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**Transformations of the Art Market in the World –
Quantitative Approach**

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Transformations of the Art Market in the World – Quantitative Approach

JEL Classification: *C1; D4; F6; Z11*

Keywords: *art market; art economics; art; market analysis, cultural economics*

Abstract

Research background: The dynamics of the art market is usually presented using price perspective, price indexes for the market and financial returns. In this paper the value and volume approach is proposed, that haven't been considered in aggregative way for a longer period of time in the literature.

Purpose of the article: The presentation of changes taking place in the global art market in the period 2002-2015 is the aim of the paper. The results of dynamic analysis of the art market have been presented, including the two approaches: value and volume of transactions. The impact of the global crisis on the art market has been considered.

Methodology/methods: In order to present the changes on the global art market statistical indexes of dynamics (single base and chain indexes) have been used. Moreover the trend analyses have also been conducted for the value and volume of transactions on the art market. The sources of data on the global art market have come from Artprice, ArtTactic, TEFAF (The European Fine Art Foundation).

Findings: In the analyzed period 2002-2015 the changes of sales on the global art market had in general increasing tendency. The value and volume of sales have reached their tops in 2007 and 2014. The art market has been touched considerably by economic recession in 2009, but in the next year it has already staged a recovery. The trend analyses have allowed describing the changes on the market by means of mathematical functions. The analyses have allowed identifying the countries with the largest share in the global art market. A particular attention has been paid to the existence of triad on the art market, including the countries of Europe, USA and China. It is noteworthy that Europe and USA have dynamically lost their market share in favor of China.

Introduction

Since the papers of R.C. Anderson (Anderson, 1974, pp. 13-26) and J.P. Stein (Stein, 1977, pp.1021-1035), there has been a growing number of the literature on the issues connected with the art market. Several directions of scientific research can be distinguished: value and price of art (Holub *et al.*, 1993, pp. 49-69; Grampp, 1989, Witkowska, 2014, pp. 281-293; Ye *et al.*, 2016, pp. 1-12), construction of art indexes (Candela & Scorcu, 1997, pp. 175-196; Collins *et al.*, 2009, pp. 57-60), risk and returns from art investments (de la Barre *et al.*, 1994, pp. 143-181; Matsumoto *et al.*, 1994, pp. 495-519; Lucinska, 2015, pp. 67-79), comparison of returns from art with other assets (Frey & Pommerenhe, 1989, pp. 396-409; Srivastava & Babu, 2016, pp. 5327-5341), art market efficiency (David *et al.*, 2013, pp. 23-35; Botha *et al.*, 2016, pp. 358-368), globalization of the art market (Afonso, 2012, pp. 53-59; Munteanu & Pece, 2015, pp. 82-88; Schultheis *et al.*, 2016).

The paper has a cognitive character. Its aim is to present the results of the dynamic analysis of the art market in recent years, 2002-2015, based on the available aggregated data for the market of these objects. The results of dynamic analysis of the art market have been presented, including the two approaches: value and volume of transactions. Analysis of volume of sales allows for separate treatment of each transaction closed on the market. The analysis of turnover takes into accounts both sales volume and price level of works of art on the market. Moreover the impact of the global crisis on the art market has been considered.

Method of the Research

In the paper the base indexes and chain indexes have been used to present the dynamics of changes on the art markets in the analyzed period. Base index is a number derived by relating the value at any given period to the value of the base constant period. Chain index is a number derived by relating the value at any given period to the value in the previous period. Apart from dynamic indexes time series analysis has been used, especially trend analysis. Trend analysis refers to the science of studying changes in economic patterns. It is a mathematical technique that uses historical data to predict the future level of economic phenomena. Particularly, trend analysis involves the collection of empirical data from multiple time periods and plotting the information on a horizontal line for further review. The best fit trend is the function for which the sum of the distances between each of the n data points

and the function is as small as possible (the ordinary least squares method - OLS). A mathematically useful approach is therefore to find the mathematical function with the property that the sum of the following squares is minimum:

$$\sum_{i=1}^n (\hat{y} - y)^2 = \min$$

To measure how well the trend model explains the changes in empirical data the coefficient of determination is used. The coefficient of determination, denoted as R^2 (R-squared), is used as a guideline to measure the accuracy of the model. It is represented as a value between zero and one. The closer the value is to one, the better the fit of the model to the data. The formula for computing the coefficient of determination for a linear regression model with one independent variable is given below:

$$R^2 = \frac{\sum_{i=1}^n (\hat{y} - \bar{y})^2}{\sum_{i=1}^n (y - \bar{y})^2}$$

where:

y - empirical value of the variable Y in period t ,

\hat{y} - theoretical value of variable (based on the trend model),

\bar{y} - arithmetical mean of empirical data.

$$\phi^2 = \frac{\sum_{i=1}^n (y - \hat{y})^2}{\sum_{i=1}^n (y - \bar{y})^2}$$

The trend model is better if coefficient of determination R^2 is close to 1. The relation between two measures is as follows:

$$R^2 = 1 - \phi^2$$

Dynamics of the Art Market in the World

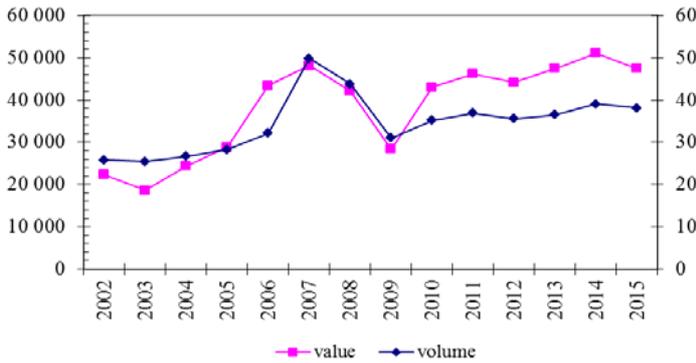
Data concerning sale value and volume of transactions concluded on the global art market in the years 2002-2015 are listed in Table 1 and presented in Figure 1.

Table 1. Value and volume of transactions on the art market and total volume of transactions on the global art market in 2002-2015

Year	Value in m €	Dynamic base index 2002 =100%	Dynamic chain index previous year = 100%	Volume in mln	Dynamic base index 2002 =100%	Dynamic chain index previous year = 100%	Value/ volume
2002	22 264	100.00	100.00	25.8	100.00	100.00	862.95
2003	18 631	83.68	83.68	25.4	98.45	98.45	733.50
2004	24 385	109.53	130.88	26.6	103.10	104.72	916.71
2005	28 833	129.51	118.24	28.2	109.30	106.02	1022.45
2006	43 331	194.62	150.28	32.1	124.42	113.83	1349.87
2007	48 065	215.89	110.93	49.8	193.02	155.14	965.16
2008	42 158	189.36	87.71	43.7	169.38	87.75	964.71
2009	28 335	127.27	67.21	31.0	120.16	70.94	914.03
2010	42 951	192.90	151.58	35.1	136.05	113.23	1223.67
2011	46 137	207.23	107.40	36.8	142.64	104.84	1253.72
2012	44 091	198.04	93.20	35.5	137.60	96.47	1242.00
2013	47 419	212.98	107.54	36.5	141.47	102.81	1299.15
2014	51 000	229.07	107.55	39.0	151.16	106.85	1307.69
2015	47 430	213.03	93.00	38.1	147.67	97.69	1244.88

Source: author's own work based on data provided by: *The Global Art Market in 2010. Crisis and Recovery*, TEFAF, Helvoirt 2011; *The International Art Market 2011. Observations on the Trade over 25 Years*, TEFAF, Helvoirt 2012; *TEFAF Art Market Report 2013. The Global Art Market with a focus on China and Brazil*, TEFAF Helvoirt 2013, *TEFAF Art Market Report 2014 The global art market with a focus on the US and China* TEFAF, Helvoirt 2014; *Art Market Report* TEFAF, Helvoirt 2016.

Figure 1. Dynamics of value and volume of sales on the global art market in 2002 - 2015



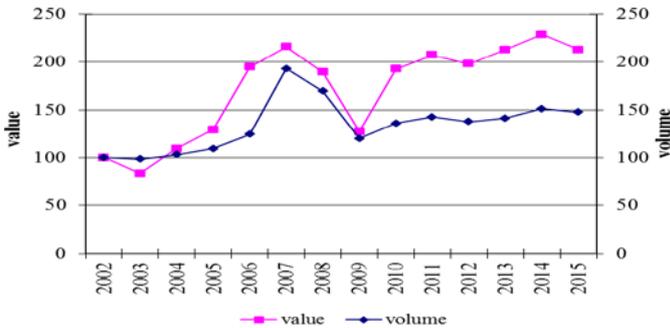
Source: author's own research

Value of turnover on the global art market in 2002-2014 ranged between €8.6 and 51bn with the lowest value in 2003, and the highest in 2014. Sale volume ranged between 25.4 and 49.8 million transactions, with the lowest value in 2003 and the highest in 2007. General trends of changes in value and volume of art sale in the analysed period are convergent – noteworthy in both cases is a growing trend from the level of €22.3bn in 2002, boom on the market in 2007 (€48bn), then slump in 2009 (€28.3bn). It should be noted that the value of art sale in a very short period of time (in the following year, 2010) regained its level from 2008 (€42-43bn) (Fig. 1). The following years, 2011 -2014, brought an increase of the sale value up to the level of €51bn as well as of the sale volume up to 39 million transactions. In 2015 the value of sales fell to € 47.4 billion, while trading volume dropped to 38.1 million transactions.

Single base indices of dynamics indicated that in the analysed period, the value of sale on the art market grew more than two-fold, whereas volume grew by about 50%. Chain indices of dynamics display drops in value and volume in the years 2003, 2008-2009, 2012 as compared with the respective preceding year. It should be noted that the recession on the art market was caused by the global crisis. The sales of works of art in the world in 2009 have fallen to 32.8% compared to 2008 and 41.5% in relation to 2007. The decrease in sales volume in 2009 decreased by 29.5% compared to 2008 and 37.7% compared to 2007. The decrease in value of sales was thus higher than the decrease in the volume of sales of works of art in the world. It should be

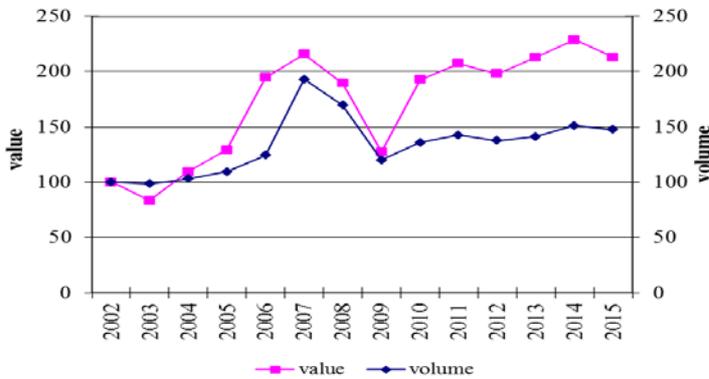
noted that turnover volume on the art market in 2009 (31 mln transactions) has not regained the level from before the crisis (43.7 mln transactions) and in recent years ranged between 35.1 and 39 mln transactions (the transactions with lower prices were concluded).

Figure 2. Base indexes for the volume and value of sales on the global art market in 2002 – 2015



Source: author’s own research

Figure 3. Chain indexes for the volume and value of sales on the global art market in 2002 - 2015

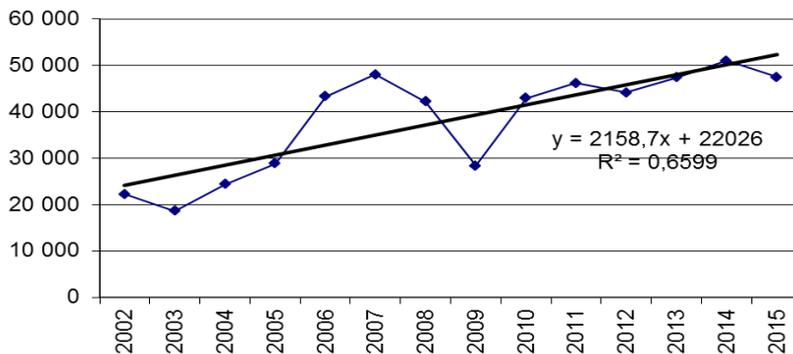


Source: author’s own research

On the basis of the collected data on the sales of works of art on the world market the trend line function of the form $y = 2158,7x + 22026$ has been set and the coefficient of determination $R^2 = 0.66$ has been estimated (trend model explains 66% of variability in the value of sales of works of art). In turn, the volume of global sales of these objects designated power function of

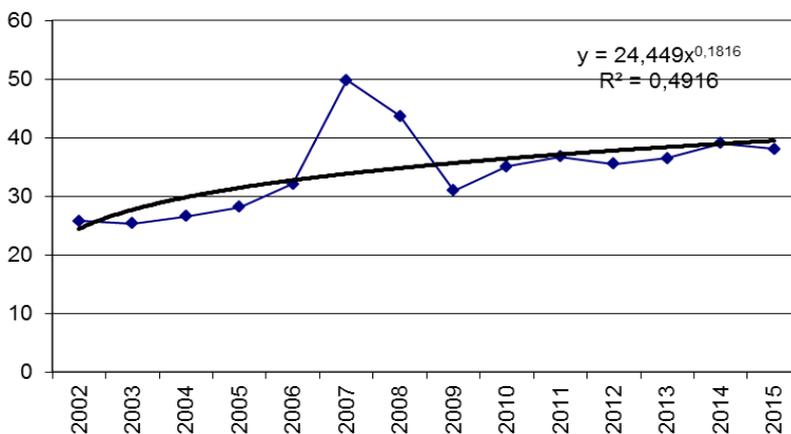
the trend taking the form of: $y = 24,449x^{0,1816}$ with the coefficient of determination $R^2 = 0.49$ (trend model explains 49% of variation in the volume of sales of works of art) (Fig 4 and Fig. 5).

Figure 4. Value of sales on the art market with linear trend function



Source: author's own research

Figure 5. Volume of sales on the word art market with power trend function



Source: author's own research

Dynamics of the Domestic Art Markets Shares in the World Art Market

The art markets retain their individual specifics related to cultural circumstances, level of economic development and local laws (Melnyk, 2013, pp. 62-70). In order to identify geographical structure of art market, Table 3 presents share of selected countries in art turnover on auctions in 2002-2014.

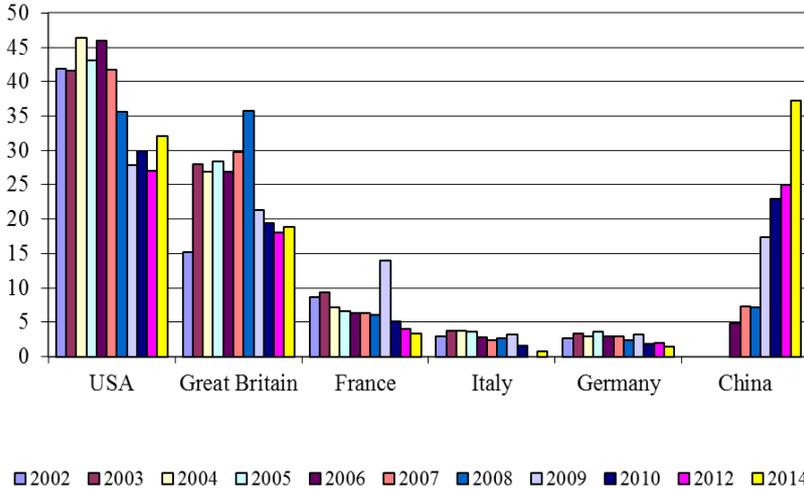
Table 2. Dynamics of shares (%) of countries in value of art auction sales in 2002-2014

Country	2002	2003	2004	2005	2006	2007	2008	2009	2010	2012	2014
USA	41.9	41.6	46.3	43.1	45.9	41.7	35.6	27.9	29.9	27.0	32.1
Great Britain	15.2	28.0	26.9	28.4	26.9	29.7	35.7	21.3	19.4	18.0	18.9
France	8.6	9.3	7.2	6.6	6.4	6.4	6.0	13.9	5.1	4.0	3.3
Italy	2.9	3.7	3.7	3.6	2.8	2.4	2.7	3.2	1.5	n.a.	0.8
Germany	2.7	3.4	2.9	3.6	2.9	2.9	2.4	3.2	1.9	2.0	1.4
Hong Kong	1.1	1.2	1.9	3.7	n.a.						
China	n.a.	n.a.	n.a.	n.a.	4.9	7.3	7.2	17.4	23.0	25.0	37.2

Source: author's own work based on the data provided by: *Art Market Trends. Tendencias du marche de l'art*, Artprice 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2012, 2014.

Share of the USA in the global sale of art in 2002-2014 ranged between 27% and 46.3%, share of the UK fell in the range of 18%-35.7%, France: 4%-13.9%, Italy: 0.8%-3.7%, and Germany: 1.4%-3.6%. It is worth to underline the main tendencies – decreasing share of the US in auction turnover of works of art (drop from 46.3% in 2004 to 32% in 2014), then falling share of European countries (the UK, France, Germany), and finally surging share of China in global art sale value in recent years (4.9% in 2006; 7.2% in 2007; 17.4% in 2008; 23% in 2010, 25% in 2012 and 37.2% in 2014).

Figure 6. Dynamics of shares in art auction value in 2002-2014 in the selected countries of the world



Source: author’s own work based on the data provided by: *Art Market Trends. Tendencias du marche de l’art, Artprice 2002-2014.*

Based on the collected data it is possible to identify the triad of countries with the largest art markets, including: the USA, Europe and China. Fig. 8 indicates clearly the tendency of changes in shares among three main geographical markets – the falling share of the USA and European countries and dynamically increasing share of China.

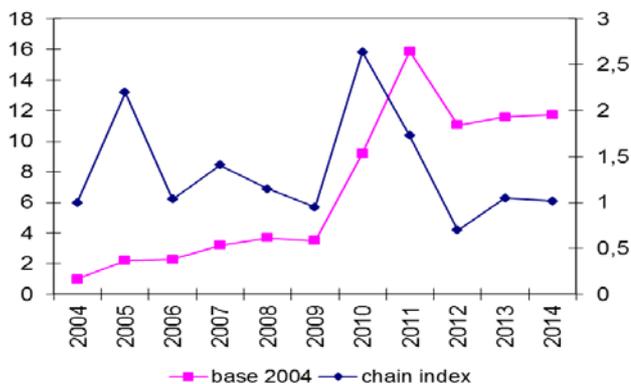
The value of sales on the art market in China in the period 2004-2014 (Table 3), increased from 860 mln USD in 2004 to 10 bln USD in 2014. The highest value of 13.7 bln it reached in 2011. Single base indices have shown that the value of sales of works of art in 2005-2006 doubled compared to 2004, tripled in the period 2007-2009, and increased nine times in 2010 compared to 2004 and increased sixteen times in 2011. In total, calculating in a cumulative way, base dynamic indexes have shown the increment of over eleven times in the market within a decade 2004-2014. On the art market in China, there was no increase in value in 2007 (as in the case of the global art market). The growth in China is attributed to 2011. The economic recession caused a 5.2% decrease in sales in the Chinese art market in 2009 in comparison with 2008 and was much smaller compared to the reaction of the world market (decrease in turnover of 32.8%).

Table 3. Value of sales at art auctions in China in m USD in 2004-2014

Year	Value of sales	Dynamic base index 2004 =100	Dynamic chain index previous year=100
2004	860	100.00	100.00
2005	1890	219.77	219.77
2006	1960	227.91	103.70
2007	2757	320.58	140.66
2008	3166	368.14	114.83
2009	3000	348.84	94.76
2010	7914	920.23	263.80
2011	13660	1588.37	172.60
2012	9518	1106.74	69.68
2013	9954	1157.44	104.58
2014	10083	1172.44	101.29

Source: author’s own work based on: TEFAF Report 2015, Art Economics i AMMA (Art Market Monitor of Artron)

Figure 7. Dynamic indexes (base and chain) for art value of sales in China in 2004- 2014

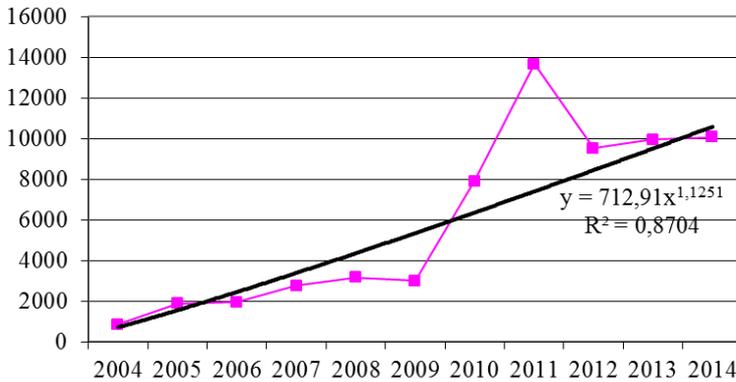


Source: author’s own work

Using the data on the value of sales of works of art in China power function of the trend $y = 712,91x^{1,1251}$ has been set. The coefficient of determination for the trend model $R^2 = 0.87$ (the model explains 87% of the

volatility of the value of sales of works of art). More detailed information on the art market in China have been delivered in the literature (Ma, 2015, pp. 1492-1498; Zhou & Sensel, 2016, pp. 1508-1511; Wang, 2017, pp. 44-53).

Figure 8. Value of auction sales of works of art in China in mln USD in 2004-2014 with trend function



Source: author’s own work based on data provided by: TEFAF Report 2015, Art Economics i AMMA (Art Market Monitor of Artron)

Conclusions

Turnover on the global art market in 2002-2015 ranged between €18.6 and 51bn and had in general increasing tendency. Volume of sales fell in the range of 25.4-49.8 million transactions. The value and volume of sales have reached their tops in 2007 and 2014. Single base indices of dynamics indicated that in the analysed period, the value of sale on the art market grew more than two-fold, whereas volume grew by about 50%. Chain indices of dynamics display drops in value and volume in the years 2003, 2008-2009, 2012 as compared with the respective preceding year. Global crisis affected art market in the years 2008-2009, causing decrease in art value and volume sales. In the next year the art market staged a recovery. The trend analyses have allowed describing the changes on the market by means of mathematical functions.

The analysis of geographical structure of art market indicates the existence of three markets with the highest share: the USA, the ECC and China. The United Kingdom, France, Germany and Italy are the most significant among the ECC art markets. It is worth to underline the changes in the geographical structure of art markets - decreasing share of the USA in auction turnover of works of art (drop from 46.3% in 2004 to 32% in 2014), then falling share of

European countries (the UK, France, Germany), and finally surging share of China in global art sale value in recent years (4.9% in 2006; 7.2% in 2007; 17.4% in 2008; 23% in 2010, 25% in 2012 and 37.2% in 2014). It is noteworthy that Europe and USA have dynamically lost their market share in favour of China.

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