysis of international trade in works of art is to learn about the structure of the network from the point of view of the relationships strength of its elements (countries). In network analysis, binary data can be used to describe the relationships existing/ or not existing between its elements. Hence, in the case of a different nature of the

collected data, it is necessary to carry out a dichotomization procedure before entering the data into the network analysis. The choice of the dichotomization level has a significant impact on the number of network elements. The change (increase) in the level of dichotomization of the export in the OECD member countries will lead to a the change (decrease) in the number of countries remaining in the network structure. The analysis of the network structure for different levels of dichotomization will be carried out for the export of works of art. The network created after the dichotomization of art export at the level of 50 million € is presented in Fig. 3.

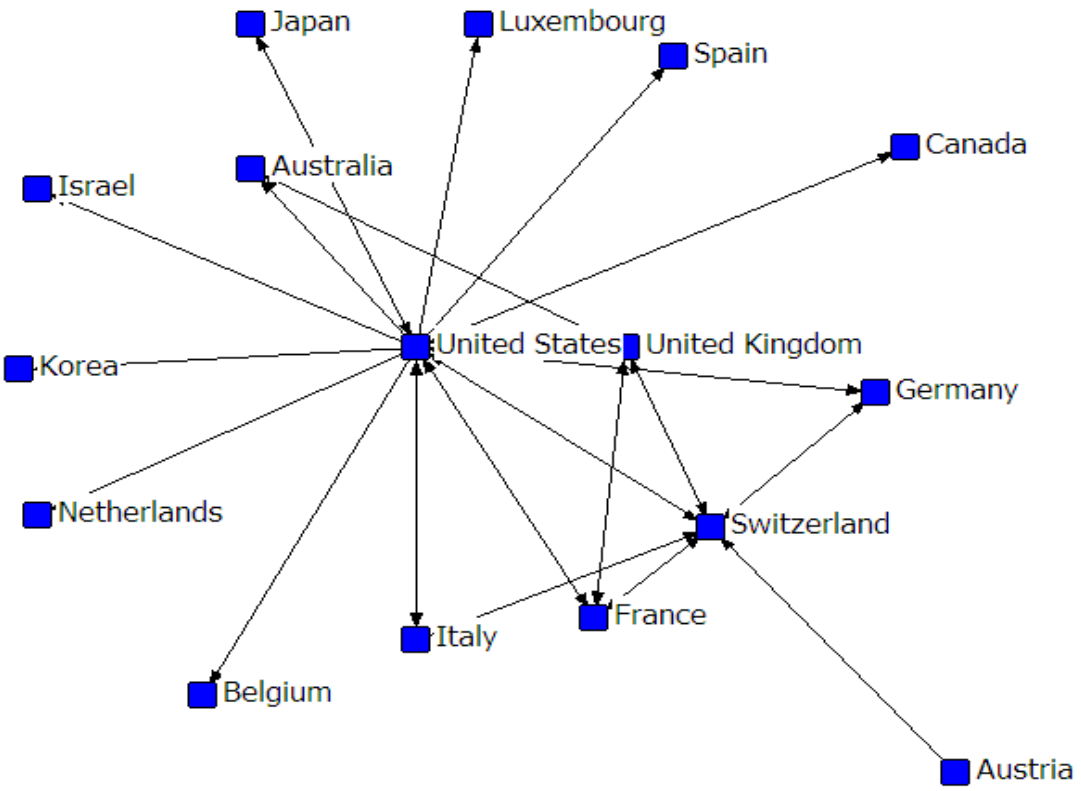

Fig. 3. Network for OECD countries in the field of international trade in works of art (dichotomization of art exports at the level of 50 million €)
Source: own study based on the UCINET 6 and Netdraw program.

The network created after the prior dichotomization of the art export at the level 50 million €, contains sixteen OECD member countries, the others are treated as isolated nodes. The most important countries, from the point of view of international trade in works of art, remain in the network structure. The network includes the following countries: the United States (node rank 14), Switzerland (6), United Kingdom (4) France (3), Germany, Australia and Italy (degree 2), Belgium, Netherlands, Canada, Korea, Spain, Israel, Austria, Luxemburg, Japan (degree 1). The most important intermediary nodes are the United States, Switzerland and Great Britain. The removal of hanging nodes (pendants) leads to receiving the network presented in Fig. 4.

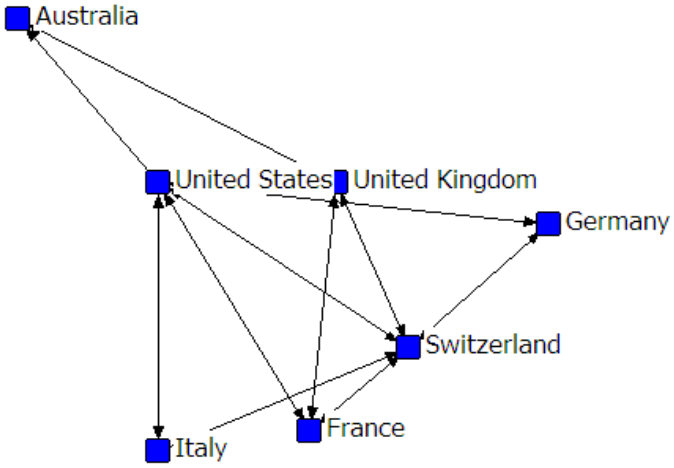

Fig. 4. Network for OECD countries in the field of international trade in works of art (dichotomization of art exports at the level of 50 million €) after removal of hanging nodes (pendants)
Source: own study based on the UCINET 6 and Netdraw program.

An important aspect of network analysis is the identification of its structure. According to the concept of Borgatti and Everett, the network can have a core / periphery structure, if it can be divided into two blocks: core and periphery [Borgatti, Everett, 1999]. In this approach, the elements of the core network are mutually intertwined, while the elements belonging to the periphery have more relationships with the core of the network than among themselves. In the block model core / periphery structure, apart from the core block, the interactions between the elements are much weaker. Core elements are characterized by a structural advantage from the point of view of the existence of the relation of exchange, in comparison to peripheral elements. The results of the analysis are presented in the form of a blocked Blocked Adjacency Matrix, dividing network elements into two blocks: core and periphery. The identification of the core / periphery structure is based on the value of the correlation coefficient between the data set on which the given network is based and the network with the "ideal" core / periphery structure [Hanneman, Riddle, 2005].

Core / periphery analysis leads to the division of network elements into entities constituting the core of the network and peripheral entities from the point of view of international trade in works

of art. Depending on the level of dichotomization of the art export, a different divisions of network elements can be obtained. The Blocked Adjacency Matrix is presented in Fig. 5. The matrix can be divided into four parts, one of which is the core. The core of the network is characterized by the existence of connections (the advantage of the value of 1 in the matrix) between its individual elements. It includes the following countries: Austria, Belgium, Canada, France, Germany, Italy, Japan, Switzerland, the United Kingdom, the United States. The rest of elements remain the peripheral elements of the network (in the considered parts of the matrix, the values of 0 prevail, meaning the lack of relations between the pairs of countries with the adopted level of dichotomization of art export)[2].

[2] In contrast to the core-periphery structure, the group structure (clumpy networks) is distinguished, which consists of several subgroups within each other closely related but weakly connected with each other.

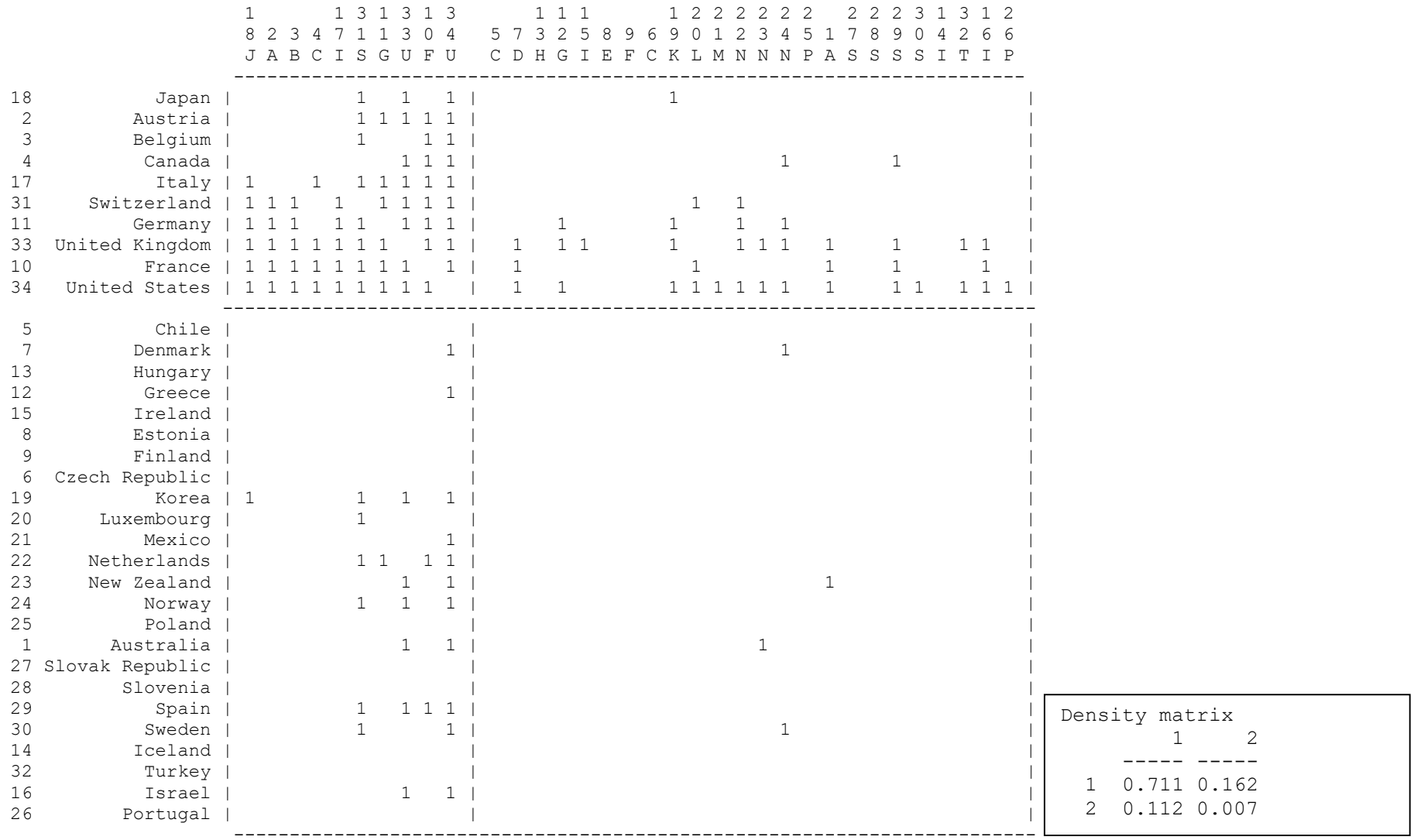

Fig. 5 The results of core / periphery analysis – Blocked Adjacency Matrix
Source: own study based on the UCINET 6 and Netdraw program.

It is worth mentioning that the analysis of the ego network (egocentric network, neighborhood network) is an important aspect of network analysis. It allows to deepen the analysis of the network structure from the point of view of each individual element belonging to the network. The ego network consists of a focal node, nodes connected directly with it (alters) and relations between neighboring nodes (if such relationships exist) [Borgatti S.P, Everett M, 2005; Hanneman R. A., Riddle M., 2005; Prell, 2012]. In this approach, individual network elements / entities are considered in the context of their relationship in relation to other elements / entities. Theoretically, each of the elements of the network can become a focal node of its own ego network. The nodes occupying the central positions in the network have more complex ego networks compared to peripheral nodes, eg. "hanging" nodes (pendants) are connected only to one other network node.

The egocentric networks have be constructed for OECD countries, occupying the central positions in the network of international trade in works of art. The analysis of the ego network has been carried out after the previous procedure of dichotomization of art exports at the level of 50 million €. Fig. 6, 7, 8 present the visualization of the ego networks for the United Kingdom, France and Switzerland.

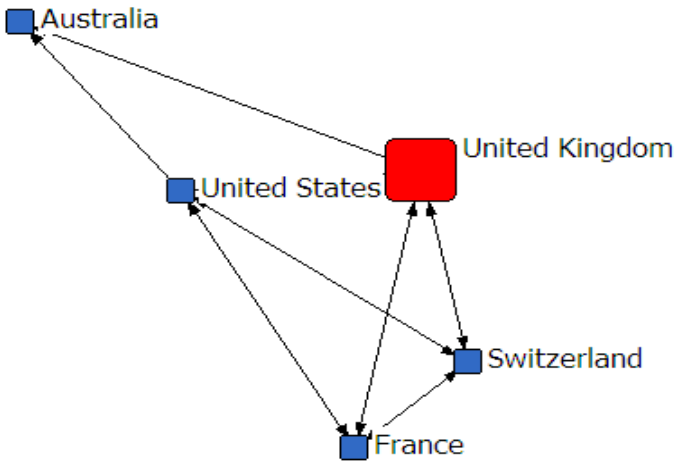

Fig. 6. Ego network for international art trade in Great Britain (dichotomization of art exports at the level of 50 million €)
Source: own study based on the Netdraw program.

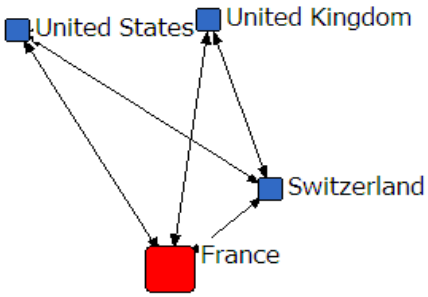

Fig. 7. Ego network for international art trade in France (dichotomization of art exports at the level of 50 million €)
Source: own study based on the Netdraw program.

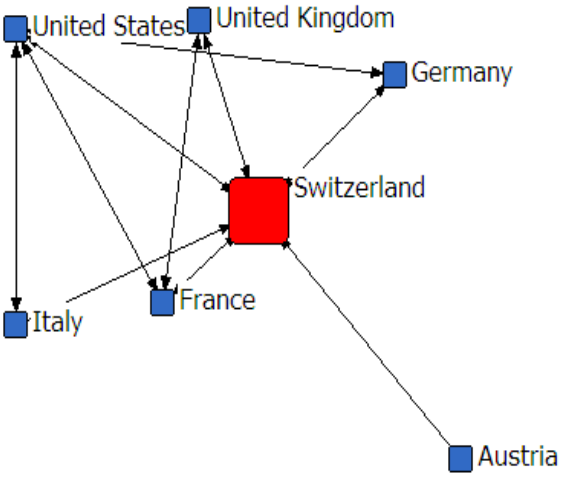

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Fig. 8. Ego network for international art trade in Switzerland (dichotomization of art exports at the level of 50 million €)
Source: own study based on the Netdraw program.

The analysis of the ego network allows to deepen the analysis of the network structure from the point of view of each individual element / OECD country belonging to the network. After the dichotomization of art export at the level of 50 million €, the ego network for France includes four countries, for Switzerland - seven OECD countries. In the Great Britain network, Australia is located; in the Swiss ego network - Germany and Austria. The analysis of the ego network includes the determination of a series of network indicators. The results of the ego network analysis are presented in Table 2.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
		Size	Ties	Pairs	Densit	AvgDis	Diamet	nWeakC	pWeakC	2StepR	ReachE	Broker	nBroke	EgoBet	nEgoBe
1	Australia	5.00	16.00	20.00	80.00	1.20	2.00	1.00	20.00	75.76	30.49	2.00	0.10	0.67	3.33
2	Austria	5.00	20.00	20.00	100.00	1.00	1.00	1.00	20.00	75.76	26.88	0.00	0.00	0.00	0.00
3	Belgium	6.00	28.00	30.00	93.33	1.07	2.00	1.00	16.67	75.76	25.25	1.00	0.03	0.00	0.00
4	Canada	8.00	43.00	56.00	76.79	1.23	2.00	1.00	12.50	75.76	22.32	6.50	0.12	1.00	1.79
5	Chile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	Czech Republic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	Denmark	4.00	10.00	12.00	83.33	1.17	2.00	1.00	25.00	75.76	35.71	1.00	0.08	0.33	2.78
8	Estonia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	Finland	1.00	0.00	0.00		0.00	0.00	1.00	100.00	72.73	100.00	0.00		0.00	
10	France	17.00	90.00	272.00	33.09			1.00	5.88	75.76	17.24	91.00	0.33	25.68	9.44
11	Germany	14.00	79.00	182.00	43.41			1.00	7.14	75.76	18.12	51.50	0.28	8.73	4.80
12	Greece	3.00	6.00	6.00	100.00	1.00	1.00	1.00	33.33	75.76	41.67	0.00	0.00	0.00	0.00
13	Hungary	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	Iceland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	Ireland	1.00	0.00	0.00		0.00	0.00	1.00	100.00	66.67	100.00	0.00		0.00	
16	Israel	3.00	6.00	6.00	100.00	1.00	1.00	1.00	33.33	75.76	39.68	0.00	0.00	0.00	0.00
17	Italy	7.00	36.00	42.00	85.71	1.14	2.00	1.00	14.29	75.76	23.15	3.00	0.07	0.20	0.48
18	Japan	7.00	38.00	42.00	90.48	1.10	2.00	1.00	14.29	75.76	23.58	2.00	0.05	0.17	0.40
19	Korea	6.00	28.00	30.00	93.33	1.07	2.00	1.00	16.67	75.76	25.00	1.00	0.03	0.00	0.00
20	Luxembourg	3.00	6.00	6.00	100.00	1.00	1.00	1.00	33.33	72.73	42.11	0.00	0.00	0.00	0.00
21	Mexico	2.00	2.00	2.00	100.00	1.00	1.00	1.00	50.00	75.76	54.35	0.00	0.00	0.00	0.00
22	Netherlands	6.00	28.00	30.00	93.33	1.07	2.00	1.00	16.67	75.76	25.25	1.00	0.03	0.00	0.00
23	New Zealand	3.00	6.00	6.00	100.00	1.00	1.00	1.00	33.33	75.76	49.02	0.00	0.00	0.00	0.00
24	Norway	7.00	24.00	42.00	57.14	1.43	2.00	1.00	14.29	75.76	27.47	9.00	0.21	1.33	3.17
25	Poland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	Portugal	2.00	2.00	2.00	100.00	1.00	1.00	1.00	50.00	75.76	54.35	0.00	0.00	0.00	0.00
27	Slovak Republic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	Slovenia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	Spain	5.00	19.00	20.00	95.00	1.05	2.00	1.00	20.00	75.76	28.74	0.50	0.03	0.00	0.00
30	Sweden	3.00	5.00	6.00	83.33	1.17	2.00	1.00	33.33	72.73	51.06	0.50	0.08	0.00	0.00
31	Switzerland	16.00	87.00	240.00	36.25			1.00	6.25	75.76	17.24	76.50	0.32	43.62	18.17
32	Turkey	4.00	12.00	12.00	100.00	1.00	1.00	1.00	25.00	75.76	32.47	0.00	0.00	0.00	0.00
33	United Kingdom	22.00	100.00	462.00	21.65			2.00	9.09	75.76	16.13	181.00	0.39	132.68	28.72
34	United States	24.00	100.00	552.00	18.12			2.00	8.33	75.76	15.72	226.00	0.41	233.55	42.31

Table 2. Results of ego network analysis - density measures after dichotomization of art export at the level of 4 million €
Source: printout of the UCINET 6 program

Considering the results summarized in the table, the size index, reflecting the number of neighbor nodes with which the ego is directly related, indicates the highest values for the United States (24), United Kingdom (22), France (17), Switzerland (16), and Germany (14). The number of pairs of neighbor nodes in the ego network (potential relationships) assumes the highest values for the United States and the United Kingdom. The access indicator in two steps indicates that 67-76% of network elements to which the ego has access in two steps. Australia, Austria, Belgium, Canada, France, Germany, Greece, Israel, Italy, Japan, Korea, Mexico, Netherlands, New Zealand Norway, Portugal, Spain, Switzerland, Turkey are combined in two steps from over 75% of OECD countries. In turn, Chile, Czech Republic, Hungary, Iceland, Poland, Slovak Republic and Slovenia have achieved the level of zero equal to the adopted dichotomization level of art export. The brokerage rate for the United States has the highest value by specifying the number of pairs of neighbor nodes that are not directly connected to each other and thus emphasizing the importance of that country's node on the network. The most important intermediary role in the network structure are played by the United States, the United Kingdom, France, and Switzerland.

An important aspect of the analysis of the structure of the ego network is the analysis of structural holes, i.e. the identification of missing connections between pairs of nodes in the ego network. The concept of structural gaps, created by R. Burt, is a generalization of the concept of "strength of weak ties" by M. Granovetter [Granovetter, 1973; Borgatti, Kidwell, 2011; Prell, 2012]. In this approach, network analysis is focused not on the strength of relationships between nodes and their positions in the network, but on the structural properties of the network. In order to identify the existence of structural gaps in the network, a number of measures are used, indicating the disintegration of relations between network elements [Burt, 1992]. Structural gap measures are determined for all network nodes that are treated as the egos (focal nodes). The results of the structural gaps analysis for art export after dichotomization at the level of 4 million € have been presented in Table 3.

	Degree	EffSize	Efficie	Constra	Hierarc	Ego Bet
Australia	5.000	1.750	0.350	0.672	0.069	0.667
Austria	5.000	1.000	0.200	0.648	0.000	0.000
Belgium	6.000	1.278	0.213	0.589	0.033	0.000
Canada	8.000	2.273	0.284	0.477	0.069	1.000
Chile	0.000	0.000				0.000
Czech Republic	0.000	0.000				0.000
Denmark	4.000	1.400	0.350	0.848	0.080	0.333
Estonia	0.000	0.000				0.000
Finland	1.000	1.000	1.000	1.000	1.000	0.000
France	17.000	10.827	0.637	0.276	0.211	25.683
Germany	14.000	7.476	0.534	0.310	0.157	8.733
Greece	3.000	1.000	0.333	1.024	0.041	0.000
Hungary	0.000	0.000				0.000
Iceland	0.000	0.000				0.000
Ireland	1.000	1.000	1.000	1.000	1.000	0.000
Israel	3.000	1.000	0.333	0.970	0.026	0.000
Italy	7.000	1.667	0.238	0.510	0.035	0.200
Japan	7.000	1.545	0.221	0.512	0.033	0.167
Korea	6.000	1.300	0.217	0.578	0.026	0.000
Luxembourg	3.000	1.000	0.333	1.024	0.041	0.000
Mexico	2.000	1.000	0.500	1.235	0.057	0.000
Netherlands	6.000	1.278	0.213	0.589	0.033	0.000
New Zealand	3.000	1.000	0.333	0.926	0.000	0.000
Norway	7.000	3.167	0.452	0.553	0.145	1.333
Poland	0.000	0.000				0.000
Portugal	2.000	1.000	0.500	1.389	0.000	0.000
Slovak Republic	0.000	0.000				0.000
Slovenia	0.000	0.000				0.000
Spain	5.000	1.125	0.225	0.679	0.032	0.000
Sweden	3.000	1.250	0.417	1.022	0.090	0.000
Switzerland	16.000	10.148	0.634	0.263	0.163	43.617
Turkey	4.000	1.000	0.250	0.862	0.000	0.000
United Kingdom	22.000	16.878	0.767	0.205	0.250	132.683
United States	24.000	19.443	0.810	0.175	0.220	233.550

Table 3. Structural hole measures after dichotomisation of art export at the level of 4 mln €
Source: printout of the UCINET 6 program

The highest values of the effective network size indicator were obtained by the United States (19.4) and the United Kingdom (16.9), followed by France (10.8) and Germany (7.5). In turn, the effective size indicator divided by the number of nodes neighboring in the ego network assumes the highest values for the same countries. The constraint indicator, which determines the extent to which the ego is connected to nodes that are connected to other neighboring nodes, is the highest for Portugal, Mexico and Luxembourg. The hierarchy index, which determines the extent to which the ego constraints are related to a single neighbor node, assumes the highest values (1) for Finland and Ireland, and the lowest (0) for Austria, Portugal, Turkey.

6 CONCLUSION

The results of network analysis for international trade in works of art between OECD countries allow to draw several conclusions. International trade in works of art shows a significant degree of network centralization in relation to a centralized network of the "star" type. The network model indicates that a few OECD countries play the most important role, namely: the United States, the United Kingdom, France, Switzerland, and Germany. Peripheral places in the network structure are taken by the following countries: Chile, Czech Republic, Estonia, Hungary, Iceland, Poland, Slovak Republic, Slovenia. The highest rates of Freemann's betweenness have been obtained by the United States, Germany, Switzerland and the United Kingdom, which underlines the mediating role of these countries in the network structure. A change in the level of dichotomization of data on art export, on the basis of which networks were created, led to the appearance or disappearance of links between its elements. As a result, more and more accurate information on how to connect elements in the network structure can be obtained.

It should be noted that the core / periphery structure in the network of international trade in works of art in OECD countries has been identified in the paper. The following countries have been qualified to the core: Austria, Belgium, Canada, France, Germany, Italy, Japan, Switzerland, the United Kingdom, the United States. Other OECD member countries remain peripheral elements of the presented network. In addition, the analysis of the ego network indicated that Australia belongs to the ego network of the Great Britain and Germany and Austria are located in the ego network of Switzerland,.

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