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# The regression model of the art market in Poland

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## Abstract

**Aim:** The aim of the article was to study the impact of the functional form of the regression model, i.e. the set of explanatory variables, on the rates of return. The assessment of the investment effectiveness in the Polish art market required building a regression model to determine price indices and rates of return. The knowledge of price-forming factors can be used to build a hedonic regression model that maps the dependence of painting prices and their characteristics.

**Methodology:** The purpose of the article was achieved by analysing the sales records from Polish auction houses, for the most sold painters in the period 2007–2022. On this sample of 7,442 records, the parameters of nine hedonic regression models were estimated with the *LSM* using many combinations of explanatory variables.

**Results:** The research results indicate that the form of the regression model is crucial for the value of indices and affects the rates of return with differences in examined models ranging from 3.71 p.p. to 13.71 p.p. Although the selection of explanatory variables affects the value of the indices and the rates of return, the variability of the average index values remained within the limits of a strong and positive correlation between the individual studies.

**Implications and recommendations:** The article expands the knowledge on the assessment of investment effectiveness in the Polish art market. Recommendations for future research include searching for new price-forming factors and incorporating them into the regression model.

**Originality/value:** The study of hedonic regression on the Polish market is unique due to the lack of access to a database on the sales of paintings on the Polish auction market.

**Keywords:** art market, regression model, hedonic price index, rate of return

## 1. Introduction

Treating art as an investment requires addressing the problem of the profitability of investment and creating a price index of painting. The worldwide and popular method of repeated sales requires price data of the same painting from the past sales, it is difficult to apply in Poland due to the small scale of the art market. The hedonic method allows for the inclusion of all selected sales transactions in the research sample, therefore it was necessary to construct a hedonic index in which the price of the artwork is a function of its characteristics. This required:

- knowledge about price-setting mechanisms in the art market,
- finding the appropriate functional form of the regression model.

The price of a painting is unpredictable and it is shaped by numerous factors, including the features of the art market, the external environment in relation to the art market, as well as the attributes of the work of art and its creator, whilst their composition is different for each sale transaction.

The art market in Poland is only slightly regulated, which results in its lack of transparency, the monopolistic position of auction houses, and information asymmetry. Market laws work differently in this case than they do in traditional goods markets – the operation of the law of demand is limited to low-price pictures that are affected by the high price elasticity of demand, whereas it does not apply to high-value artefacts, where prices may be influenced by emotional factors. The demand for expensive artworks of high artistic value is insensitive to price changes. Similarly, the supply of paintings should be broken down into works of art that are low and highly valued by the market. The former are characterised by abundant supply, the latter form an exclusive market with a generally constant supply, where few artists earn a significant share of income, which meets the conditions of the Pareto principle and makes the price distribution asymmetric and right-skewed (Lucińska, 2011, pp. 239-251).

One of the important factors influencing the low level of prices achieved at painting auctions is the limited scale and local nature of the domestic art market. Another group of factors affecting the price levels is related to the specificity of the auction mechanisms, where the law of one price does not apply and where the prices of paintings may be a derivative of the rank of auction houses and their location, type of auction, manner of competition and market games conducted by the auction participants. Market games are a frequently used mechanism that effectively affects the prices of paintings, and one of them often used in Poland is the so-called 'price building' (Szafrański, 2011, p. 234) including, e.g. hiding part of the market offer, suggesting an increase in interest of a specific artwork, when auction houses buy auctioned objects from each other (the so-called 'sham auctions').

The participants of the art market are primarily collectors, art dealers and investors who differ, among others, regarding the acceptable price level. Purchases made by important collectors and investors can trigger market phenomena such as a 'price bubble'. There are examples of intensive purchases of highly valued works of art, resulting in a significant increase in their market value. In Poland such a situation occurred in 1991, due to the purchase of Polish paintings by the Art-B company, which caused a rapid boom in the art market and the appearance of a large number of canvases.

The timing of the sale, the macroeconomic situation and the condition of the financial markets also affect the price of paintings. Low prices are sustained in periods of economic slowdown and recession, whereas the boom in the stock market, increased optimism of buyers, general wealth of the society and income inequality, along with the concentration of maximum income among the most affluent, are conducive to price rises. The faster income inequality grows, the greater the ensuing boom in the art market (Goetzmann et al., 2011).

Prices are also influenced by factors such as the attributes of artworks and their creators. Among the features expressing the meaning and origin of the artwork, its position in a newly emerging style in painting should also be mentioned. Works that were innovative at the time they were created obtain

the highest valuation (Singer, & Lynch, 1997). The documented history and provenance, and even a legend (an interesting story related to the painting), its presence in an important collection, the exhibition catalogue and a quality photo album are also important for the price of the painting. The features of the artefact, important for shaping its price also include the artist's signature, date, painting style and preferred subjects, which in the Polish market comprise self-portraits and *Polonica* (Lucinska, & Schabek, 2014). Other attributes include: the appearance of the painting, its rarity, state of preservation (the smaller the area of cavities and restorations, the better for the price), techniques (usually paintings painted with durable techniques on a durable surface, e.g. oil on canvas, are valued higher), surface (price of painting increases to a certain size, beyond which paintings become less saleable, exceptions being, e.g. when the purchasing party is a museum); in addition, the horizontal orientation of the painting positively influences the valuation (Higgs, & Foster, 2011).

In the group of price-setting factors related to the artist, his/her reputation is of fundamental importance – the higher reputation of the artist, the higher are prices of the paintings. Moreover, the past results of auction sales are important. The artist's branding process may include information about his/her private life, and the artist's death may cause a short-term increase in the prices. The 'death effect', as well as the artist's advanced age, and information about his/her health condition may positively affect the valuation of paintings created by more famous artists (Frick, & Knebel, 2007).

The fundamental problem is the form of the regression function and the set of explanatory variables. The specification of the regression function significantly affects the value of the hedonic index and, consequently, the rate of return on the market of paintings. The aim of the study was to evaluate the influence of the regression model functional form on the rates of return in the art market in Poland in the period 2008–2022 by determining the differences in rates of return obtained from the tested models.

## 2. Literature review

To examine the achievements in this area, a review of the scientific literature belonging to the canon of contemporary world literature was made. The use of hedonic indices in researching the art market dates back to Anderson (1974), who took into account in the regression model the following variables: *the year of sale, the surface of the painting* and *the artist's reputation,* where the painter's artistic and prestigious reputation was expressed by the average price of his/her paintings. Buelens and Ginsburgh (1993) created a small model with three explanatory variables*: the year of sale, painting style* i.e. 17th century Dutch paintings, British paintings, 15th century Italian paintings, Impressionist work, and information about *artist living status* (alive/deceased in the time of the auction). Agnello and Pierce (1996) introduced the variable defining *the subject* of the painting, i.e. *abstract painting, still life, genre painting, landscape, cityscape, portrait* among others. Chanel et al. (1996) extended the list of explanatory variables by: *the width and height of the painting, their squares* and zero-one variables indicating: *the artist,* i.e. his/her name, and *auction house*.

Nowadays the set of explanatory variables selected for the hedonic regression model includes many features, but there are some variables that are used in most of the studied cases: *painter's name* indicating his reputation*, signing* indicating whether the painting was signed or not*, living status, technique* (e.g. *oil, acrylic, watercolour, gouache, pastel, tempera*), *background* (e.g. *canvas, board, paper, plywood, cardboard*)*, width* and *height* or *area, date* and *place of sale* i.e. *the year of the sale* and *the name of the auction house*. The *painter's name* variable was used by, among others: Kräussl et al. (2014), Dürr (2010), Edwards (2004), Higgs and Foster (2011), Hodgson (2011), Kräussl and Elsland (2008), Renneboog and Spaenjers (2013), Kräussl (2014), Renneboog and van Houtte (1999), Worthington and Higgs (2006), Hodgson and Vorkink (2004). Other variables appeared in individual cases, e.g. *status: African American/White American* was used in the Agnello and Xu studies (2008). The variables: *year of birth, year of death, country of birth, artist's age, dating, subject matter, auction history, provenance* (does the painting come from a private collection?)*, exhibitions* (was the painting

exhibited at prestigious exhibitions?)*, literature1* (was the painting discussed in texts on the history of art?)*, literature2* (was the painting included in the artist's monographs?)*, the year / decade in which the artwork was painted* were included in the study by Barbosa and Campos (2008), whilst variables: *month of sale, picture / description in the auction catalogue*, *lot* (*order number at the auction/1000)* were admitted by Agnello (2002), whilst the variable *number of sold works per year* was included by Biey and Zanola (2005).

In individual cases, the mentioned authors used such variables as: *word count in articles on art market portals, presence in texts on art history, painting price range, average price, nationality, area$^2$, length$^2$, width$^2$, in length, in width, artist's age$^2$, artist's age$^3$, artist's age$^4$, dating, attribution, dedications, auction house country, auction house city, semester of sale, quarter of sale, estimated price*.

Some of the mentioned explanatory variables are not in doubt, e.g. *year of birth, year of death, area, length, width, in length, in width,* and others, however some of them may raise concerns related to their ambiguity, e.g. *word count*. Word count in texts posted on art market portals, in texts on the history of art and others, is controversial information – which of the portals of art and texts can be taken into consideration? A similarly problematic feature is the painting style. A painting is not always a representative of a specific style in painting, sometimes it is eclectic, combining different styles, and can also be evidence of the artist's deliberate choice. Outside the mainstream 20$^{th}$ century artistic trends rests the artistic work of painters popular on the Polish market, e.g. Wojciech Kossak, Jerzy Kossak, Władysław Chmieliński (Stachowicz). Józef Pankiewicz followed a variety of styles, whilst Leon Wyczółkowski moved away from Impressionism towards Symbolism. Tadeusz Makowski was initially inspired by Cubism, and then over time he developed his own, original style, hence assigning a painting to a specific style requires not only a specialist knowledge of art history but also of the artist's biography. This may also explain the reason why certain features rarely become explanatory variables in regression models of the art market.

In research on the Polish art market, the list of factors determining the price of an artwork includes: *the name of the painter, the year/semi-year/quarter of sale, auction house, signature, painting technique, background, surface* and its transformations, e.g. *the natural logarithm of the surface area, the square of the surface area, the relationship between the reserve price and the selling price, living status, price class of the painting, maximum price* obtained for the painter's painting, *the era in painting* indicated by the date of painter's birth, *the subject of the painting and the age of the painter at the time of creating the painting*. The above were used in: Lucińska (2013), Witkowska and Kompa (2013), Witkowska and Kompa (2014a), Witkowska and Kompa (2014b), Witkowska and Kompa (2014c), Witkowska (2014), Lucińska (2015), Witkowska and Kompa (2015), Witkowska and Lucińska (2015), Lucińska (2021). It should be mentioned that Białowąs et al. (2018) examined the Polish art market applying the repeated sales method.

## 3. Methodology

The theory of hedonic functions and hedonic indices is not a theory of prices of goods but concerns their characteristics. Heterogeneous goods, which are paintings, are aggregates of their features, namely the buyer purchases a package of the features (characteristics) of the artwork essential for him/her, which contribute to the selection of a specific set of features from among many other sets available on the market (Triplett, 2004). As a result, the aggregate of these characteristics is treated as a measure of painting quality and the price is understood as the sum of the prices of these characteristics.

The hedonic model necessary to determine the hedonic index of the price is a specific multiple regression model, in which the price of the artwork (or natural logarithm of the price) is the explained variable and the explanatory variables are its characteristic features. Thus, the hedonic price of a work of art is defined as a linear additive function of a set of its characteristics, and these variables can be

estimated. To determine the hedonic index one should use the parameters of the hedonic regression model into which the work's features are incorporated. These features can be divided into: quantitative – measurable, numerical, e.g. *surface of painting in cm²* or *ln of surface*, qualitative – immeasurable, expressed in words, e.g. *the painter's name, the auction* house where the painting was sold, *the technique* in which it was made, *the subject of the painting*, etc.

The price index in the art market should show general market trends, as in financial markets this is done by indices, e.g. WIG in Poland. This may imply the need to use objective criteria for categorising the characteristics of works of art and their creators, however this objectivity is very difficult to achieve. Attempts made in the eighteenth century to classify artists into the following groups, namely composition, drawing, colour and expression, and to assign them a score (e.g. Rembrandt received 15, 6, 17 and 12 points, respectively) were described as a "notorious aberration" (Ginsburgh, & Throsby, 2006, p. 960).

As there is no objective categorisation of painting, hence one should use substitutes for the artistic characteristics that create the value of the painter and his/her work, i.e. their qualitative, immeasurable features. In a hedonic regression model these are usually described in terms of binary, zero-one explanatory variables:

$$x_{i,j} = \begin{cases} 0 \\ 1, \end{cases} \tag{1}$$

where $x_{i,j}$ = 1 if the event occurs or the object has the given feature and $x_{i,j}$ = 0 if the event does not occur or the object does not have the given feature.

The standard approach in the literature is to use a semi-logarithmic multiple (SML) regression function of the form (see Kräussl, & Elsland, 2008):

$$ln\, P_{i,t} = a_0 + \sum_{j=1}^{k} \alpha_j X_{ij,t} + \sum_{t=1}^{\tau} \beta_t Z_{i,t} + \varepsilon_{i,t}, \tag{2}$$

where $P_{i,t}$ – the price of painting *i* (*i* = 1, 2,…, *I*) sold in period *t* (*t* = 1, 2,…, *T*), $\alpha_0$ – intercept, $X_{ij,t}$ – the $j^{th}$ characteristics *(j* = 1, 2,…, *k)* of painting *i* sold in period *t*, $\alpha_j$, $\beta_t$ – regression coefficients, $Z_{i,t}$ – zero-one time variable, $\varepsilon_{i,t}$ – random component.

This equation expresses the natural logarithm of price *P* of $i^{th}$ picture sold over period *t* ($ln\, P_{i,t}$) as a linear additive function of independent variables $X_{ij,t}$ and $Z_{i,t}$, random component $\varepsilon_{i,t}$ and intercept $\alpha_0$. Explanatory variables $X_{j,t}$ represent the attributes of the paintings sold, they indicate the painter's name, technique, auction house, signature, subject of the painting, period of birth, ln of surface area, living status, etc. These characteristics are most often qualitative, represented in the model by binary variables. In all cases, one variant of the dummy variable, as a reference variable, is omitted to avoid collinearity. There may also be continuous variables, e.g. of surface area. The period of the sale of the artwork can be expressed using the zero-one variable of time $Z_{i,t}$ that is the vector of variables $Z_{i,t}$ taking the value 1 if the $i^{th}$ work was sold in period *t* or the value 0 otherwise.

The research sample comprised sales records from the www.artinfo.pl portal of paintings in Polish auction houses. The auction records included: title, technique, ground, width, height, signing, dating, and also additional information (presence in the subject's literature, art exhibitions, etc.), name and surname of the artist, possibly date of birth, possibly date of death, auction house, date of auction, reserve price, selling price.

Records of all sales of 7,442 paintings were selected and entered into the author's database. The transactions covered the period 2007–2022 and concerned 21 artists who took the highest positions in terms of the number and value of works sold during this period.

The list of explanatory variables, i.e. characteristics of paintings, included variables $X_{ij,t}$ and $Z_{i,t}$, the first of them being:

- zero-one variable *NAME* (described in Table 1) – identifies the artist, links the artwork with the reputation and the quality of the artist, defines his/her reputation by name, appears in twenty variants, reference variable *NIKIFOR KRYNICKI*;
- zero-one variable *TECHNIQUE* (described in Table 1) – indicates the technique used while painting, occurs in four variants, reference variable *OTHER* techniques;
- zero-one variable *AUCTION HOUSE* (described in Table 1) – presents the reputation of auctioneer, occurs in three variants, reference variable *OTHER* auction houses;
- zero-one variable *SIGNATURE* (see Table 1) – occurs in two variants: value 1 means that the painting was signed, 0 – it was not;
- zero-one variable *SUBJECT* (described in Table 1) – presents the subject of a painting, appears in eight variants, reference variable *OTHER* subjects;
- zero-one variable *PERIOD OF BIRTH* of the artist (described in Table 1) – appears in two variants, reference variable *AFTER 1900*;
- zero-one variable *ALIVE / DECEASED STATUS* (see Table 1) – included in the regression model since the death of an artist may cause the rise of prices, occurs in two variants: value 1 means that artist was deceased when the painting was sold during the auction, 0 – was alive;
- quantitative variable *LN SURFACE* – describes the physical characteristic of a painting, natural logarithm of the painting's area, expressed in $cm^2$.

Variable $Z_{i,t}$ is zero-one *YEAR OF SALE* in which the painting was sold – covers the period 2008 – 2022, appears in fifteen variants, reference variable *2007*.

The descriptive statistics of binary variables in regression models is presented in Table 1. Table 2 shows the explanatory variables in hedonic regression models I–IX built on the basis of formula (2), where X in Table 2 means that the variable was included into the model. In the first model there was only one explanatory variable, i.e. *YEAR OF SALE*, in further models the list was expanded by subsequent explanatory variables, creating in the last model a set consisting of all discussed variables. The presented hedonic regression models were tested, and the results of the hedonic regression analysis, i.e. parameter estimates for the analysed models are presented in Table 3, where *, **, and *** indicate statistical significance at the levels of 15%, 10%, and 5%, respectively.

The direct method of calculating the hedonic price index involves the use of time variables $Z_{i,t}$ as the characteristics that influence the price of the painting. Based on the estimated regression coefficients $\beta$ in model (2), the total hedonic index *THI* in period *t* was built with the application of the following formula (Triplett, 2004, p. 51; Renneboog, & Spaenjers, 2013):

$$THI_t = exp(\beta_t). \tag{3}$$

The transformation of the single-base index $THI_t$ into a chain hedonic index in period *t, i.e.* $HI_t$ was performed according to the formula (Witkowska, & Kompa, 2015):

$$HI_t = \frac{\exp(\beta_t)}{exp(\beta_{t-1})} = \frac{THI_t}{THI_{t-1}}, \tag{4}$$

where $HI_0 = 1$. Then the rates of return in the period 2008–2022 were calculated. The rate of return *R* in period *t* in relation to the previous period *t*-1 is the relative increase in the value of the *HI* index and is defined as follows (Witkowska, & Kompa, 2014c):

$$R_t = (HI_t - 1) \cdot 100\%. \tag{5}$$

The results are shown in Table 4.

## 4. Results

The descriptive statistics in Table 1 indicated that Jacek Malczewski's paintings reached over 27% of the value of turnover in the market, oil paintings accounted for over 83% of total turnover, 72% of turnover was achieved in three auction houses: DESA UNICUM, POLSWISSART and AGRA-ART. Taking the value of sales in the entire period 2007–2022 as a basis, the sales recorded in 2007–2014 accounted for 1.5% to 3.5%, the gradual increase of market share began in 2017 to reach the level of 15% in 2020 and 24.4% in 2021. In 2022, the share of sales decreased to 10.2%. The vast majority of paintings (over 94%) were signed, and the themes of the paintings with the highest market share, in order, were: symbolic content, portraits and landscapes. Paintings created by artists born before 1875, in 1875–1896 and after 1900, accounted for a 37%, 30% and 33% share in the market, respectively. More than 91% transactions concerned paintings by artists deceased at the time of the auction.

The parameter estimates and quality parameters of the estimated models are presented in Table 3. The adjusted $R^2$ of 4.08% and 16.65% in models I and II, respectively, were too low, therefore these models were rejected for further consideration. $R^2$ in models III to IX were in the range of [52.76%, 79.84%] and sufficient enough for cross-sectional data as the bigger number of explanation variables brings the higher value of determination coefficient. The values of the F-statistic were in the range of [82.38, 629.60] and indicated that the regression equations correctly mapped the relationships between the independent and the dependent variables. Models VIII and IX had the same value of the coefficient of determination $R^2$ and the AIC criterion, which may indicate that the *PERIOD OF BIRTH* variable does not improve the goodness of fit of the model. In turn, models VI and VII were characterized by a slightly lower model fit ($R^2$ coefficient) and had better statistical properties from the point of view of the Akaike criterion.

Taking into account models VI to IX, it should be noted that most of the *NAME* variable coefficients were significant at the level of 5%. According to the estimated coefficients of this variable, significantly higher values were likely to be placed on the works by *MALCZEWSKI JACEK, MUTER MELA, NOWOSIELSKI JERZY, OLBINSKI RAFAŁ* and *FAŁAT JULIAN* in comparison with the reference variable, i.e. *NIKIFOR.* Works created using *ACRYLIC* and *OIL* techniques may reach higher prices than those using *OTHER* techniques, while those created using *WATERCOLOR* techniques may be cheaper. The biddings in auction house *POLSWISS ART* were associated with higher prices than in *AGRA-ART* and *DESA UNICUM*. This confirms the opinion that *POLSWISS ART* has been successful in its market strategy of selling high-value works of art and in line with the average prices set for these auction houses. Most of the time variables *YEAR OF SALE* for the period 2008-2014 were insignificant. Presumably, sales in 2021 and 2022 were expected to see the largest price increases compared to 2007.

The coefficients of significant variables *SIGNATURE* and *LN SURFACE* indicated that art prices tended to positively and significantly react to these factors. In models VIII and IX a higher value tended to be attributed to works on themes: *SYMBOLISM, CITYSCAPE, BATTLE THEMES, PORTRAIT* and *GENRE PAINTING* than on *OTHER* subjects. The coefficients of the variable *PERIOD OF BIRTH* suggest that paintings by artists born in *YEARS 1875–1896* were probably more expensive than those by artists born *AFTER 1900.* This is not consistent with market price observations in these groups, where the average price in the 1875-1896 group was PLN 31,150 and was lower than the average price in the reference group, i.e. PLN 47,719 for AFTER 1900. This can be explained by the large spread of average prices in the first group, where for NIKIFOR it was PLN 5,300 and PLN 197,184 for MELA MUTER, confirmed by the high coefficient of variation of 7.19. The living status of the artist (*ALIVE / DECEASED*) was statistically significant, indicating that the market appreciated the information of the death of the artist when the painting was sold.

As far as the rates of return are concerned (Table 4) it can be stated that significant differences in the rates of return determined on the basis of the examined models were found. The spread in the rates of return ranged from 3.71% in 2022 to 13.71% in 2014. In 2022 the lowest rate of return calculated

as $R_t$ *min* (-2.47%) was determined on the basis of model IV, and the highest $R_t$ *max* (1.24%) – based on models VIII and IX. In 2014 the rate of return was the lowest (-9.27%) in model VII and the highest (4.44%) in model IV. This is a significant difference in rates of return, resulting from the form of the regression model used.

The explanatory variables used in the hedonic regression models in seven Polish art market studies are presented in Table 5. Each analysis included several models differing in the selection of explanatory variables, and the summary of the average annual indices of the Polish art market is presented in Table 6. It should be noted that the presented models and indices were estimated for research samples which differed in the list of artists, the years studied and the formula of the hedonic model, thus the obtained results cannot be directly compared.

The Pearson correlation coefficients of average indices were determined for the corresponding periods. Their positive and high values allowed to conclude that there was a strong, linear relationship between average indices in the analysed studies and in the comparable periods of 2008–2010 and 2008–2013 (Table 7). Therefore, although the selection of explanatory variables affected the value of the indices and consequently the rates of return, the variability of the average index values remained within the limits of strong dependence between individual studies.

However, this comment does not apply to the study by Witkowska and Kompa (2014a), where the correlation with the remaining indices was weak as a consequence of the selection of explanatory variables and the large dispersion of the determined indices.

## 5. Conclusions

The research conducted on the basis of the sales in Polish art market and the comparison of the results of these studies with those of foreign markets, lead to the conclusion that the explanatory variables taken into account in this study were similar to the variables most frequently used in foreign markets. The research results indicate differences in the values of the indices and rates of return based on the analysed models due to the diversified sets of explanatory variables. Nevertheless the average values of the indices were within a limited range of variability and strong, linear relationship in individual studies.

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# APPENDIX

Table 1. Binary variables in regression models – descriptive statistics

| Name | Number of paintings | Total value of paintings | Mean price | Standard deviation | Coefficient of variation | Market share |
|---|---|---|---|---|---|---|
| *BERDYSZAK JAN (1934–2014)* | 252 | 5,561,750 | 22,070 | 37,860 | 1.72 | 1.5% |
| *CHMIELIŃSKI STACHOWICZ Wł. (1911–1979)* | 282 | 2,472,150 | 8,766 | 6,051 | 0.69 | 0.6% |
| *DOMINIK TADEUSZ (1928–2014)* | 254 | 6,416,700 | 25,263 | 19,075 | 0.76 | 1.7% |
| *DWURNIK EDWARD (1943–2018)* | 807 | 25,443,150 | 31,528 | 39,859 | 1.26 | 6.7% |
| *FAŁAT JULIAN (1853–1929)* | 289 | 21,843,000 | 75,581 | 181,301 | 2.4 | 5.7% |
| *HOFMAN WLASTIMIL (1881–1970)* | 592 | 14,127,850 | 23,865 | 25,322 | 1.06 | 3.7% |
| *KARPIŃSKI ALFONS (1875–1961)* | 245 | 4,587,630 | 18,725 | 12,936 | 0.69 | 1.2% |
| *KORECKI WIKTOR (1890–1980)* | 284 | 2,132,750 | 7,510 | 5,213 | 0.69 | 0.6% |
| *KOSSAK JERZY (1886–1955)* | 610 | 11,471,300 | 18,805 | 14,425 | 0.77 | 3.0% |
| *KOSSAK WOJCIECH (1856–1942)* | 332 | 14,577,400 | 43,908 | 47,313 | 1.08 | 3.8% |
| *MALCZEWSKI JACEK (1854–1929)* | 320 | 102,789,200 | 321,216 | 666,809 | 2.08 | 27.0% |
| *MALCZEWSKI RAFAŁ (1892–1965)* | 260 | 9,921,200 | 38,158 | 96,178 | 2.52 | 2.6% |
| *MAŁACHOWSKI SOTER JAXA (1867–1952)* | 241 | 2,028,550 | 8,417 | 6,139 | 0.73 | 0.5% |
| *MENKES ZYGMUNT (1896–1986)* | 223 | 13,250,100 | 59,417 | 39,495 | 0.66 | 3.5% |
| *MUTER MELA (1876–1967)* | 232 | 45,746,700 | 197,184 | 211,229 | 1.07 | 12.0% |
| *NIKIFOR KRYNICKI (1895–1968) reference variable* | 597 | 3,163,950 | 5,300 | 5,886 | 1.11 | 0.8% |
| *NOWOSIELSKI JERZY (1923–2011)* | 501 | 48,941,900 | 97,688 | 108,922 | 1.11 | 12.9% |
| *OLBIŃSKI RAFAŁ (born 1943)* | 230 | 15,009,900 | 65,260 | 54,970 | 0.84 | 3.9% |
| *SETKOWICZ ADAM (1876–1945)* | 229 | 1,273,350 | 5,560 | 4,880 | 0.88 | 0.3% |
| *TARASIN JAN (1926–2009)* | 311 | 21,990,200 | 70,708 | 70,425 | 1 | 5.8% |
| *WEISS WOJCIECH (1875–1950)* | 351 | 7,181,900 | 20,461 | 27,208 | 1.33 | 1.9% |
| ***TECHNIQUE*** | | | | | | |
| *ACRYLIC* | 444 | 17,789,700 | 40,067 | 47,577 | 1.19 | 4.7% |
| *WATERCOLOUR* | 1,277 | 15,955,200 | 12,494 | 20,289 | 1.62 | 4.2% |
| *OIL* | 4,316 | 318,434,700 | 73,780 | 216,623 | 2.94 | 83.8% |
| *OTHER reference variable* | 449 | 6,494,900 | 14,465 | 26,383 | 1.82 | 1.7% |
| *MIXED TECHNIQUE* | 956 | 21,256,130 | 22,234 | 37,070 | 1.67 | 5.6% |
| *OTHER: crayon, liquitex acrylic paints, pencil, pastel, tempera, gouache, sanguine, among others* | | | | | | |
| *MIXED TECHNIQUE: combinations of acrylic, watercolour, oil, tempera, gouache, among others* | | | | | | |
| ***AUCTION HOUSE*** | | | | | | |
| *AGRA-art.* | 1,042 | 65,339,750 | 62,706 | 267,665 | 4.27 | 17.2% |
| *DESA UNICUM* | 1,905 | 126,228,100 | 66,261 | 176,426 | 2.66 | 33.2% |
| *POLSWISS art.* | 612 | 81,128,000 | 132,562 | 299,480 | 2.26 | 21.4% |
| *OTHER reference variable* | 3,883 | 107,234,780 | 27,616 | 63,769 | 2.31 | 28.2% |
| *OTHER: DESA, KRAKOWSKI DA, OSTOYA, POLSKI DA, REMPEX, RYNEK SZTUKI, SOPOCKI DA, among others.* | | | | | | |

| Name | Number of paintings | Total value of paintings | Mean price | Standard deviation | Coefficient of variation | Market share |
|---|---|---|---|---|---|---|
| ***YEAR OF SALE*** | | | | | | |
| *2007 reference variable* | 311 | 9,711,650 | 1,227 | 61,533 | 1.97 | 2.6% |
| *2008* | 329 | 13,382,530 | 40,676 | 74,674 | 1.84 | 3.5% |
| *2009* | 300 | 8,494,100 | 28,314 | 49,441 | 1.75 | 2.2% |
| *2010* | 217 | 6,537,550 | 30,127 | 57,969 | 1.92 | 1.7% |
| *2011* | 252 | 6,556,950 | 26,020 | 46,596 | 1.79 | 1.7% |
| *2012* | 218 | 5,781,150 | 26,519 | 44,327 | 1.67 | 1.5% |
| *2013* | 262 | 10,499,000 | 40,073 | 167,299 | 4.17 | 2.8% |
| *2014* | 220 | 7,747,000 | 35,214 | 82,558 | 2.34 | 2.0% |
| *2015* | 437 | 24,685,900 | 56,489 | 127,106 | 2.25 | 6.5% |
| *2016* | 559 | 22,856,350 | 40,888 | 72,950 | 1.78 | 6.0% |
| *2017* | 594 | 24,739,150 | 41,648 | 95,270 | 2.29 | 6.5% |
| *2018* | 534 | 24,917,450 | 46,662 | 103,949 | 2.23 | 6.6% |
| *2019* | 570 | 25,412,100 | 44,583 | 98,076 | 2.20 | 6.7% |
| *2020* | 832 | 57,140,550 | 68,679 | 212,172 | 3.09 | 15.0% |
| *2021* | 1,115 | 92,679,100 | 83,120 | 312,139 | 3.76 | 24.4% |
| *2022* | 692 | 38,790,100 | 56,055 | 178,614 | 3.19 | 10.2% |
| ***SIGNATURE*** | | | | | | |
| *0* | 948 | 20,370,330 | 21,488 | 52,143 | 2.43 | 5.4% |
| *1* | 6,494 | 59,560,300 | 55,368 | 178,848 | 3.23 | 94.6% |
| ***SUBJECT*** | | | | | | |
| *ABSTRACTION* | 889 | 41,039,050 | 46,163 | 61,043 | 1.32 | 10.8% |
| *BATTLE THEME* | 598 | 18,260,500 | 30,536 | 38,803 | 1.27 | 4.8% |
| *STILL LIFE* | 541 | 20,585,900 | 38,052 | 58,381 | 1.53 | 5.4% |
| *GENRE PAINTING* | 1,273 | 43,534,900 | 34,199 | 127,601 | 3.73 | 11.5% |
| *LANDSCAPE* | 1,594 | 51,246,150 | 32,149 | 95,849 | 2.98 | 13.5% |
| *PORTRAIT* | 922 | 68,009,080 | 73,763 | 168,623 | 2.29 | 17.9% |
| *OTHER reference variable* | 986 | 47,857,500 | 48,537 | 75,640 | 1.56 | 12.6% |
| *SYMBOLISM* | 348 | 82,336,800 | 236,600 | 595,722 | 2.52 | 21.7% |
| *CITYSCAPE* | 291 | 7,060,750 | 24,264 | 55,207 | 2.28 | 1.9% |
| *OTHER: NUDE, SELF PORTRAIT, MARINE, NOCTURNE, SURREALISM, among others* | | | | | | |
| ***PERIOD OF BIRTH*** | | | | | | |
| *BEFORE 1875* | 1,182 | 141,238,150 | 119,941 | 27,082 | 0.28 | 37.8% |
| *YEARS 1875 – 1896* | 3,623 | 112,856,730 | 31,150 | 224,052 | 7.19 | 29.7% |
| *AFTER 1900 reference variable* | 2,637 | 125,835,750 | 47,719 | 106,255 | 2.03 | 32.5% |
| ***ALIVE/*DECEASED** | | | | | | |
| *0* | 860 | 32,324,600 | 37,587 | 50,219 | 1.34 | 8.5% |
| *1* | 6,582 | 347,606,030 | 52,812 | 178,153 | 3.37 | 91.5% |
| **TOTAL** | **7,442** | **379,930,630** | **51,052** | **168,478** | **3.30** | **100.0%** |

Source: own elaboration, prices in PLN.

Table 2. Explanatory variables in I – IX regression models

| Explanatory variables | I | II | III | IV | V | VI | VII | VIII | IX |
|---|---|---|---|---|---|---|---|---|---|
| *YEAR OF SALE* – 15 variants | X | X | X | X | X | X | X | X | X |
| *AUCTION HOUSE* – 3 variants | - | X | X | X | X | X | X | X | X |
| *NAME* – 20 variants | - | - | X | X | X | X | X | X | X |
| *SIGNATURE* | - | - | - | X | X | X | X | X | X |
| *TECHNIQUE* – 4 variants | - | - | - | - | X | X | X | X | X |
| *LN SURFACE* | - | - | - | - | - | X | X | X | X |
| *ALIVE / DECEASED STATUS* | - | - | - | - | - | - | X | X | X |
| *SUBJECT* – 8 variants | - | - | - | - | - | - | - | X | X |
| *PERIOD OF BIRTH* – 2 variants | - | - | - | - | - | - | - | - | X |

Source: own elaboration.

Table 3. Regression analysis results: models I to IX

| Variables and variants | I | II | III | IV | V | VI | VII | VIII | IX |
|---|---|---|---|---|---|---|---|---|---|
| ***NAME*** | | | | | | | | | |
| *BERDYSZAK JAN* | - | - | 0.8760 *** | 0.6520 *** | 0.1016 | -0.6805 *** | -0.5079 *** | -0.4939 *** | 0.0000 |
| *CHMIELIŃSKI STACHOWICZ* | - | - | 0.5115 *** | 0.2547 *** | -0.5164 *** | -0.8249 *** | -0.8234 *** | -1.0905 *** | -0.5965 *** |
| *DOMINIK TADEUSZ* | - | - | 1.5338 *** | 1.2908 *** | 0.3160 *** | -0.6181 *** | -0.4115 *** | -0.3898 *** | 0.1041 ** |
| *DWURNIK EDWARD* | - | - | 1.2879 *** | 1.0675 *** | 0.1778 *** | -0.5156 *** | -0.2243 *** | -0.2822 *** | 0,2117 *** |
| *FAŁAT JULIAN* | - | - | 2.3145 *** | 2.0603 *** | 1.9288 *** | 1.0470 *** | 1.0394 *** | 1.0418 *** | 1.4726 *** |
| *HOFMAN WLASTIMIL* | - | - | 1.4484 *** | 1.1946 *** | -0.1450 *** | -0.2712 *** | -0.2594 *** | -0.4954 *** | -0.4954 *** |
| *KARPIŃSKI ALFONS* | - | - | 1.4132 *** | 1.1590 *** | -0.0991 | -0.4425 *** | -0.4481 *** | -0.4781 *** | -0.4781 *** |
| *KORECKI WIKTOR* | - | - | 0.4808 *** | 0.2272 *** | -1.1249 *** | -1.5475 *** | -1.5531 *** | -1.5240 *** | -1.5240 *** |
| *KOSSAK JERZY* | - | - | 1.3899 *** | 1.1319 *** | -0.2380 *** | -0.5819 *** | -0.5742 *** | -0.7352 *** | -0.7352 *** |
| *KOSSAK WOJCIECH* | - | - | 2.0370 *** | 1.7831 *** | 0.5317 *** | 0.1598 *** | 0.1566 *** | 0.0092 | 0.4399 *** |
| *MALCZEWSKI JACEK* | - | - | 3.0214 *** | 2.7762 *** | 1.7059 *** | 1.4457 *** | 1.4463 *** | 1.1690 *** | 1.5998 *** |
| *MALCZEWSKI RAFAŁ* | - | - | 1.2913 *** | 1.0505 *** | 0.9188 *** | 0.1653 *** | 0.1639 *** | 0.1848 *** | 0.1848 *** |
| *MAŁACHOWSKI SOTER JAXA* | - | - | 0.6428 *** | 0.3911 *** | 0.1989 *** | -0.4253 *** | -0.4204 *** | -0.4308 *** | 0.0000 |
| *MENKES ZYGMUNT* | - | - | 2.2933 *** | 2.0451 *** | 0.9812 *** | 0.4809 *** | 0.4743 *** | 0.4229 *** | 0.4229 *** |
| *MUTER MELA* | - | - | 3.1560 *** | 2.9273 *** | 1.9036 *** | 1.3998 *** | 1.4081 *** | 1.3370 *** | 1.3370 *** |
| *NOWOSIELSKI JERZY* | - | - | 2.3579 *** | 2.1625 *** | 1.3838 *** | 0.9390 *** | 1.1311 *** | 1.1056 *** | 1.5995 *** |
| *OLBIŃSKI RAFAŁ* | - | - | 2.3767 *** | 2.1279 *** | 1.3215 *** | 0.5935 *** | 1.2571 *** | 1.2613 *** | 1.7552 |
| *SETKOWICZ ADAM* | - | - | 0.1816 *** | -0.0769 | -0.7363 *** | -0.8665 *** | -0.8548 *** | -0.9314 *** | -0.9314 *** |
| *TARASIN JAN* | - | - | 2.0894 *** | 1.8443 *** | 1.2018 *** | 0.3310 *** | 0.3918 *** | 0.4149 *** | 0.9089 *** |
| *WEISS WOJCIECH* | - | - | 0.9431 *** | 0.6895 *** | -0.0521 | -0.4071 *** | -0.3852 *** | -0.4137 *** | -0.4137 *** |
| ***PAINTING TECHNIQUE*** | | | | | | | | | |
| *ACRYLIC* | - | - | - | - | 1.1497 *** | 0.9885 *** | 0.8975 *** | 0.9049 *** | 0.9049 *** |
| *WATERCOLOR* | - | - | - | - | -0.0935 *** | -0.0479 | -0.0614 ** | -0.0688 ** | -0.0688 ** |
| *OIL* | - | - | - | - | 1.4451 *** | 0.8724 *** | 0.8603 *** | 0.8661 *** | 0.8661 *** |
| *MIXED TECHNIQUE* | - | - | - | - | 0.2735 *** | 0.1776 *** | 0.1763 *** | 0.1767 *** | 0.1767 *** |
| ***AUCTION HOUSE*** | | | | | | | | | |
| *AGRAART* | - | 0.6806 *** | 0.4065 *** | 0.4017 *** | 0.3425 *** | 0.2458 *** | 0.2707 *** | 0.2525 *** | 0.2525 *** |
| *DESA UNICUM* | - | 0.7794 *** | 0.4693 *** | 0.4561 *** | 0.3519 *** | 0.1834 *** | 0.1784 *** | 0.1753 *** | 0.1753 *** |
| *POLSWISS ART* | - | 1.5646 *** | 1.0417 *** | 1.0312 *** | 0.7792 *** | 0.4887 *** | 0.4756 *** | 0.4653 *** | 0.4653 *** |

| Variables and variants | I | II | III | IV | V | VI | VII | VIII | IX |
|---|---|---|---|---|---|---|---|---|---|
| ***YEAR OF SALE*** | | | | | | | | | |
| *2008* | 0.2858 *** | 0.2273 *** | 0.0926 | 0.1000 | 0.0661 | 0.1122 *** | 0.0548. | 0.0548 | 0.0548 |
| *2009* | -0.1186 | -0.1739 ** | -0.0985 | -0.0901 | -0.0563 | 0.0343 | -0.0154 | -0.0123 | -0.0123 |
| *2010* | -0.0614 | -0.0669 | 0.0198 | 0.0290 | 0.0253 | 0.0498 | 0.0090 | 0.0147 | 0.0147 |
| *2011* | -0.1424 | -0.2960 *** | -0.1765 *** | -0.1715 *** | -0.1073 * | -0.0676 | -0.1303 *** | -0.1308 *** | -0.1308 *** |
| *2012* | -0.1341 | -0.3742 *** | -0.1376 ** | -0.1240 ** | -0.0489 | -0.0142 | -0.0563 | -0.0561 | -0.0561 |
| *2013* | -0.0336 | -0.2669 *** | -0.0956 | -0.0877 | -0.0852 | -0.0184 | -0.0436 | -0.0404 | -0.0404 |
| *2014* | 0.1028 | -0.0868 | -0.0627 | -0.0443 | -0.0608 | -0.0667 | -0.1408 *** | -0.1288 *** | -0.1288 *** |
| *2015* | 0.3843 *** | 0.0843 | 0.1783 *** | 0.1833 *** | 0.1730 *** | 0.2020 *** | 0.0545 | 0.0559 | 0.0559 |
| *2016* | 0.3049 *** | 0.1198 | 0.2368 *** | 0.2492 *** | 0.2689 *** | 0.2399 *** | 0.1046 *** | 0.1095 *** | 0.1095 *** |
| *2017* | 0.1757 ** | 0.0572 | 0.1731 *** | 0.1755 *** | 0.1515 *** | 0.1585 *** | 0.0365 | 0.0369 | 0.0369 |
| *2018* | 0.2500 *** | -0.0034 | 0.1327 *** | 0.1416 *** | 0.1487 *** | 0.2146 *** | 0.0794 ** | 0.0793 ** | 0.0793 ** |
| *2019* | 0.3842 *** | 0.2585 *** | 0.2912 *** | 0.3017 *** | 0.2864 *** | 0.3379 *** | 0.1455 *** | 0.1459 *** | 0.1459 *** |
| *2020* | 0.5092 *** | 0.3928 *** | 0.4725 *** | 0.4804 *** | 0.5095 *** | 0.5431 *** | 0.3607 *** | 0.3617 *** | 0.3617 *** |
| *2021* | 0.7527 *** | 0.7065 *** | 0.8020 *** | 0.8069 *** | 0.8306 *** | 0.9161 *** | 0.7163 *** | 0.7209 *** | 0.7209 *** |
| *2022* | 0.5519 *** | 0.6729 *** | 0.7826 *** | 0.7820 *** | 0.8074 *** | 0.9217 *** | 0.7271 *** | 0.7332 *** | 0.7332 *** |
| ***SIGNATURE*** | - | - | - | 0.2627 *** | 0.2432 *** | 0.0823 *** | 0.0718 *** | 0.0751 *** | 0.0751 *** |
| ***SUBJECT*** | | | | | | | | | |
| *ABSTRACTION* | - | - | - | - | - | - | - | -0.0089 | -0.0089 |
| *BATTLE THEME* | - | - | - | - | - | - | - | 0.2141 *** | 0.2141 *** |
| *STILL LIFE* | - | - | - | - | - | - | - | 0.0103 | 0.0103 |
| *GENRE PAINTING* | - | - | - | - | - | - | - | 0.0793 *** | 0.0793 *** |
| *LANDSCAPE* | - | - | - | - | - | - | - | -0.0272 | -0.0272 |
| *PORTRAIT* | - | - | - | - | - | - | - | 0.1361 *** | 0.1361 *** |
| *SYMBOLISM* | - | - | - | - | - | - | - | 0.5362 *** | 0.5362 *** |
| *CITYSCAPE* | - | - | - | - | - | - | - | 0.3411 *** | 0.3411 *** |
| ***PERIOD OF BIRTH*** | | | | | | | | | |
| *BEFORE 1875* | - | - | - | - | - | - | - | - | 0.0632 |
| *YEARS 1875-1896* | - | - | - | - | - | - | - | - | 0.4939 *** |
| ***ALIVE / DECEASED STATUS*** | - | - | - | - | - | - | 0.6355 *** | 0.6334 *** | 0.6334 *** |
| ***LN SURFACE*** | - | - | - | - | - | 0.5484 *** | 0.5553 *** | 0.5486 *** | 0.5486 *** |
| $\alpha_0$ | 9.4357 *** | 9.1222 *** | 7.7474 *** | 7.7391 *** | 7.7052 *** | 4.5445 *** | 4.0041 *** | 4.0457 *** | 3.5517 *** |
| $R^2$ | 4.08% | 16.65% | 52.76% | 52.92% | 66.62% | 78.30% | 79.30% | 79.84% | 79.84% |
| *Df* | 7,426 | 7,423 | 7,403 | 7,402 | 7,398 | 7,397 | 7,396 | 7,388 | 7,388 |
| F | 21.07 | 217.54 | 343.34 | 629.60 | 551.91 | 82.38 | 213.35 | 606.75 | 551.91 |
| AIC | -0.562 | -0.421 | 0.152 | 0.156 | 0.501 | 0.932 | 0.979 | 1.008 | 1.008 |

Source: own elaboration.

Table 4. Rates of return $R_i$ in Polish art market in 2008-2022 calculated using models III to IX

| YEAR | III | IV | V | VI | VII | VIII | IX | $R_t$ *max* | $R_t$ *min* | spread |
|---|---|---|---|---|---|---|---|---|---|---|
| 2008 | 9.7% | 10.52% | 6.83% | 11.88% | 5.63% | 5.63% | 5.63% | 11.88% | 5.63% | 6.25 p.p. |
| 2009 | -17.39% | -17.32% | -11.52% | -7.5% | -6.78% | -6.49% | -6.49% | -6.49% | -17.39% | 10.90 p.p. |
| 2010 | 12.55% | 12.66% | 8.51% | 1.56% | 2.47% | 2.74% | 2.74% | 12.66% | 1.56% | 11.10 p.p. |
| 2011 | -17.83% | -18.17% | -12.42% | -11.07% | -13.01% | -13.54% | -13.54% | -11.07% | -18.17% | 7.10 p.p. |
| 2012 | 3.97% | 4.87% | 6.01% | 5.48% | 7.69% | 7.75% | 7.75% | 7.75% | 3.97% | 3.79 p.p. |
| 2013 | 4.29% | 3.69% | -3.56% | -0.42% | 1.27% | 1.58% | 1.58% | 4.29% | -3.56% | 7.85 p.p. |
| 2014 | 3.34% | 4.44% | 2.47% | -4.72% | -9.27% | -8.46% | -8.46% | 4.44% | -9.27% | 13.71 p.p. |
| 2015 | 27.26% | 25.56% | 26.33% | 30.82% | 21.56% | 20.29% | 20.29% | 30.82% | 20.29% | 10.53 p.p. |
| 2016 | 6.02% | 6.81% | 10.07% | 3.86% | 5.15% | 5.51% | 5.51% | 10.07% | 3.86% | 6.21 p.p. |
| 2017 | -6.17% | -7.11% | -11.07% | -7.81% | -6.59% | -7,00% | -7,00% | -6.17% | -11.07% | 4.90 p.p. |
| 2018 | -3.96% | -3.33% | -0.29% | 5.77% | 4.39% | 4.33% | 4.33% | 5.77% | -3.96% | 9.73 p.p. |
| 2019 | 17.18% | 17.37% | 14.77% | 13.12% | 6.83% | 6.88% | 6.88% | 17.37% | 6.83% | 10.54 p.p. |
| 2020 | 19.88% | 19.57% | 24.99% | 22.78% | 24.02% | 24.08% | 24.08% | 24.99% | 19.57% | 5.42 p.p. |
| 2021 | 39.02% | 38.61% | 37.87% | 45.2% | 42.7% | 43.22% | 43.22% | 45.2% | 37.87% | 7.34 p.p. |
| 2022 | -1.92% | -2.47% | -2.29% | 0.57% | 1.09% | 1.24% | 1.24% | 1.24% | -2.47% | 3.71 p.p. |
| Mean | 6.4% | 6.38% | 6.45% | 7.3% | 5.81% | 5.85% | 5.85% | 7.3% | 5.81% | 1.49 p.p. |
| Standard deviation | 15.48% | 15.33% | 14.73% | 15.51% | 14.38% | 14.37% | 14.37% | | | |

Source: own elaboration.

Note: spread = $R_t$ *max* – $R_t$ *min*

Table 5. The explanatory variables in hedonic regression models in Polish art market research

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| NAME | + | + | + | + | + | + | + |
| ALIVE / DECEASED STATUS | + | + | + | | + | + | |
| PERIOD OF BIRTH | + | + | | | | | |
| AUCTION HOUSE | + | + | + | + | + | + | + |
| YEAR OF SALE | + | + | + | + | + | + | + |
| SIGNATURE | + | + | + | + | + | + | + |
| TECHNIQUE | + | + | + | + | + | + | + |
| LN SURFACE | + | + | | | + | + | + |
| LN SURFACE$^2$ | | | | | + | + | |
| SURFACE AREA | | | | | | | |
| SURFACE AREA $^2$ | | | + | + | | | |
| SUBJECT OF PAINTING | + | | | | | + | |
| PRICE RELATION | | + | + | + | + | + | + |
| PRICE CLASS | | + | | | | | |

Source: (1) – own elaboration, (2) – Witkowska & Kompa, 2014a, (3) – Witkowska & Kompa, 2014b, (4) – Witkowska & Kompa, 2014c, (5) – Witkowska & Kompa, 2015, (6) – Witkowska & Lucińska, 2015, (7) – Lucińska, 2021.

Table 6. The summary of annual hedonic indices of the Polish art market in 2008-2010 and 2008-2013, determined for hedonic models used in Polish art market research

| Year | (1) | | | | (2) | | | | (3) | | | | (4) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | index max. | index min. | spread | average index | index max. | index min. | spread | average index | index max. | index min. | spread | average index | index max. | index min. | spread | average index |
| 2008 | 1.1188 | 1.0563 | 0.0625 | 1.0719 | 1.3586 | 1.0163 | 0.3423 | 1.0738 | 1.1303 | 1.0582 | 0.0721 | 1.0828 | 1.3586 | 1.0582 | 0.3004 | 1.1589 |
| 2009 | 0.9351 | 0.9250 | 0.0101 | 0.9319 | 1.0394 | 0.7206 | 0.3188 | 0.9546 | 0.8981 | 0.7206 | 0.1775 | 0.8387 | 0.9344 | 0.8975 | 0.0369 | 0.9100 |
| 2010 | 1.0274 | 1.0156 | 0.0118 | 1.0238 | 1.0389 | 0.0030 | 1.0359 | 0.8681 | 1.0389 | 0.9549 | 0.0840 | 0.9838 | 0.9575 | 0.8345 | 0.1230 | 0.9156 |
| 2011 | 0.8893 | 0.8646 | 0.0247 | 0.8721 | | | | | | | | | | | | |
| 2012 | 1.0775 | 1.0548 | 0.0227 | 1.0717 | | | | | | | | | | | | |
| 2013 | 1.0158 | 0.9958 | 0.0200 | 1.0101 | | | | | | | | | | | | |
| Painters included into the research sample | | | | | | | | | | | | | | | | |
| 20 | | | | | 10 | | | | 10 | | | | 10 | | | |
| Number of hedonic models | | | | | | | | | | | | | | | | |
| 4 | | | | | 10 | | | | 3 | | | | 3 | | | |

| Year | (5) | | | | (6) | | | | (7) |
|---|---|---|---|---|---|---|---|---|---|
| | index max. | index min. | spread | average index | index max. | index min. | spread | average index | index |
| 2008 | 1.4250 | 1.1529 | 0.2721 | 1.2340 | 1.1051 | 1.1021 | 0.0030 | 1.1037 | 1.1220 |
| 2009 | 0.8626 | 0.7553 | 0.1073 | 0.8243 | 0.9053 | 0.9024 | 0.0029 | 0.9031 | 0.9196 |
| 2010 | 1.0528 | 0.7949 | 0.2579 | 0.9383 | 0.9624 | 0.9600 | 0.0024 | 0.9614 | 0.9172 |
| 2011 | 0.9149 | 0.8645 | 0.0504 | 0.8985 | 0.9550 | 0.9533 | 0.0017 | 0.9543 | 0.9239 |
| 2012 | 1.0390 | 1.0059 | 0.0331 | 1.0208 | 1.0482 | 1.0427 | 0.0055 | 1.0449 | 1.0476 |
| 2013 | 1,0579 | 0.9211 | 0.1368 | 0.9810 | 1.0292 | 1.0244 | 0.0048 | 1.0273 | 0.9747 |
| Painters included into the research sample | | | | | | | | | |
| 17 | | | | | 21 | | | | 29 |
| Number of hedonic models | | | | | | | | | |
| 4 | | | | | 5 | | | | 1 |

Source: own elaboration.

Table 7. Pearson correlation coefficients of the average annual hedonic indices in the analysed studies

| | **(1)** | **(2)** | **(3)** | **(4)** | **(5)** | **(6)** | **(7)** |
|---|---|---|---|---|---|---|---|
| **(1)** | 1 | | | | | | |
| **(2)** | 0.4227 | 1 | | | | | |
| **(3)** | 0.9976 | 0.4850 | 1 | | | | |
| **(4)** | 0.7762 | 0.8995 | 0.8184 | 1 | | | |
| **(5)** | 0.7355 | 0.7613 | 0.9363 | 0.9681 | 1 | | |
| **(6)** | 0.7727 | 0.7527 | 0.9408 | 0.9647 | 0.9511 | 1 | |
| **(7)** | 0.7402 | 0.9122 | 0.8008 | 0.9995 | 0.9360 | 0.9303 | 1 |

Source: own elaboration.