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Network Analysis of International Trade in Works of Art in the European Community Countries

Abstract
The issue of international trade in works of art in the European Community countries will be taken up in the paper. It will present the results of network analysis of unique art import and export. The analysis will be based on Eurostat international trade data (Harmonised System for Chapter 97 – works of art, collectors' pieces and antiques). The analysis of international trade will be held according to respective kinds of works of art i.e.: paintings, drawings and pastels; collages, graphic arts, sculptures and antiques. The network analysis will be held in UCINET software while visualisation of trade relations among countries will be created in Netdraw. The presented paper proposes a new approach to analysis of international trade in art – network approach.

Key words: works of art, unique art, national heritage protection, international trade, trade analysis, social network analysis (SNA), network analysis of international trade.

JEL: Z1, Z11

1. Introduction

Works of art are very specific objects of international trade. They represent cultural property and national heritage and they are protected against export[2]. Most countries of the world have laws that protect their cultural property. The legal regulations concern different range of works of art and include different instruments of art export control. Moreover the flows of art are restricted on the basis of cultural property agreements between countries - bilateral and international.

Few economists have brought up trade in cultural goods in the literature until recently. The issue of international trade in cultural goods has been covered by the following authors: Marvasti A. (1994), Schulze G. G.(1999), Francois P., van Ypersele T. (2002), Janeba E. (2004), Marvasti A., Canterbery E.R. (2005), Hanson G. H. and Xiang Ch. (2006)[3]. The first study by A. Marvasti presents the estimation of production function for books, newspapers, records and films. G.G.

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[2] For further details on cultural heritage protection against export see.: Białynicka-Birula J., Ochrona narodowych dóbr kultury przed wywozem w krajach Wspólnoty Europejskiej, Zeszyty Naukowe Akademii Ekonomicznej w Krakowie No 739, Kraków 2007, pp. 21-37.

[3] Marvasti A., International Trade in Cultural Goods: A Cross-Sector Analysis, Journal of Cultural Economics 18/1994, pp.135-148; Schulze G. G., International Trade in Art, Journal of Cultural Economics, No 1-2/1999, pp. 109-136, Francois P., van Ypersele T., On the Protection of Cultural Goods, Journal of Cultural Economics, 56/2002, pp. 359-369, Janeba E., International Trade and Cultural Identity, National Bureau of Economic Research Working Paper 10426, 2004; Marvasti A., Canterbery E.R., Cultural and Other Barriers to Motion Pictures Trade, Economic Inquiry No 43/2005, pp. 39-54; Hanson G. H., Xiang Ch., International Trade in Motion Picture Services, NBER, October 2006.

Schulze verifies the implementation of trade theories, with special regards to gravity approach to explain international exchanges in reproducible art (recorded music, books, movies) and unique art (paintings, sculpture). P. Francois and T. van Ypersele use the example of movie pictures to analyse the conditions of protection of cultural goods. E. Janeba develops a new framework to study the effects of trade liberalization on cultural identity and reaches the conclusion that consumers of imported cultural goods tend to gain, while the consumers of exported cultural goods tend to lose from trade liberalization. A. Marvasti and E.R. Canterbery explain the American motion picture trade on the basis of gravity model of U.S. export. G. H. Hanson and Xiang Ch. examine the determinants of U.S. motion picture export to Europe using a modified version of the gravity model. The above mentioned papers have taken into account a wide range of cultural goods i.e.: films, books, newspapers, records, unique art. The only empirical analysis on flows of works of art, in the narrow sense of this word – unique art, appeared only in G.G. Schulze study (1999).

In this paper the works of art will be understood as individual unique objects created by homo faber. From foreign trade statistics perspective they belong to the chapter 97 of Harmonised System - works of art, collectors' pieces and antiques. The paper will show the results of network analysis of international trade in works of art. It is important to underline at the beginning that the European Community Countries, as a whole, have one of the biggest art markets[4]. The paper will present the results of network analysis on export and import of works of art.

2. Network analysis of international trade in works of art in the EU countries

In order to identify connections in the area of international trade in works of art network analysis method will be used. Social Network Analysis uses tools of two scientific fields: mathematics (graph theory) and sociology (sociometric analysis).This approach implies presumption that respective countries play the role of nodes in the network, whereas foreign trade (export/import) should generate ties understood as single - or double-sided relations between countries[5]. Network approach allows for multi-aspect insight into the network structure: first - it is about identification of global properties of the network structure as a whole, secondly defining position of respective units in the network structure, and finally - distinguishing individual units in the network structure. A series of specific measures are used in order to do that, describing position and properties of network structure elements[6].

Network analysis will be held taking works of art categories adopted in international terminology under consideration[7]. UCINET 6 software will be used for analysis together with a package to

[4] The European Art Market in 2002: A Survey, European Fine Art Foundation, Kusin & Company, Helvoirt 2002; Art Market Trends. Tendencies du marche de l'art, Artprice 2002, 2003, 2004, 2005, 2006.

[5] Theoretical and methodological issues regarding network analysis may be found in the following works: Freeman 1979; Wellman 1988; Borgatti, Everett, Freeman 2002; Breiger 2004; Borgatti 2005; Hanneman, Riddle, 2005.

[6] Among the terms which deal with interpretation of network analysis results, the following should be mentioned: node, path, dyad, clique, concentration, structural coherence, density, reach, level of connection, distance, measures of node centrality in the network, closeness, centralization, bottle neck etc.

[7] Section XXI works of art, collectors' pieces and antiques in chapter 97 under the same title covers the following categories of objects:
9701 - paintings, drawings and pastels, done entirely by hand, collages, graphic arts, sculptures and antiques and similar decorative plaques other than drawings from CN code 4906 (plans and drawings for architectural, engineering, industrial, commercial, topographical or similar purposes, hand-decorated manufactured articles, reproductions on sensitized paper as well as carbon copies), and industrial products made or decorated by hand;
9702 - original engravings, prints and lithographs, being impressions produced in limited numbers directly in black and white or in colour of one or of several plates executed entirely by hand by the artist, irrespective of the process or of the material employed by him, but not including any mechanical or photomechanical process;
9703 - original sculptures and statuary in any material; item does not cover mass produced reproductions and typical craftsmanship of commercial character, even if such works are designed and created by artists;
9704 – post and fiscal stamps, stamps used for stamp-duty, envelopes;
9705 - zoological, botanic, mineralogical, anatomic collections and elements;

visualise Netdraw data[8]. The picture of network of international trade in paintings, drawings and pastels was shown on Figure1.

9706 – antiques over 100 years old.

[8] Borgatti, S.P., Everett, M.G. and Freeman, L.C. 2002. Ucinet for Windows: Software for Social Network Analysis. Harvard, MA: Analytic Technologies.

Input data have a form of square matrices (with 27 verses and 27 columns referring to individual countries of the European Union, which are afterwards dichotomized before network analysis).

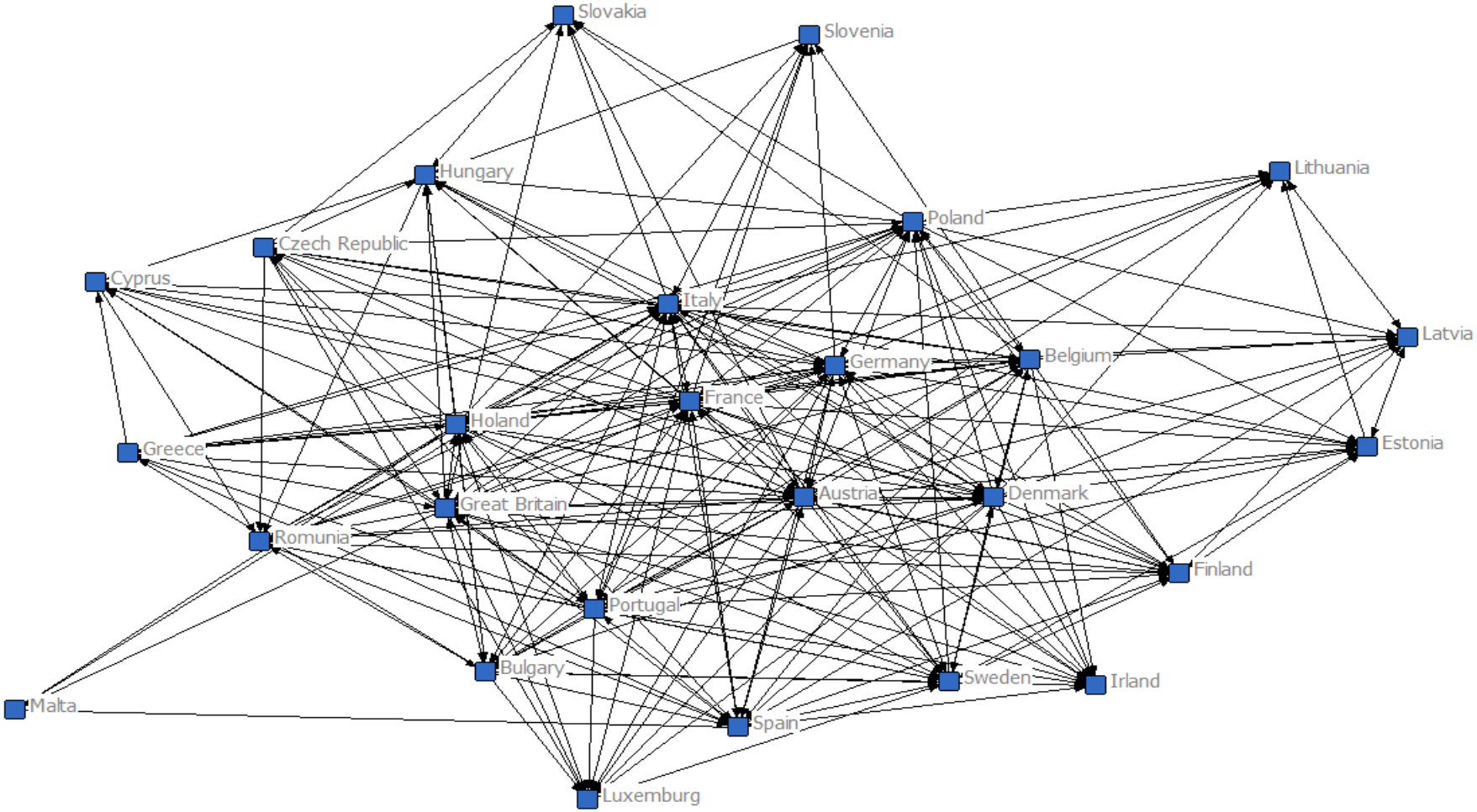

Fig. 1. Network of relations between the European Community countries in the area of international trade in paintings, drawings and pastels
Source: author's own study based on UCINET 6 Netdraw software.

Properties of network as a whole are defined by a synthetic index of network centralization, which specifies a degree of centralization for the analysed network in relation to the most centralized star-type network. For the discussed network of international trade in paintings the indicator is on the level of 44.77%, which points to a significant degree of centralization in terms of export-import relations in the area of works of art in the European Community countries. Major instruments to measure position and importance of individual objects (countries) in the network structure are centrality indicators. Reading characteristics of created network will be based on selected indicators of network analysis, and in particular: the degree centrality, closeness centrality, information centrality, Freeman's betweennes, flow, betweennes indicators, Bonacich's power centrality (table 1)[9].

[9] In network analysis number of indicators are used. Centrality indicators are to measure the importance of node in network structure, they are the values describing each node by defining its level of integration with the rest inside network. Interpretation of selected centrality indicators:

- Network degree centrality – number of node's connections to the other nodes in the network, it specifies the influence of direct connections, understood as an ability to influence directly and being itself a subject of direct influence;
- Network closeness centrality - index which is opposite to centrality, specifies how far a node is from other nodes, peripherality;
- Freeman's betweennes indicator defines a degree of nodes location between other nodes in the network. This measurement considers connections with neighbouring nodes, nodes which play a role of bridges to nodes concentration have higher values. Number of connections going through a unit, a degree of node's direct linkage only to these nodes, which are not directly connected to each other; a gauge related to flow control – how often a node is located within the closest distance between two other nodes, thus connecting parts of network which would otherwise remain separate;
- eigenvector centrality - general assessment of node's importance in the network based on centrality and power gauge, including gauges discussed above. High value proves a node is connected to many other nodes, which are interrelated;
- Bonacich's power, alfa centrality – indicates the most central objects in global structure of connection network, based on algorithm of factor analysis (eigenvalues).

More on the gauges used in network analysis, see.: S.P. Borgatti, *Centrality and Network Flow*, Social Network No 27/2005, pp. 55-71.

Table 1. Results of network analysis for international trade in paintings, drawings and pastels in the European Union

Country	Centrality measures					
	Degree	Closeness		Freeman's Betweeness	Bonacich Alfa	
		in	out		power	normal
Austria	22	41.93	70.27	24.10	18	8.05
Belgium	20	41.27	65.00	17.08	15	6.70
Bulgary	16	38.80	55.32	2.42	8	3.57
Cyprus	10	32.50	53.06	0.00	6	2.68
Czech Rep.	13	37.14	60.46	3.38	12	5.36
Denmark	21	44.07	65.00	36.37	13	5.81
Estonia	11	36.11	50.98	46.39	5	2.23
Finland	11	38.23	55.32	6.19	8	3.58
France	23	45.61	70.27	39.91	18	8.05
Greece	12	37.14	61.90	4.33	13	5.81
Spain	17	41.93	65.00	29.78	13	5.81
Holland	22	48.15	61.90	20.87	13	5.81
Irland	12	37.68	53.06	0.95	6	2.68
Lithuania	8	21.85	63.41	0.35	11	4.91
Luxemburg	11	34.67	55.06	0.00	8	3.57
Latvia	10	37.39	61.90	26.40	10	4.47
Malta	4	33.77	49.06	0.00	4	1.79
Germany	24	48.15	74.27	74.26	20	8.94
Poland	19	40.00	59.09	7.46	11	4.91
Portugal	19	37.14	56.52	1.27	9	4.02
Romania	16	63.41	3.70	0.00	0	0.00
Slovakia	7	35.77	50.98	1.98	8	3.58
Slovenia	7	35.13	53.06	0.93	7	3.13
Sweden	16	41.93	60.46	22.91	10	4.47
Hungary	14	36.62	57.78	2.47	10	4.47
Great Britain	22	46.43	68.42	55.48	17	7.60
Italy	25	47.27	65.00	36.72	15	6.70

Source: authors own research based on UCINET 6.

In the presented network of connections all elements belong to a single group (network is not fragmented). Italy, Germany, France occupy most central locations in the network. Another countries following in order should be mentioned: Netherlands, Great Britain and Austria. Italy reached the highest level of the indicator (25), which points to this country's connection with 25 other nodes in the network. Malta has the lowest level of the degree. Closeness indicators point to peripheral location of Romania in the network of export-import connections. Considering Bonacich's power, alfa centrality, the following order in respect of central location in the network has been reached: Germany, France, Austria and Great Britain. The highest values of Freeman's betweennes indicators have been reached by Germany (74.26) and Great Britain (55.48). Figure 2 presents network of international trade in collages in the UE.

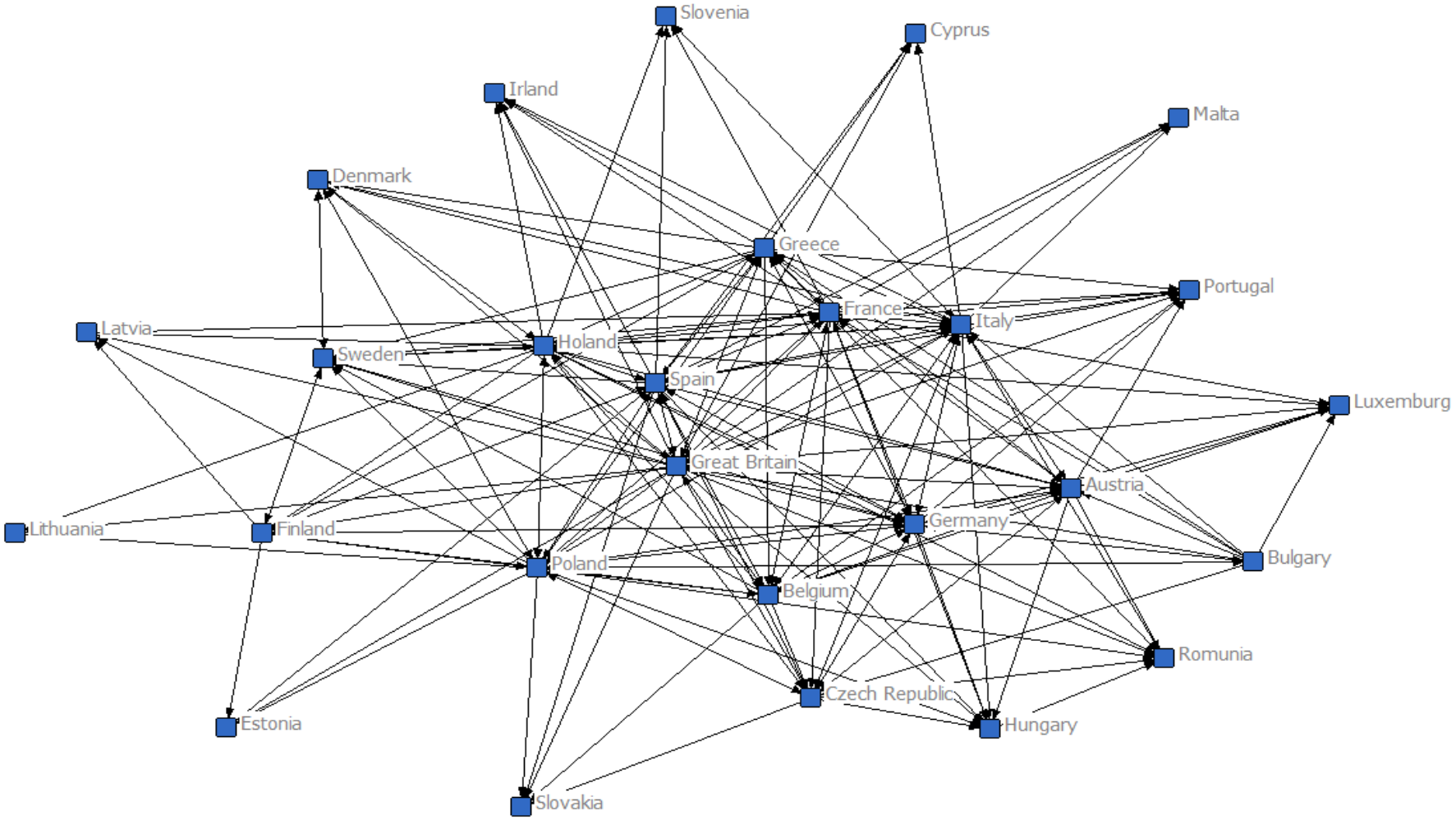

Fig. 2. Network of connections in the European Community countries in the area of international trade in collages
Source: authors own research based on UCINET 6 software and Netdraw.

Table 2. Results of network analysis for international trade in collages in the European Community

Country	Centrality measures					
	Degree	Closeness		Freeman's Betweeness	Alfa Bonacich	
		in	out		power	normal
Austria	15	10.788	63.415	8.775	11	5.262
Belgium	15	10.788	66.667	15.595	13	6.218
Bulgary	9	10.236	59.091	1.093	8	3.827
Cyprus	4	11.504	3.704	0.000	0	0.000
Czech Rep.	13	10.744	52.000	3.745	6	2.870
Denmark	7	10.526	50.000	0.378	3	1.435
Estonia	4	10.359	45.614	0.000	1	0.478
Finland	10	10.484	59.091	5.458	8	3.827
France	20	10.788	78.788	34.536	19	9.089
Greece	17	10.569	72.222	8.716	16	7.654
Spain	20	10.788	78.788	49.792	19	9.089
Holland	20	10.744	76.471	31.251	18	8.610
Irland	6	11.712	3.704	0.000	0	0.000
Lithuania	3	11.454	3.704	0.000	0	0.000
Luxemburg	7	10.526	46.429	0.143	2	0.957
Latvia	5	11.607	3.704	0.000	0	0.000
Malta	4	11.556	3.704	0.000	0	0.000
Germany	16	10.879	66.667	20.021	13	6.218
Poland	20	10.788	70.270	38.886	15	7.175
Portugal	9	10.700	53.061	0.143	3	1.435
Romania	8	13.265	3.704	0.000	0	0.000
Slovakia	5	11.607	3.704	0.000	0	0.000
Slovenia	4	10.442	44.828	0.000	1	0.478
Sweden	11	10.744	53.061	4.691	5	2.392
Hungary	9	11.872	3.846	0.589	1	0.478
Great Britain	25	10.744	96.296	46.645	25	11.959
Italy	20	10.788	78.788	46.543	19	9.089

Source: authors own research based on UCINET 6.

In network of international trade in collages Great Britain takes up central position. Then, another countries in order should be mentioned: France, Spain, Netherlands, Poland and Italy. Great Britain reached the highest level of the indicator (25), which points to the country's connection with 25 other nodes in the network. Cyprus, Estonia, Malta and Slovenia have the lowest level of the degree. Closeness indicators point to peripheral location of Romania in the network of export-import connections. Considering Bonacich's power, alfa centrality, the following order in respect of central location in the network has been reached: Great Britain, France, Spain and Italy. The highest values of Freeman's betweennes indicators have been reached by Great Britain (46,6) and Italy (46,5). Synthetic index of network centralization (in relation to star-type networks) reaches the value of 56.77%. Figure below presents network of international trade in graphic art in the UE.

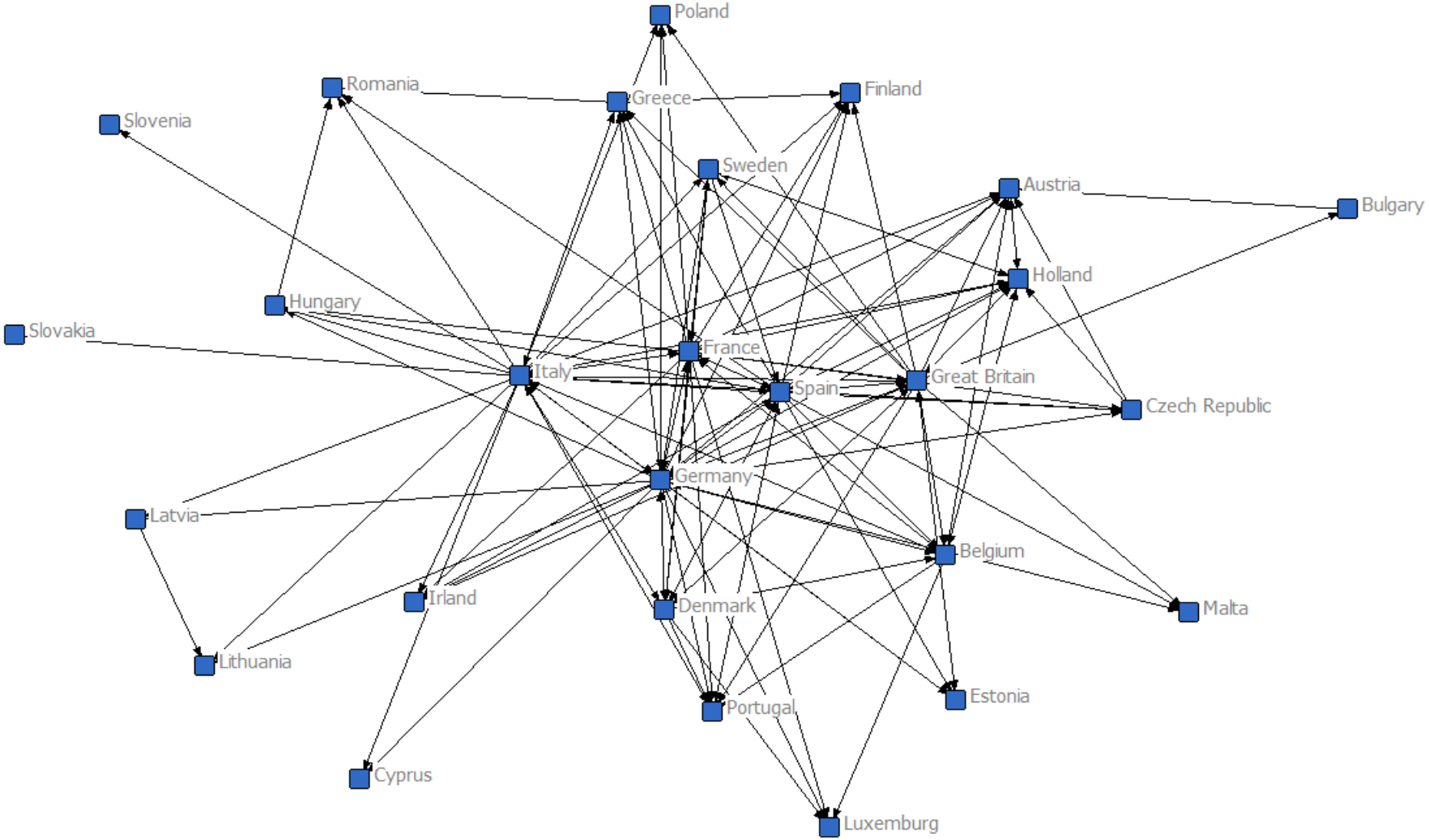

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Fig. 3 Network of connections in the European Community countries in the area of international trade in graphic art
Source: authors own research based on UCINET 6 and Netdraw.

Table 3. Results of network analysis for international trade in graphic art in the European Community

Country	Centrality measures					
	Degree	Closeness		Freeman's Betweenness	Alfa Bonacicha	
		In	Out		power	Normal
Austria	9	7.580	52.000	25.841	3	1.748
Belgium	10	7.514	59.091	2.060	8	4.662
Bulgary	2	7.283	35.616	0.000	1	0.583
Cyprus	2	7.951	3.704	0.000	0	0.000
Czech Rep.	6	7.450	50.000	0.000	4	2.331
Denmark	9	7.493	60.465	4.750	9	5.244
Estonia	4	8.025	3.704	0.000	0	0.000
Finland	6	8.075	3.704	0.000	0	0.000
France	17	7.558	74.286	22.073	17	9.906
Greece	7	7.471	50.000	1.265	3	1.748
Spain	18	7.536	74.286	25.782	17	9.906
Holland	9	7.580	59.091	9.632	8	4.662
Irland	5	8.050	3.704	0.000	0	0.000
Lithuania	3	8.638	3.704	0.000	0	0.000
Luxemburg	4	7.975	3.704	0.000	0	0.000
Latvia	3	7.951	3.846	0.000	1	0.583
Malta	3	7.975	3.704	0.000	0	0.000
Germany	22	7.602	86.667	78.323	22	12.819
Poland	4	7.450	47.273	0.000	1	0.583
Portugal	7	7.514	74.286	0.167	2	1.165
Romania	4	8.638	3.704	0.000	0	0.000
Slovakia	1	7.879	3.704	0.000	0	0.000
Slovenia	1	7.879	3.704	0.000	0	0.000
Sweden	7	7.493	48.148	0.310	4	2.331
Hungary	5	8.025	3.846	0.932	1	0.583
Great Britain	17	7.514	74.286	22.626	17	9.906
Italy	23	7.602	89.655	101.240	23	13.402

Source: authors own research based on UCINET 6.

In network of international trade in graphic art Italy takes up central positions. Then, another countries in order should be mentioned: Germany, Spain, France. Italy reached the highest level of the indicator (23), which points to the country's connection with 23 other nodes in the network. Slovakia and Slovenia reach the lowest level of the degree. Closeness indicators point to peripheral location of Romania, Lithuania, Ireland, Finland, Estonia and Hungary in the network of export-import connections. Considering Bonacich's power, alfa centrality, the following order in respect of central location in the network has been reached: Italy, Germany, France, Spain and Great Britain. The highest values of Freeman's betweennes indicator have been reached by Italy (101.2) and Germany (78,3). Synthetic gauge of network centralization (in relation to star-type networks) reaches the value of 63.54%. Figure below presents network of international trade in sculptures in the UE.

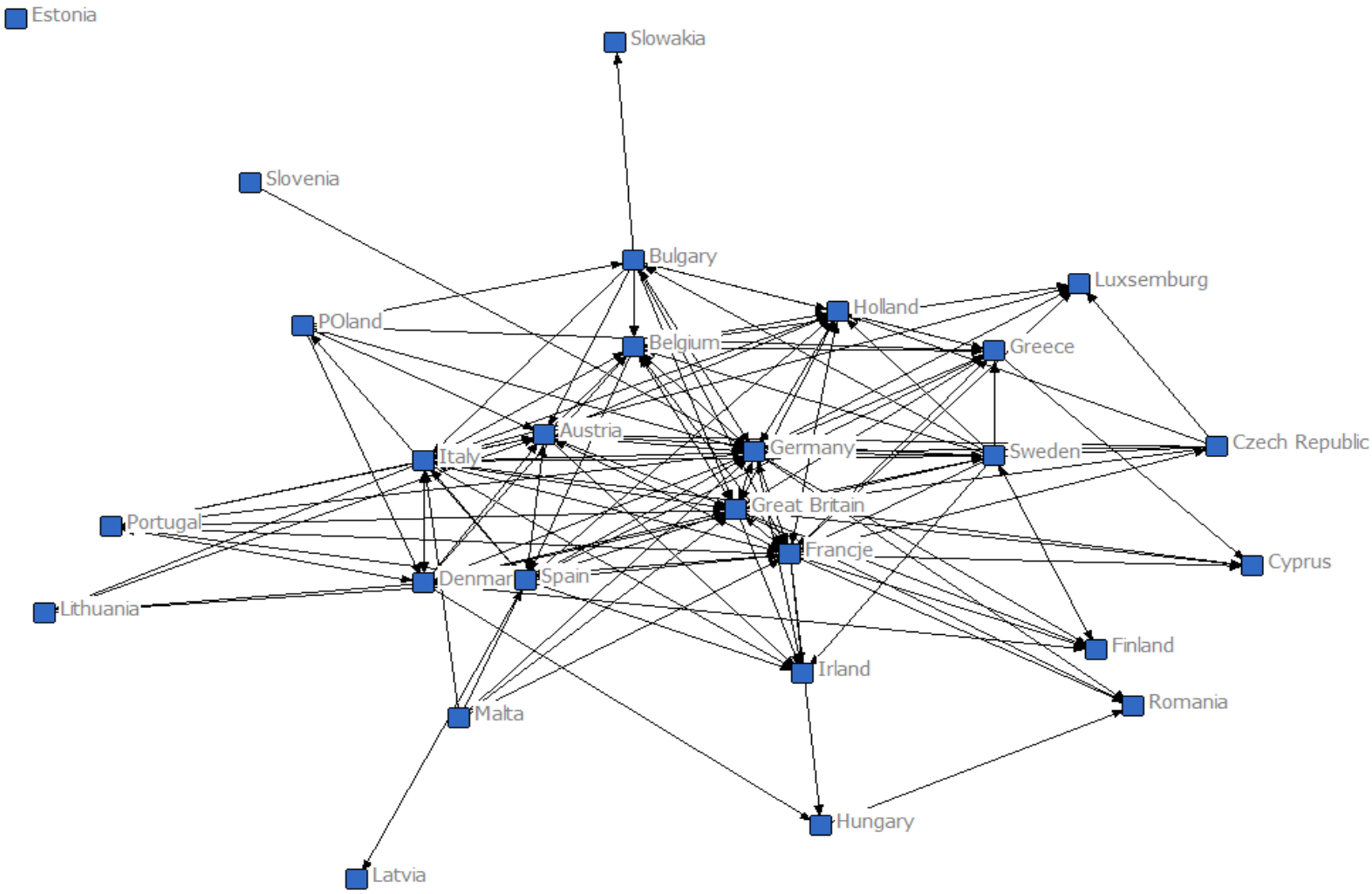


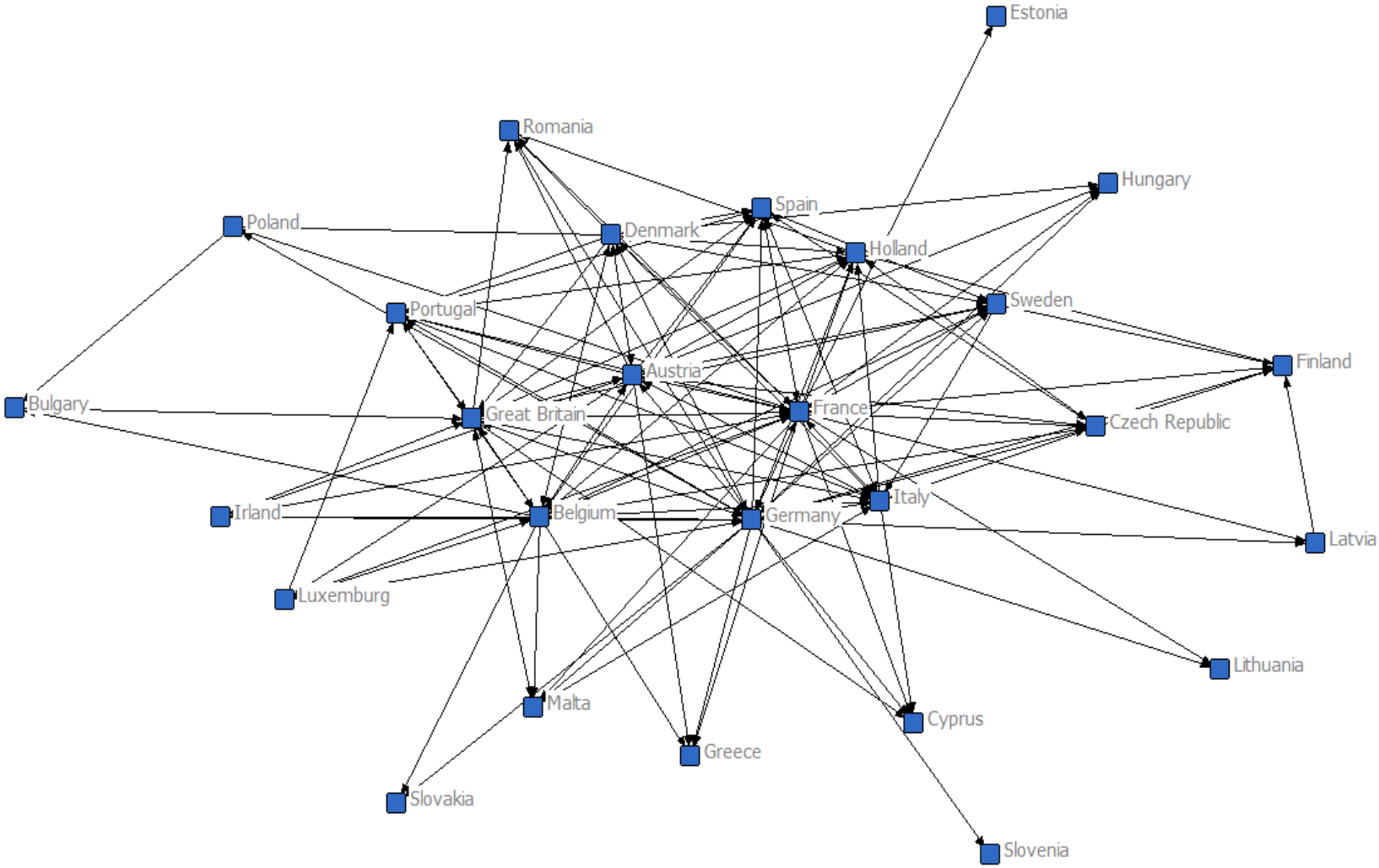
Fig. 4. Network of connections in the European Community countries in the area of international trade in sculptures
Source: authors own research based on UCINET 6 and Netdraw.

Tablica 4. Results of network analysis for international trade in sculptures in the European Community

Country	Centrality measures					
	Degree	Closeness		Freeman's Betweenness	Alfa Bonacich	
		in	out		power	normal
Austria	15	10.788	22.034	15.041	10	6.421
Belgium	12	10.700	21.667	5.155	8	5.137
Bulgary	11	10.400	21.849	20.910	9	5.779
Cyprus	4	11.504	3.704	0.000	0	0.000
Czech Rep.	7	10.196	21.138	0.143	7	4.495
Denmark	12	10.526	22.222	29.517	11	7.063
Estonia	0	3.704	3.704	0.000	0	0.000
Finland	5	10.526	18.841	0.143	1	0.642
France	21	10.924	23.423	72.613	17	10.916
Greece	10	10.612	20.968	7.233	5	3.211
Spain	15	10.612	22.414	31.625	12	7.706
Holland	11	10.744	20.635	0.833	4	2.569
Irland	7	11.765	3.704	0.000	0	0.000
Lithuania	4	10.117	20.000	0.000	2	1.284
Luxemburg	5	11.607	3.704	0.000	0	0.000
Latvia	1	10.970	3.704	0.000	0	0.000
Malta	5	3.704	26.531	0.000	5	3.211
Germany	20	10.970	23.423	78.625	16	10.274
Poland	6	10.277	20.800	1.200	5	3.211
Portugal	7	10.569	18.705	0.733	1	0.642
Romania	4	13	3.704	0.000	0	0.000
Slovakia	1	10.744	3.704	0.000	0	0.000
Slovenia	1	3.704	24.074	0.000	1	0.642
Sweden	13	10.612	22.414	31.863	12	7.706
Hungary	3	11.454	3.846	0.500	1	0.642
Great Britain	18	10.833	23.009	23.606	15	9.632
Italy	16	10.744	22.807	22.260	14	8.990

Source: authors own research based on UCINET 6.

In network of international trade in sculptures France, Germany and Great Britain take up central positions. Then, another countries in order should be mentioned: Italy, Spain and Austria. France reached the highest level of the indicator (21), which points to the country's connection with 21 other nodes in the network. Estonia, Lithuania, Slovakia and Slovenia reach the lowest level of the degree. Closeness indicators point to peripheral location of Romania in the network of export-import connections. Considering Bonacich's power, alfa centrality, the following order in respect of central location in the network has been reached: France, Germany, Great Britain and Italy. The highest values of Freeman's betweennes indicator have been reached by Germany (78,6) and France (72.6). Synthetic gauge of network centralization (in relation to star-type networks) reaches the value of 51.2%. Figure below presents network of international trade in antiques in the UE.



Rys. 5. Network of connections in the European Community countries in the area of international trade in antiques
Source: authors own research based on UCINET 6 and Netdraw.

Tablica 5. Results of network analysis for international trade in antiques in the European Community

Country	Centrality measures					
	Degree	Closseness		Freeman's Betweeness	Alfa Bonacich	
		in	out		power	normal
Austria	16	8.814	72.222	11.891	16	9.126
Belgium	17	8.874	72.222	25.308	16	9.126
Bulgary	3	8.667	40.625	0.500	1	0.570
Cyprus	4	9.524	3.704	0.000	0	0.000
Czech Rep.	8	8.696	54.167	1.100	6	4.422
Denmark	13	8.696	66.667	2.867	13	7.415
Estonia	1	9.253	3.704	0.000	0	0.000
Finland	6	10.484	3.704	0.000	0	0.000
France	23	8.935	89.655	88.477	23	13.118
Greece	4	9.455	3.704	0.000	0	0.000
Spain	10	8.874	53.061	2.319	5	2.852
Holland	11	8.844	56.522	4.655	7	3.992
Irland	5	8.754	50.000	0.000	2	1.141
Lithuania	2	9.386	3.704	0.000	0	0.000
Luxemburg	5	8.667	54.167	0.000	4	2.281
Latvia	3	9.386	3.846	0.000	1	0.570
Malta	5	8.725	41.935	0.000	2	1.141
Germany	24	8.935	92.857	95.244	24	13.688
Poland	4	8.638	50.980	1.100	2	1.141
Portugal	10	8.844	52.000	1.650	4	2.281
Romania	6	9.594	3.704	0.000	0	0.000
Slovakia	2	9.286	3.704	0.000	0	0.000
Slovenia	1	9.253	3.704	0.000	0	0.000
Sweden	9	8.784	57.778	3.604	7	3.992
Hungary	4	9.455	3.704	0.000	0	0.000
Great Britain	15	8.997	66.667	65.744	13	7.415
Italy	13	8.935	60.465	18.542	9	5.133

Source: authors own research based on UCINET 6.

In network of international trade in antiques in the EU Germany, France and Belgium take up central positions. Then, the following countries in order should be mentioned: Austria, Great Britain, Denmark and Italy. Germany reached the highest level of the indicator (23), which points to the country's connection with 23 other nodes in the network. Estonia and Slovenia reach the lowest level of the degree. Closeness indicators point to peripheral location of Finland, Romania, Cyprus, Hungary, Latvia, and Lithuania in the network of export-import connections. Considering Bonacich's power, alfa centrality, the following order in respect of central location in the network has been reached: Germany, France, Austria, Belgium, Denmark, Great Britain. The highest values of Freeman's betweennes indicator have been reached by Germany (95.2) and France (88.5). Synthetic gauge of network centralization (in relation to star-type networks) for international trade in antiques reaches the value of 65.2%.

Below table recapitulates the results of the network analysis for international trade in works of art.

Table 6. List of results of the centralization analysis of international trade in works of art for paintings, collage, graphic art, sculpture and antiques

Indicators	paintings	collage	graphic art	sculpture	antiques
Network centralization	44.77	56.77	63.54	51.2	65.2
Degree	Italy 25 Germany 24 France 23	Great Britain 25 France 20 Spain 20 Netherlands 20 Poland 20 Italy 20	Italy 23 Germany 22 Spain 18 France 17	France 21 Germany 20 Great Britain 18	Germany 24 France 23 Belgium 17
Closeness	Romania	Cyprus Estonia Lithuania Malta Slovenia	Romania Lithuania	Romania Ireland	Finland Romania
Fremann's betweenness	Germany Great Britain	Great Britain Italy	Italy Germany	Germany France	Germany France
Bonachich power alfa	Germany France Austria Great Britain	Great Britain France Spain Italy	Italy Germany France Spain	France Germany Great Britain Italy	Germany France Austria Belgium Dania

Source: authors own research based on UCINET6

3. Conclusions

Abundance of collected results of network analysis of international trade in works of art between European Community countries allows to draw few conclusions. International trade in works of art exhibits significant degree of network centralization in respect of centralized star-type network. Network model points to a few countries playing a substantial role regarding the issue in question i.e: Italy, Germany, France, Great Britain. In the case of collage, high values of the degree, besides the countries already mentioned, were reached by Spain, Netherlands and Poland; in graphic art by Spain; in antiques Belgium and Netherlands. Peripheral locations in the network structure (depending on the kind of work of art) are occupied by: Romania, Ireland, Finland, Cyprus, Estonia, Lithuania, Malta, Slovenia. Finally, Germany, Great Britain, Italy, Germany, France reached highest values of Fremann's betweenness, which is the fact that emphasizes the intermediary role these states play in network structure.

It needs to be pointed out that the most important nodes-states in the network of international trade in works of art are also the states with biggest markets of works of art in Europe[10]. The results of analyses presented are part of author's research work in the area of international trade in works of art. Apparently, the issue which remains to be clarified is the identification of factors determining directions of international trade in works of art.

[10] *The European Art Market in 2002: A Survey*, European Fine Art Foundation, Kusin & Company, Helvoirt 2002; *Art Market Trends. Tendencies du marche de l'art*, Artprice 2002, 2003, 2004, 2005, 2006.

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