



# Art investment: hedging or safe haven through financial crises

Belma Öztürkkal<sup>1</sup> · Aslı Togan-Eğrican<sup>1</sup>

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## Abstract

We analyze long-term art auction sales data focusing on and around financial crisis periods with other investment returns to understand whether art can be considered a safe haven during volatile times or a hedging option in general by analyzing art auction data in a volatile emerging market. Our findings suggest Turkish art returns are either negatively correlated or at low correlation with other investments, including the equity market. We have the view that art can be considered a hedging mechanism on average to enhance returns and to decrease the risk of portfolios and improve diversification. However, we do not discard the safe-haven hypothesis, either. Although the auction data on the crisis period is limited, results of and around crisis periods show art returns are positively correlated with various volatility indices. In addition, the number of art transactions also increases after the crisis years, which may be a sign of liquidity requirement of some investors and an opportunity for buyers. The benefit is visible especially during years of contractions, which do not end with a very severe crisis, since the art auction market liquidity dries if the crisis is severe.

**Keywords** Art market · Hedonic price index · Portfolio choice · Financial crises · Emerging markets · Investment · Risk · Hedging · Diversification

**JEL Classification** G1 · G11 · G15 · Z11

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✉ Belma Öztürkkal  
belma.ozturkkal@khas.edu.tr

Aslı Togan-Eğrican  
asli.togan@khas.edu.tr

<sup>1</sup> Department of International Trade and Finance, Faculty of Management, Kadir Has University, Istanbul, Turkey

## 1 Introduction

In the last years, we have seen frequent discussions about art as an investment, mainly in the US and European markets. For investors who are always looking for potential instruments that can be used as a safe haven during volatile times, whether the volatility in art prices can be a hedge or safe haven would be an important question to be answered even though some debate prices of art resemble Tulipmania (Ekelund et al. 2017). During unstable times, investors may see physical assets such as paintings, gold, and precious stones as secure places to store their wealth (Referee 2). In the most recent global financial crisis of 2008–2009, investors moved into the USA. Treasury securities as equity market plunged (McCauley and McGuire 2009). Baur and Lucey (2010) observe that investors see gold as a safe haven under extreme market conditions and a hedge against stocks on average.

Within the past few decades, the increase in the number of art investment funds provides some evidence that the demand for art is on the increase.<sup>1</sup> Additionally, the end of 2017 was special to witness an auction of *Salvator Mundi*<sup>2</sup> of Leonardo da Vinci as the most expensive artwork with \$450.3 million by Louvre Abu Dhabi. In addition, many countries open art museums to gain prestige as Louvre Abu Dhabi, Sharjah Art Museum in Dubai, MATHAF Qatar, and lastly the National Museum of Qatar, which opened in March 2019 with a construction cost of \$434 million. The art fairs spread throughout the world like Art Basel, Frieze. This explains the increase in demand of \$67.4 billion in 2018 up 6% from the previous year with 39.8 million transactions according to the UBS Global Art Report (2019), where 46% of these transactions are through auction markets.

One reason for this renewed interest in art is the increase in total worldwide wealth. The number of millionaires increases each year, with 2.3 million new millionaires in the last 12 months of 2018. A total of \$317 trillion wealth and 42.2 million millionaires were reported to be present in the world in 2018.<sup>3</sup> The increase in the demand for the artworks can also be related to the inequality and the rise of unequal distribution of wealth as shown in the work of Atkinson (2015) and Piketty (2014). As the rich get even richer, wealthy individuals are interested in art for many reasons such as investment, diversification, status, pleasure, emotional attachment, or speculative purposes.<sup>4</sup>

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<sup>1</sup> Deloitte 2017 report on Art and Finance estimated the assets under management at \$1 billion in 2016. Deloitte 2017 report on Art and Finance pointed out that there has been a shift in the primary focus on art investment toward issues around the management of art-related wealth, including art-secured lending, estate planning, art advisory, and risk management and that within the next decade more wealth is expected to be invested in art globally. Deloitte Art and Finance Report, 2017, 5th edition.

<sup>2</sup> [https://www.nytimes.com/2019/03/30/arts/design/salvator-mundi-louvre-abudhabi.html?emc=edit\\_th\\_190331&nl=todaysheadlines&nlid=594768030331](https://www.nytimes.com/2019/03/30/arts/design/salvator-mundi-louvre-abudhabi.html?emc=edit_th_190331&nl=todaysheadlines&nlid=594768030331). Accessed on May 1, 2019.

<sup>3</sup> Credit Suisse Global Wealth Report 2018. <https://www.credit-suisse.com/corporate/en/research/research-institute/global-wealth-report.htm>. Accessed on May 1, 2019.

<sup>4</sup> An important example for the initial demand of quality art works in the USA is John Pierpont Morgan, who started to collect art from 1890s to 1913, including collections from Sir James Fenn (English autographs) and Charles Fairfax Murray as the first classic collection of master drawings, spending \$60 million with the purchasing power of \$900 million today for a wide coverage collection of art. He quoted: “No price is too high for an object of unquestioned beauty and known authenticity.” This collec-

Similar to the change of world wealth, the number of wealthy individuals in Turkey also increased during the past decade. For instance, as of 2018, 80,000 individuals had above \$1 million, and 2% of the population had above \$100,000 wealth.<sup>5</sup> This wealth increase has resulted in a new interest in artworks, and the privately funded art museums, too. In Turkey, Sakip Sabanci Museum opened in Istanbul in 2002. Two years later, Eczacıbasi family launched the Istanbul Museum of Modern Art. Fortune 500 company Koc Group supports modern art through Arter since 2010, which transformed into a beautiful contemporary art museum in the new premises in September 2019.<sup>6</sup>

The Turkish art market is one of the few markets with a heritage of art exchange for the paintings and other artwork produced in the Ottoman Empire period by richer families. There are some valuable private collections and private museums established as a sign of prestige by the Turkish elites. Even though modern Turkey is relatively new with a history of about 100 years, the art culture of Turkey is based on tropes of Ottoman art (Shaw 2011). Although the Ottoman Empire was once the source of civilization in the world, it started to lose its dominance after the sixteenth century (Ferguson 2011). Based on the heritage of the Ottoman period, the art culture in Turkey is immensely rich and extends over centuries. The Ottoman art, influenced by the Byzantine, Mamluk and Persian cultures, was integrated to form a distinct art culture. This art culture was especially vibrant during the late fifteenth and sixteenth centuries when developments occurred in every artistic field, architecture, calligraphy, manuscript painting, textiles, and ceramics (Yalman 2000). The art collectors in the Ottoman era existed even as early as the early nineteenth century (Yalcin 2007).

The Turkish case is purported to be of special interest because it is a relatively unstable emerging market economy where systemic risk and loss of confidence may be pronounced, and thus the need for hedging assets as well as safe havens is stronger. Macroeconomic and political uncertainty in Turkey may occur periodically which provides a natural laboratory environment to test these hypotheses. The World Federation of Exchanges reports Borsa Istanbul's (the stock exchange in Turkey) volatility in 2018 as 242% (London Stock Exchange, 56%).<sup>7</sup> We define safe haven as an asset that is uncorrelated or negatively correlated with another asset or portfolio in times of market stress or turmoil as in Baur and Lucey (2010). Alternatively, a hedge is defined as an asset that is uncorrelated or negatively correlated with another asset or portfolio on average (Baur and Lucey 2010).

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Footnote 4 (continued)

tion now has reached more than 30,000 items traveling through exhibitions or the offices of JP Morgan in the world.

<sup>5</sup> Credit Suisse Global Wealth Report 2018. <https://www.credit-suisse.com/corporate/en/research/research-institute/global-wealth-report.htm>. Accessed on May 1, 2019.

<sup>6</sup> <http://www.arter.org.tr/W3/?sAction=Arter>. About an affiliate of the Vehbi Koç Foundation (VKF), Arter was opened in 2010 with the aim of providing a sustainable infrastructure for producing and exhibiting contemporary art.

<sup>7</sup> <https://www.world-exchanges.org/our-work/statistics>. Accessed on June 13, 2019.

In order to empirically test the question of whether art is considered a safe haven during volatile times, and if prices increase as wealth increases, or if art can be considered a hedging instrument, we analyze a long-term art (paintings) auction data set in a volatile emerging market including financial crisis periods with other investment returns. For instance, Ceritoglu (2017) studies a different asset class, the housing market in Turkey, and shows a decline in the housing investment between 2003 and 2014 due to the boom in the market, where income is the determining factor on demand, and demand is still strong.<sup>8</sup>

Our paper attempts to contribute to the literature by looking at safe haven and hedging hypotheses in an emerging country with a recent and previously not used rich database of art auctions. Even though literature has looked at various commodities (especially gold) or other investment options (e.g., currencies) can be used as a safe haven or a hedge (Jones and Sackley 2016; Kopyl and Lee 2016; Baur and McDermott 2016; Baur and Lucey 2010; Iqbal 2017; McCauley and McGuire 2009; Agyei-Ampomah et al. 2014; Choudhry et al. 2015), the literature connecting art and these two hypotheses is scant. In this paper, we explore whether art is an asset that is considered a safe haven and/or whether art is an asset perceived as a hedging instrument. Our second contribution is establishing a regression model for understanding art prices, and then creating a hedonic art index for the Turkish art market from 1994 to 2014. Additionally, we contribute to the investment literature by comparing the returns of the art index with returns of alternative investment options, including the Turkish stock market, bond market, alternative emerging market investments, gold, housing market as well as various uncertainty measures including Credit Default Swap (CDS) spreads of Turkey, consumer confidence index and CBOE's VIX volatility index.<sup>9</sup>

Most of the literature relies on the analysis of art, and economics is conducted using auction data. We use detailed auction data of 3347 (2391 paintings and detailed variables for individual paintings available) paintings from a reputable auction house, *Portakal Art and Culture House*, which has been in the art business for more than a century.<sup>10</sup> A key hypothesis of this study is that art is an investment to improve diversification and enhance returns. This has high importance especially around crisis periods. An important feature of our study is that the data period coincides with macroeconomic and structural reforms and economic crises. The paper documents three main economic crises and a major earthquake with important macroeconomic consequences within Turkey's recent history of many surpassed crisis periods. We scrutinize 1994, 2001, and 2009 as the years of financial crisis, and 1999 as the year of the major earthquake with high real GDP contraction rates and

<sup>8</sup> The explanation can be that wealthy investors continue to purchase houses, and they might consider housing a safe investment.

<sup>9</sup> Cboe Global Markets revolutionized investing with the creation of the Cboe Volatility Index® (VIX® Index), the first benchmark index to measure the market's expectation of future volatility. The VIX Index is based on options of the S&P 500® Index, considered the leading indicator of the broad US stock market. The VIX Index is recognized as the world's premier gauge of US equity market volatility. *Source:* <http://www.cboe.com/vix>.

<sup>10</sup> <http://www.rportakal.com/En/Article.aspx?PageID=101>.

as reported crisis periods in the literature (Comert and Yeldan 2018; Baum et al. 2010).

Our auction data contains only paintings of many Turkish artists (88% of the sample) as well as artists from other nationalities. These artists include European painters such as Amedeo Preziosi, Pavlikevitch, and Fausto Zonaro. Although not many, there are a few paintings of Modigliani and Picasso as well. A major percentage of non-Turkish artists are anonymous. For the paintings for which century data is available, more than 85% were painted during the twentieth century, 10% were painted during the nineteenth century. There are a few paintings from the seventeenth and eighteenth centuries. Most of the paintings in the sample are either landscapes (44%) or figurative paintings (21%). However, there are modern paintings (2%), abstracts (6%), or portraits (9%).

Overall, consistent with prior literature, we confirm that art provides lower returns as compared to other main investment options such as stocks and bonds and emerging market indices during our sample period. The geometric return of art for the whole data period 1995–2014 provided a real annual return of (3.1) % compared to real equity return of 3.5%. The geometric mean for the world and emerging market returns were also higher at 8% for MSCI World, and 3.4% for MSCI Emerging Markets Index compared to the USD nominal geometric return for the art of (−3.8) %. In nominal TL terms (simple average), art index, equity, and bonds brought in an annual average return of 18, 6 and 42% in Turkey, respectively.

We observe that there is strong evidence for investors to consider art a hedging option that would benefit an investor's diversified portfolio by decreasing risk and enhancing returns. Nominal USD art returns are low and positively correlated with gold prices (USD), and art returns are negatively correlated with equity returns. In general, nominal art returns in USD are negatively correlated with the nominal USD MSCI World, MSCI Emerging markets and S&P Global Luxury Index; and real art returns have a negative correlation with bonds, house prices, and foreign currency holdings.

On the other hand, even though we cannot strongly confirm that art is considered a safe haven during volatile times (as the number of observations is too low), we have some indication that it may be so. Looking at the number of sales for art, we do observe an increase in sales immediately after economic crises, which may be an indication for supporting that investors in need of liquidity generating funds with fire sales (or demand more art because they see art as a safe haven).<sup>11</sup> In addition, art returns (nominal USD and nominal TL) are positively correlated with CDS spreads (which is available only for a limited time of the data period) and volatility measure VIX, which suggests further support for the safe-haven hypothesis. We also find that our measured art index returns around crisis periods yield better results than other investment options for this emerging market.

The rest of the paper is organized as follows. In Sect. 2, we provide a review of the literature on the art market and other investments. Section 3 summarizes the data

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<sup>11</sup> We borrow the “fire sales” terminology from finance literature [see, for example, Shleifer and Vishny (2011)].

and our methodology. Section 4 provides the results from our analysis. Section 5 concludes.

## 2 Literature review

Collectibles and specifically art as an investment and its risk and return characteristics have been a major interest to researchers. However, the findings in terms of risk and returns on whether art is a better investment than standard investment options of equity and bonds provide conflicting results. Anderson (1974), with his seminal work, initiates a discussion that art may be an attractive investment opportunity, especially if one includes the consumption value. Following Anderson (1974) and Stein (1977) calculates the return on artworks from auctions using data for the US and the UK art before World War II. He finds a nominal appreciation compound rate of 10.5% as compared to the stock market returns of 14% during the post-war period (1946–1968).

On the other hand, Baumol (1986), using several centuries of art price data, finds that art prices are unpredictable and that the real rate of return on art investments is close to zero and lower than other securities such as government bonds.<sup>12</sup>

Many following studies compare art returns to those of other assets, especially using auction data from the US or the UK. Agnello and Pierce (1996) conclude that art is a comparable investment option alternative to stocks and bonds. Average returns are slightly below the returns of stocks and bonds. Mei and Moses (2002) state that art can bring higher returns than fixed income but provides lower returns than stocks. Renneboog and van Houte (2002) find that the risk-adjusted buy and hold returns underperform equities. Renneboog and Spaenjers (2009) use a data set of auctions containing 1.1 million paintings and conclude that the artist and the strength of the attribution to an artist are important determinants of price. The rates of return they find for art are much lower than prior findings in the literature. Pesando (1993) also finds that art (in this case defined as modern prints) is not as attractive an investment as other securities. Contrary to previous findings, modern, contemporary and impressionist paintings have been analyzed by De la Barre et al. (1994), using a time period of 30 years. They conclude that contemporary paintings provide a higher return compared to equities.<sup>13</sup>

Other studies focus on art sold outside of the US or the UK. For instance, Hodgson and Vorkink (2004) analyze the Canadian art market and confirm that the results are in line with previous findings of equity returns being higher than art returns. Hodgson and Seçkin (2012) look at the relationship between Canadian and international art markets. The authors find slightly higher volatility in the Canadian

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<sup>12</sup> Buelens and Ginsburgh (1993) argue that the findings of Baumol (1986) are overly pessimistic; and using the same data set, they calculate a significantly higher return for art than stocks and bonds within certain segments of the market (subperiods and different schools), especially for 20–40-year periods.

<sup>13</sup> Others like Campbell (2008) and Burton and Jacobsen (1999) conduct an extensive review of the methodologies used and the interpretations for financial returns to investing in various types of collectibles. Several studies of art focus on Picasso as a master of art (Czujack 1997; Pesando and Shum 2007; Biey and Zanolà 2005).

art market for the period of 1969–2006.<sup>14</sup> Several others study art as a measure of investment within emerging markets, including Edwards (2004), Campos and Barbosa (2008) who focus on Latin American countries. Kraeussl and Logher (2010) focus on Chinese, Russian and Indian art markets. A detailed summary of the literature on art can be found in “Appendix 3” section.

Our research question evolves around whether art can be a hedging option through diversification of assets at all times or whether art is considered a safe haven during the existence of economic instability. Previous studies find that art has greater volatility than bonds and stocks. The return of paintings was 17.5% between 1900 and 1986, but the volatility was higher than bonds and stocks (Goetzmann 1993). A few studies relating to crisis and bear markets findings are summarized for the following papers. The findings of Higgs (2012) using Australian paintings show there were no statistically significant differences between the returns of the art, housing and stock markets around the time of the financial crisis of 2008, but the art market’s volatility was quite high. The Polish art market study by Lucińska (2015) compares the returns of the Polish market with British and French art markets. The Polish returns seem to be more volatile than the British and the French art returns. During the financial crisis, however, the Polish art returns declined much less. Campbell (2008) focuses on bear markets when the benefits of diversification are needed more. The author confirms that including art in one’s portfolio helps with diversification. The relationship between volatility and art sales is analyzed during war periods for WWI by David (2014) who found that artworks underperformed gold, real estate, bonds and stocks in terms of risk-return performances.

Economists define investment as the act of incurring an immediate cost in the expectation of future rewards. One main characteristic of an investment is that there is uncertainty over the future rewards (Dixit and Pindyck 1994). Of course, among assets, this uncertainty is not homogeneous. Art is especially prone to uncertainty in future rewards, and as suggested by Shiller (1990), speculative assets tend to show more volatility compared to efficient market models where present values are calculated. If there is additional volatility within the investment that will be made, how investors maximize utility during periods of volatility is important. One theory that Dixit and Pindyck (1994) suggest is that investors consider their investment a real option. They may keep the investment until they believe they will gain a certain return out of it. Investing in art would fit well into the category of uncertain future rewards. Literature models art within the real option framework, but only recently (Ulibarri 2009).

With assets such as art, it is expected that wealth of individuals is positively correlated with demand for the asset. However, under volatile environments, two things might happen. First, certain investors, because of liquidity needs, might have to liquidate their assets immediately, and might accept lower prices, similar to the fire sales literature (Shleifer and Vishny 2011). This might mean purchasing an artwork

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<sup>14</sup> Other international studies include French Canadian paintings (Hodgson 2011), Germany Kraeussl and van Elsland (2008); Australian (Worthington and Higgs 2006), and a study on Islamic art sold in London (McQuillan and Lucey 2016).

at a bargain price for certain investors. Second, the demand for art during volatile times might increase because investors might be considering art as a diversification option and a safe haven and shift a portion of their wealth toward art and other negatively or low-correlated assets. Both suppliers' and art demanders' needs then would suggest an increase in the sales of art (transaction size) in volatile periods although liquidity needs of suppliers and going after bargain deals of demanders may or may not suggest an increase in returns.

Alternatively, following the Dixit and Pindyck (1994) argument, if investors have already invested in art, then these purchasers of art may choose to wait and see during volatile periods. As a result, in volatile times, we may not observe too much market activity especially in art. If this is the case, negative economic or political events should hamper the art market overall.

In this paper, we follow the literature in hypothesizing art as a safe haven if returns of art are uncorrelated or negatively correlated with another asset or portfolio in times of market stress or turmoil. Alternatively, we hypothesize art as a hedge if the returns of art are uncorrelated or negatively correlated with another asset or portfolio on average (Baur and Lucey 2010). A strength of this study is that the data period coincides with attractive investment environment years as well as with higher risk periods as crisis years to test the proposed hypothesis.

There are a limited number of studies on art prices and its effects on a market portfolio in Turkey. The first study by Seçkin and Atukeren (2006) estimates a hedonic price index using data from an art auction database for the 1989–2006 period and concludes that even in an environment of high inflation and macroeconomic volatility, art yielded positive real returns and showed better performance than gold or the US Dollar. In their study, the authors observe that the returns for art are lower than the stock market and 12-month bank deposits. Atukeren and Seçkin (2009) look at the relationship between the Turkish art market and a global portfolio of assets using Capital Asset Pricing Model (CAPM) framework for the period 1990–2005. Testing for the time series properties of the Turkish Paintings Market Price Index (TPMI) and the Artprice's Global Paintings Market Price Index (APPI), the authors show that the prices of Turkish paintings move in line with international paintings. The authors also find support for diversification benefits from investing in Turkish art markets for international investors.

Our main difference from the previous studies is that we look at whether art could be considered a hedging instrument in general or a safe haven during uncertain times, and whether investors have a potential to use it for decreasing the volatility of their assets. There are some caveats in investing in art as the art market is not as transparent, or liquid, and it is a high transaction cost market unlike capital market instruments.<sup>15</sup> Even so, art has an increasing potential for being considered an investment option,

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<sup>15</sup> Art has high transaction costs. The transaction costs in the US can be up to 35% where the seller pays 5–10%, and buyer pays 12–25% (Burton and Jacobsen 1999). Indeed, the calculation of art returns is difficult as art is less transparent with high information asymmetry than other financial assets; and there is no regulated art exchange. Another factor affecting the sale of artworks is the difference between the reservation price of the investor and the actual sales price. Using data from contemporary art auctions, Ashenfelter and Graddy (2011) estimate that the confidential reserve price to be set at approximately



mainly because of the negative correlation it provides with the main asset classes. The online networks, art fairs, and technology improve the transparency of art more and more. Also, its consumption value and the display feature of the work, which is not present for any other investment asset, make artworks a good investment option.

### 3 Data and methodology

We rely on two databases in the analysis. The first set of data is the art (painting auction) data, and the second set of data is the market data related to financial markets and instruments.

#### 3.1 Art data

Our auction data is from a very reputable auction house in Istanbul for the period of 1994–2014. The complete data set has 3347 observations. The database includes information on both the artist and the painting characteristics. More specifically, in addition to the price the painting was sold for (in TL), the information includes the auction date, the artist's name, the artist's age, the title, date and size of the painting, whether the artist is Turkish or a foreigner, whether the painting is signed, the genre, the technique used, and the painting's condition. We remove the paintings with missing price information and require that all other variables in our regression model have complete information. The clean data set has 2391 observations.

Figure 1 provides the trend in the number of sales by year and real returns for art for our data. Consistent with previous research (Seçkin and Atukeren 2006), we see that in the early 2000s, the number of paintings sold is higher, which reflects the pre-2001 crisis era. However, our sample also shows many sales between 1995 and 2000, which Seçkin and Atukeren (2006) do not observe in their sample as it is from a different data source.

Table 1 provides descriptive statistics for the sample. Panels A and B provide information on prices, painting characteristics and the number of artworks which were purchased at a price above the median price of our sample. Panel C of Table 1 provides information on prices by year in nominal and real TL and nominal USD. In

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Footnote 15 (continued)

70% of the low estimate. Additionally, the liquidity of artworks is lower compared to many financial assets; and art is not a standard exchange traded financial asset. Another important difficulty in investing in art is that the preferences are subject to different tastes and cultures, and they are also subject to political stability, economic conditions, and are time variant. Moreover, art has many constituents, and there are both supply and demand sides. Finally, the art market is evolving very fast, and change of trends in art is another important fact. The religious icons, impressionist paintings, contemporary art, pop art, op art, video art, installations are all different approaches and trends in the art arena. Another area of importance is the authenticity of art works, which is extremely important and an issue for court cases. The provenance arises as an important measure for authenticity. We observe opportunistic behavior of use of art in some examples of theft, fake paintings, fraud, money laundering and drug smuggling as well as barter in art. The art market's opaque nature and the need and demand for protection by experts against lawsuits makes art market vulnerable to forgery (Ekelund et al. 2017).

calculating the prices in TL, we made two adjustments to make the prices comparable over the years and with other investment options. First, we divided sales prices by 1 million before 2005 to make the prices in the sample comparable over the years as TL was replaced with YTL on January 1, 2005, with the removal of six zeros. Second, we calculated the real prices by deflating the nominal prices with the Consumer Price Index as of the auction date.

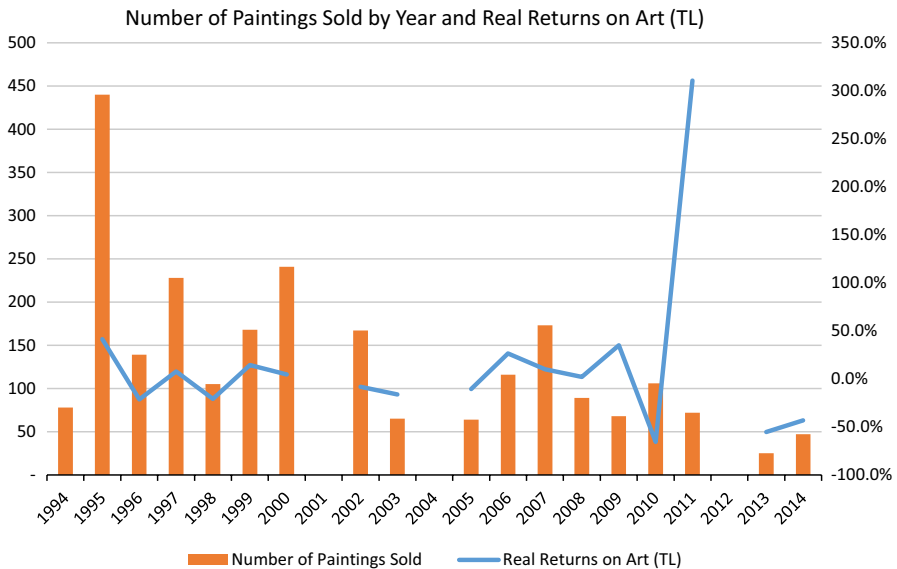
In nominal USD terms, the average sales price is \$17,795 with the highest and the lowest prices between, \$75 and \$1,907,895, respectively. 89% of the paintings are signed by the artist within the sample. 88% of the paintings in the sample are mostly painted by Turkish artists. In terms of painting characteristics, more than 70% are oil and 44% are landscape paintings. Modern paintings represent only 2% of the sample.

Table 2 provides pairwise correlations for all the painting and artist characteristics. Oil, still life and interior paintings are positively correlated in whichever way we measure the price (nominal, real or USD). Watercolor, on the other hand, is negatively correlated with all three measures of price. Size and provenance information are both positively correlated with real TL and nominal USD prices. We also see that size and provenance are strongly and positively correlated with price.

### 3.2 Market data

Due to a rich database of auctions, we are able to study the effect of contraction (crisis years) and expansion years on art investment, market returns for various alternative investment instruments as well as volatility measures. There are 4 years where the Turkish economy contracted during our sample period. 1994, 1999, 2001, and 2009 (Comert and Yeldan 2018; Baum et al. 2010). Financial crises in Turkey are not the only sources of uncertainty. Additionally, 1997 was the year of the Asian crisis; 1998 Russian crisis; and 2001 was the dot.com bubble in the US, which also had an effect. However, the effect of the financial crisis in 2001 dominated the others.

1994 was a year of major financial crisis: between December 1993 and April 1994, the devaluation rate of the Turkish lira against the US dollar reached 473%. Another economic crisis period was 2001. The devaluation rate of the Turkish lira against the US Dollar was 94% between December 2000 and April 2001. As a result, during the same period, 25 banks either went bankrupt or transferred to the government supervision authority (TMSF). However, after the 2001 crisis, the IMF standby agreement enabled the banking sector to get more robust and become more transparent; and the regulatory institutions controlled the financial markets and the banking industry. This created a period of stable and sustainable growth in the markets. Öniş (2009) acknowledges improved fiscal discipline, institutional reforms, and the strengthening of the Central Bank independence. These policy implementations created a positive environment where confidence in the financial markets was established. The Asian currency crisis of 1997 did not have a major impact on markets, but the economic crisis in Russia had a negative effect on the equity market and interest rates. The global financial crisis of 2008–2009 as well as a major disaster, namely the Istanbul earthquake, with considerable macroeconomic consequences,



**Fig. 1** Number of paintings sold by year and real returns on art (TL)

which occurred in 1999, are all possible causes of uncertainty that had an impact on the Turkish market.<sup>16</sup>

There were no auctions in *Portakal Auction House* in 2001, 2004 or 2012. It is convincing that the economic crisis resulted in no demand, and no auctions were the result in 2001. In 2004, even though the 2001 crisis was finished, the restructuring and results of the reforms in the financial sector were not proven yet, and that year, there were regional elections as well. 2004 was a year before Turkey attracted an important level of foreign investment, which was imperative to show the increased support of foreign investors and the blooming investment environment. As for 2012, the abnormal increase in demand and very high prices in the previous year (2011) did not accompany macroeconomic conditions, which might have created an environment not suitable for art auctions. It is important to inform the reader that there were no major auctions by this auction house after 2014, when our data period ends. The auction house reports only long period exhibitions, hat and purse sales, watch and jewelry sales and private exhibitions after 2014.<sup>17</sup> The environment in this market requires further explanation. After the 2009 crisis, the art index declined sharply in 2010, but it recovered in 2011 when it was seen that it did not affect the economy as much as expected. This created a positive investment environment for art. However, the stock market acted in the opposite direction; and real returns were positive

<sup>16</sup> The global financial crisis of 2009 did not have an effect on the economy, like in 1994 and 2001 thanks to the institutionalization and regulation of the financial sector in 2001. Similarly, the Asian currency crisis of 1997 did not have a long lasting effect on the Turkish markets.

<sup>17</sup> Information provided by the auction house Rafi Portakal (April 3, 2019). The dates for these were November 2015, January 2017, April–May 2017, December 2017, April 2018, September 2018, and November–December 2018.

**Table 1** Descriptive statistics (panels A, B, and C)

Variable	Count	Mean	SD	Minimum	Maximum
<i>Panel A</i>					
Sales price (nominal in TL after adjusting for TL to YTL conversion)	2391	19,363	99,650	5.50	2,900,000
Sales price (real in TL)	2391	84	421	0.11	10,694
Sales price in USD	2391	17,795	68,829	75	1,907,895
Signed	2391	0.89	0.32	0.00	1.00
Oil	2391	0.72	0.45	0.00	1.00
Watercolor	2391	0.09	0.29	0.00	1.00
Figurative	2391	0.21	0.41	0.00	1.00
Landscape	2391	0.44	0.50	0.00	1.00
Abstract	2391	0.06	0.24	0.00	1.00
Portrait	2391	0.09	0.28	0.00	1.00
Still life	2391	0.12	0.32	0.00	1.00
Modern	2391	0.02	0.13	0.00	1.00
Detail	2391	0.00	0.05	0.00	1.00
Historic	2391	0.01	0.09	0.00	1.00
Design	2391	0.01	0.10	0.00	1.00
Interior	2391	0.04	0.19	0.00	1.00
Size (in CM2)	2391	3244	5513	49	71,810
Provenance	2391	0.08	0.27	0.00	1.00
Turkish	2391	0.88	0.32	0.00	1.00
1994	2391	0.03	0.18	0.00	1.00
1995	2391	0.18	0.39	0.00	1.00
1996	2391	0.06	0.23	0.00	1.00
1997	2391	0.10	0.29	0.00	1.00
1998	2391	0.04	0.20	0.00	1.00

Table 1 (continued)

Variable	Count	Mean	SD	Minimum	Maximum
1999	2391	0.07	0.26	0.00	1.00
2000	2391	0.10	0.30	0.00	1.00
2002	2391	0.07	0.25	0.00	1.00
2003	2391	0.03	0.16	0.00	1.00
2005	2391	0.03	0.16	0.00	1.00
2006	2391	0.05	0.21	0.00	1.00
2007	2391	0.07	0.26	0.00	1.00
2008	2391	0.04	0.19	0.00	1.00
2009	2391	0.03	0.17	0.00	1.00
2010	2391	0.04	0.21	0.00	1.00
2011	2391	0.03	0.17	0.00	1.00
2013	2391	0.01	0.10	0.00	1.00
2014	2391	0.02	0.14	0.00	1.00
Artist					Number of paintings sold for artists with sales above median
<i>Panel B</i>					
Fikret Mualla					119
Bedri Rahmi Eyuboglu					88
Hoca Ali Riza					61
Nejad Devrim					65
Ibrahim Safi					61
Abidin Dino					45
Zeki Faik Izer					47
Ibrahim Calli					46

**Table 1** (continued)

Artist	Number of paintings sold for artists with sales above median											
Year	Number of paintings	Average price (nom)	Average price (real)	Average price (USD)	Minimum price (nom)	Maximum price (nom)	Minimum price (real)	Maximum price (real)	Minimum price (USD)	Maximum price (USD)	Total nom	Total real
Sukriye Dikmen											43	
Nazmi Ziya											33	
Avni Arbas											29	
Nazli Ecevit											29	
Sevket Dag											31	
Esref Uren											28	
Migirdic Civanian											26	
Halil Pasa											26	
Nuri Iyem											25	
Eren Eyuboglu											25	
Fahrelnissa Zeid											22	
Seref Akdik											21	
Orhan Peker											20	
<i>Panel C</i>												
1994	78	260	217	7910	6	3500	5.02	2926	183	106,642	20,251	16,932
1995	440	208	119	4682	6	3300	3.44	2160	134	80,539	91,318	52,142
1996	139	1044	296	12,433	12	22,000	2.88	7199	123	299,320	145,073	41,160
1997	228	1664	235	9971	15	20,000	2.77	3694	114	152,497	379,380	53,618
1998	105	2451	194	8810	35	36,000	2.48	2555	117	120,000	257,390	20,403

**Table 1** (continued)

Year	Number of paintings	Average price (nom)	Average price (real)	Average price (USD)	Minimum price (nom)	Maximum price (nom)	Minimum price (real)	Maximum price (real)	Minimum price (USD)	Maximum price (USD)	Total nom	Total real
1999	168	3580	156	7311	30	26,000	1.67	1058	75	50,377	601,451	26,143
2000	241	8101	284	13,399	55	115,000	2.14	4464	99	207,207	1,952,295	68,536
2001												
2002	167	15,938	226	10,343	150	230,000	2.01	3080	91	139,394	2,661,650	37,781
2003	65	13,856	165	9362	500	110,000	5.97	1313	338	74,324	900,660	10,752
2004												
2005	64	14,730	148	10,674	1000	160,000	10.07	1612	725	115,942	942,750	9497
2006	116	22,171	196	16,020	500	500,000	4.64	4269	377	349,650	2,571,800	22,753
2007	173	30,763	247	24,431	500	535,000	4.10	4224	373	445,945	5,322,000	42,751
2008	89	57,565	445	42,077	600	2,200,000	4.51	15,682	464	1,398,512	5,437,850	39,575
2009	68	72,307	486	47,961	1100	1,300,000	7.39	8735	740	874,243	4,916,900	33,036
2010	106	52,250	329	35,256	1000	950,000	6.30	5981	675	641,026	5,538,450	34,868
2011	72	177,243	104	116,607	1000	2,900,000	5.72	16,580	658	1,907,895	12,800,000	74,728
2012												
2013	25	97,340	508	54,156	5,000	550,000	26.09	2870	2782	305,998	2,433,500	12,697
2014	47	41,788	194	17,958	2600	250,000	12.05	1159	1117	107,435	1,964,050	9104
Average of years	133	34,070	253	24,965	784	550,600	6	4976	510	409,830	2,718,709	33,693
Total	2391	613,259	4549	449,363	14,108	9,910,800	109	89,561	9184	7,376,946	48,936,767	606,474

This table provides summary statistics for the full sample between 1994 and 2014. Variable Definitions are provided in Appendix 1. No auction data is available for the years 2001, 2004, and 2012. Panel A provides statistics for painting characteristics, year of sale and sales prices both in TL and USD. Panel B provides the number of total sales of artists with sales figures that are above median in the sample. Panel C provides summary statistics on prices by year. TL values before 2005 are adjusted by dividing the sales price by 1 million to make values comparable before and after the change from TL to YTL.

**Table 2** Correlation table

	Sales price (nominal in TL)	Sales price (real in TL)	Sales price in USD	Signed	Oil	Watercolor	Figurative	Landscape	Abstract
Sales price (nominal in TL)	1								
Sales price (real in TL)	0.252***	1							
Sales price in USD	0.0817*	0.954***	1						
Signed	0.0377	0.044	0.0373	1					
Oil	0.0683	0.191***	0.158***	-0.0274	1				
Watercolor	-0.0602	-0.0995**	-0.0814*	0.0248	-0.445***	1			
Figurative	0.013	-0.0404	-0.0399	0.0252	-0.258***	-0.00107	1		
Landscape	0.00575	0.0493	0.0357	0.00487	0.214***	0.0417	-0.491***	1	
Abstract	-0.0534	-0.0683	-0.0481	-0.0436	-0.0739	0.101**	-0.137***	-0.208***	1
Portrait	-0.0208	-0.0412	-0.039	-0.0234	-0.0178	-0.0485	-0.166***	-0.251***	-0.0702
Still life	0.0276	0.073	0.0725	0.00121	0.104**	-0.0848*	-0.210***	-0.319***	-0.0891*
Modern	-0.0285	-0.0034	0.00783	0.0182	-0.121**	-0.0398	-0.0654	-0.0991**	-0.0277
Historic	-0.0106	0.00788	-0.000936	0.00856	0.042	-0.0187	-0.0307	-0.0465	-0.013
Design	-0.0215	-0.0219	-0.0142	-0.111**	-0.0979**	0.0353	-0.0434	-0.0659	-0.0184
Interior	0.0345	-0.00195	-0.00387	0.0356	0.0625	0.0102	-0.127***	-0.193***	-0.054
Size (in CM2)	0.0497	0.261***	0.234***	0.0377	0.285***	-0.165***	-0.0459	-0.0151	0.0332
Provenance	-0.0915*	0.0995***	0.143***	-0.0111	0.00309	-0.0502	0.00698	-0.0257	-0.0147
Turkish	0.0162	-0.0619	-0.0538	-0.00989	0.129***	-0.0964*	-0.0164	-0.0311	0.0448
Portrait	Still life	Modern	Historic	Design	Interior	Size (in CM2)	Provenance	Turkish	
Sales price (nominal in TL)									
Sales price (real in TL)									
Sales price in USD									
Signed									



Table 2 (continued)

	Portrait	Still life	Modern	Historic	Design	Interior	Size (in CM2)	Provenance	Turkish
Oil									
Watercolor									
Figurative									
Landscape									
Abstract									
Portrait	1								
Still life	-0.108**	1							
Modern	-0.0334	-0.0424	1						
Historic	-0.0157	-0.0199	-0.00619	1					
Design	-0.0222	-0.0282	-0.00877	-0.00411	1				
Interior	-0.0652	-0.0827*	-0.0257	-0.0121	-0.0171	1			
Size (in CM2)	0.0252	-0.0343	0.119**	0.0291	-0.0297	0.0526	1		
Provenance	0.0504	-0.0609	0.178***	-0.0177	0.0395	-0.00458	0.0621	1	
Turkish	0.0013	0.105**	-0.161***	0.0154	-0.0505	-0.0133	-0.0219	-0.240***	1

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$

in 2010, but they declined in 2011. As for 2011, due to the rosy the macroeconomic conditions of the high growth years for Turkey, we observe that art returns reflect this growth at its highest level. By the end of 2013, there was a corruption scandal in Turkey; and three ministers resigned. This caused an unstable environment for investment, and 2014 real BIST (stock market) returns are negative. There was a regional election in 2014; two parliamentary elections in 2015; a public vote in 2017; and there was a change to the presidential system by the election of the president with a parliamentary election in 2018. In 2015–2016, there was a period of terrorist attacks and a coup d'état (July 2016) attempt. The economic conditions deteriorated leading to a period of no art auctions, which is not surprising.

All data are retrieved from Thomson Reuters Eikon database, except for the following: Consumer confidence index and inflation rates for Turkey are retrieved from the Turkish Statistical Institute (TUIK); real GDP growth rates for Turkey are taken from the IMF statistics; total foreign currency deposits in banks comes from the Turkish Banking Association database, and the House Price index for Turkey is retrieved from the OECD database.

BIST 100, MSCI Emerging Markets, MSCI World returns, Gold Prices, VIX and overnight lending rates, inflation, and real GDP growth are retrieved for the period 1994–2018. One-year bond yield data start in 1998, and 10 years bond yield data start in 2009. House price index data start in 2011, and consumer confidence index and Turkey 5 years CDS spreads start in 2004. All data end in 2018. (There were no auctions for paintings by Portakal after 2014. Hence, we consider data for other assets up to 2018).

As shown in Table 5 Panels A and B and “Appendix 2” section, the average real GDP growth for 1995–2014 is 4.9%. During crisis years and the 1999 earthquake, the economy contracted with an average of 5%. Inflation during the whole sample period was on average 45% with a decreasing trend starting from 120% in 1994 and going down to around 9% in 2014. After that period, the consumer confidence index deteriorated, and inflation rate increased constantly to 20% level in 2018. “Appendix 2” section Panels A and B show detailed results for each investment option and macroeconomic or volatility variable by year. Table 5 also provides the number of sales averages based on annual counts. We observe an increase in average sales immediately after economic crises (all sample average is 136; pre-crisis average is 145; 1999 and 2009 averages are 118, and the post-crisis is average 239), which may be an indication to support that the art investors in need of liquidity choose the option of the fire sales.

For the period of 1995–2014, MSCI World Total Return Index provides an average return of 9.4%; MSCI Emerging Markets Index, 8.4% in nominal USD terms. In terms of TL, nominal and real BIST 100 returns for the 1995–2014 period are 60.7%, and 18.7%, respectively. Turkish Central Bank overnight lending rates on average are observed to be around 41.7%, and 1-year bond yields are around 32.5% (1998–2014). Gold returns (calculated based on Gold/USD prices) are around 7%, and the Turkish real house price index, which started as of 2010 brought in an average return of 20.8%.

In order to understand our sample period, we looked at 5 years Credit Default Swap (CDS) spreads and consumer confidence index for Turkey as well as the

volatility VIX index.<sup>18</sup> For Turkey, the CDS spreads vary and are at the lowest level at 128 basis points (b.p.) in 2012; and they increased to 359 b.p. in 2018 with a peak in 2008 (412 b.p.) (“Appendix 2” section).

### 3.3 Model

As mentioned above, the main difficulty with estimating returns for art as a financial asset is that art sales are not as transparent as some capital market instruments; and art is not a homogenous investment object. Calculation of average prices of sold art and geometric return calculations have been used in the literature, but mainly two different regression methods are preferred in order to create a price measure. The first one uses repeat sales which looks at the same painting at different time periods in estimating returns, but there is also a selection bias that is inherent in repeat sales techniques (Ginsburgh et al. 2006; Korteweg et al. 2016). The other method is the hedonic sales regression which regresses prices on observable characteristics of the artwork and uses the residual (the “characteristic—free” prices) to estimate the index leaving only the effect of time and random error (Chanel et al. 1996). There are some studies that combine the repeat sales and hedonic regressions (Case and Quigley 1991).

The art market is different from the market of real estate and is not as frequently traded as equities or bonds. In such markets, in order to estimate an index and identify changes of pure prices, one needs to control any characteristics of the asset (Eurostat 2011). This would include identifying and controlling painting characteristics as well as characteristics of the place the painting was sold in. As a result, a data set such as ours with many painting characteristics and a long data period would be advantageous.

We use a hedonic price regression to estimate the annual art price index. We include all sales as unique sales. In this method, the sales price is estimated as a function of the painting characteristics such as the name of the artist, the size of the painting, the age of the painter, and the technique used. Significant studies (Buelens and Ginsburgh 1993; De la Barre et al. 1994; Chanel et al. 1996; Agnello and Pierce 1996; Renneboog and van Houte 2002; Worthington and Higgs 2006) used the hedonic price index method to estimate art price indices.<sup>19</sup>

Our hedonic index values are calculated without the transaction cost. The transaction cost in Turkey is between 0–17% for the sellers and 0–10% for the buyers, all

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<sup>18</sup> A CDS is defined as an insurance contract against losses incurred by creditors in the event that a debtor defaults on its debt obligations. As in a swap, as part of the contract, the protection buyer pays a premium (the CDS premium) to the protection seller, in exchange for a payment from the protection seller to the protection buyer if a credit event occurs on a reference credit instrument within a predetermined time period. Common credit events are bankruptcy, failure to pay, and, in some CDS contracts, debt restructuring or a credit-rating downgrade. As explained in Cornett et al. (2014) when the market perceives that the probability of a debt default decreases (increases), the spread charged on the CDS decreases (increases). CDS spreads have been widely used in the literature to measure credit risk as some argue that CDS spreads are a pure measure of credit risk as well as its relationship with equity volatility or implied volatility (Longstaff et al. 2005; Callen et al. 2009; Campbell and Taksler 2003; Zhang et al. 2009).

<sup>19</sup> Charlin and Cifuentes (2017) suggest that relying on point estimates from hedonic regressions on auctions may be misleading. As a result, they provide a log transformation followed by a wild bootstrap method correction.

subject to negotiation depending on the size of the transaction.<sup>20</sup> Since the entry and exit to this market is costly, unless the buyer purchases directly from the artist or gallery, which is not reported as auctions, we hypothesize the owners would mainly sell when in distress or at profit.

First, we calculate a regression model. Then, we use it for the hedonic index calculation. The estimated regression model is as follows:

$$\ln P_{kt} = \sum_{m=1}^M \alpha_m X_{mkt} + \sum_{t=1}^T \beta_t Z_t + \epsilon_{kt} \quad (1)$$

The dependent variable is the log of hammer prices both in Turkish Liras (real) and US Dollars (nominal) of painting  $k$  in year  $t$ .  $\alpha_m$  represents the coefficients on estimated painting characteristics  $X_{mkt}$  for painting  $k$  during the year  $t$  and  $Z_t$ , which are year dummy variables, and  $\beta_t$  is the year dummy parameter estimates. We also correct for White standard errors when running our specifications. When calculating the real TL prices, we deflate the hammer price using the consumer price index, which is calculated based on the auction dates. As mentioned earlier, the prices are also adjusted for the change of the old for the new Turkish Lira (we divide the prices by 1 million for sales made before January 1, 2005, which is the date for the change to the new Turkish Lira, 1 New TL is 1,000,000 TL).

Certain painting characteristics explain these prices as paintings are not homogeneous. In the regression, similar to prior literature, we control the following painting characteristics: whether the painting is signed or not, whether the painting falls under the classification of oil, watercolor, figurative, landscape, abstract, portrait, still life, modern, historic, design, or interior, whether the artist is Turkish or foreigner, the age of the artist, the availability of provenance information, the size of the painting, and the year the artwork was sold. We also include dummy variables for artists whose sales were higher than the median number of sales in the database as these artists may have certain characteristics that distinguish them from the rest of the sample. We transform the age of the artist, the size of the painting, and the year the artwork was sold to logarithmic form.

Most research on art that uses the hedonic price index estimation relies on the time dummy variable method. This method has also been called the “direct” method as the index number is estimated directly from the regression, and no other sources are needed (Triplett 2004). In the regression in Eq. (1), the exponential of  $\beta_t$  represents the percentage change in prices between  $t+1$  and  $t$  holding constant the characteristics of the painting.<sup>21</sup>

<sup>20</sup> Information provided by the auction house, Rafi Portakal (April 3, 2019).

<sup>21</sup> In untabulated results, we first calculate the indices based on our hedonic regressions as the exponential of the year dummy from the specification used in Seçkin and Atukeren (2006) to compare our results with prior findings. We find that for the years where our data overlaps, returns are quite close to our findings in terms of arithmetic averages. However, year by year, results differ. We believe that there may be two sources for the differences. Our data set allows us to include more explanatory variables with a longer data period, and is a larger data set. As a result, our specification might capture the variation in sales prices better, and is less likely to suffer from the omitted variable bias of the estimated index although we do not suggest that we capture all the available characteristics.

We calculate the index using 1994 as the base year. We then calculate the returns for each year using this calculated index. There are 3 years, during which no auctions were conducted. These years are 2001, 2004, and 2012. As a result, for those 3 years, we calculate the return based on the two previous years. Sales of paintings seem to be equally distributed among the years in which the auctions are held with the exception of 1995, 1997, and 2000. 18% of the sales were made in 1995; 10% each in 1997, and in 2000.

The index based on the hedonic quality adjustment (Triplett 2004; Lucińska 2015) is calculated as follows:

$$\text{Price index} = \frac{\prod_{i=1}^n P_{i,t+1}^{1/n} / \prod_{i=1}^m P_{i,t}^{1/m}}{\text{hedonic quality adjustment}} \quad (2)$$

In Eq. 2, geometric prices are calculated for each year as a geometric mean of all prices for paintings  $i$  through  $n$  or  $m$ , during that year (either in TL or USD) and then by taking the ratio of the geometric means of prices for years  $t+1$  and  $t$ . We then divide by the hedonic quality adjustment where the hedonic quality adjustment is calculated using the following equation:

$$\text{hedonic quality adjustment} = \exp \left[ \sum_{j=1}^z \alpha_j \left( \sum_{i=1}^n \frac{X_{ij,t+1}}{n} - \sum_{i=1}^m \frac{X_{ij,t}}{m} \right) \right] \quad (3)$$

Here, in Eq. 3, the hedonic quality adjustment is the exponential of the sum of each characteristic (from  $j=1$  to  $z$ ) multiplied by the difference in annual averages of each characteristic between years  $t+1$  and  $t$ . Then the calculated index shows us the characteristic free price change for the artwork.<sup>22</sup>

## 4 Results

We estimate a hedonic regression model with all characteristics and year dummies as explanatory variables on CPI-adjusted TL and nominal USD prices, and use it to create a price index. Then, we conduct a detailed return comparison of art with other investment options using two decades' calculated annual returns. The results of our two specifications can be seen in Table 3. Similar to prior findings, we observe that signed and larger paintings classified as modern, oil or watercolor, figurative, landscape, or still life, and have provenance information are more likely to be sold at a higher price. A Turkish painting, on the other hand, has a negative significant effect on the price of the artwork. Provenance and signature are important characteristics

<sup>22</sup> In hedonic regressions, if one uses a model with a logarithmic dependent variable, the time dummy hedonic index can be calculated as the ratio of the geometric average of two period prices adjusted for the difference in painting characteristics. In fact, the referenced research (Triplett and McDonald 1977) shows that the index from using pure time dummies versus calculating the ratio of geometric prices adjusted by mean characteristic differences should be similar.

which increase transparency for the art investors, and these have a positive significance on regression. We also see that certain artists are more likely to sell their paintings at higher prices. Painters such as Fikret Mualla, Bedri Rahmi Eyuboglu, Hoca Ali Riza, Ibrahim Safi, Ibrahim Calli, Halil Pasa, Fahrelnissa Zeid, Orhan Peker and Nazli Ecevit have significant and positive coefficients whereas Nejad Devrim, Abidin Dino, Zeki Faik Izer, Sukriye Dizmen, Avni Arbas, Sevket Dag, Esref Uren, and Migirdic Civanian are less likely to have higher sales prices.) In line with the previous study on Turkish art (Seçkin and Atukeren 2006), which also shows that Avni Arbas and Abidin Dino coefficients are negative and significant, Fikret Mualla and Ibrahim Calli have positive and significant coefficients.

Next, the regression results are used to estimate the price index for real TL, nominal TL, and nominal USD. We calculate the geometric means and then returns and adjust them by the hedonic quality adjustment.

The calculated art price index results are provided in Table 4. In untabulated results, time dummies are used in the regression for comparing the results with Seçkin and Atukeren (2006). Then, the index is created using the geometric price differentials revised by the hedonic quality adjustment (which provides similar results to the first one). The index suggests an average annual increase of 12% in real TL terms, 18% in nominal TL and 11% in nominal USD terms. The highest increase is seen in 2011. There is a downturn in the index prices during or immediately after the financial crisis years of 2001 and 2008. For instance, the downturn in 2001 can be seen by the lack of demand for art in 2001, and then a decline of 12% in nominal USD terms in 2002 (over 2000). The return immediately after that period in 2003 is strong with 7% in real TL. The year of 2012 is important as there were no art auctions held; and in 2011, the art returns are extremely high with about 300%. This abnormal increase in demand without the macroeconomic companion may indicate a deviation from rationality; and in 2012, the auction did not take place. In 2012, when there was no auction, but the investment environment was very rosy, and the BIST real return was 43%, and CDS spreads were at the lowest with 128 basis points.

Our findings suggest that by first comparing art returns to equity markets in real terms BIST 100 Index (a measure of Borsa Istanbul, Stock Market for Turkey), geometric annual returns of 3.5%, and the art index adjusted for CPI yield a return of (−3.1) %. For the sample period, considering nominal USD returns, the geometric mean return was (−3.8) % in contrast to Morgan Stanley Capital International (MSCI) World Index whose total return was 7.6%; and MSCI Emerging Markets Index return was 3.4%. Figure 2 shows the comparison of investment in art with equity and inflation with the base year to 1994.

Secondly, looking at bond yields and other instruments, we observe that throughout the sample period, overnight lending rates were 35.8%, gold yielded 5.8%, and the housing market 2.7%. As a result, we suggest that art investment in Turkey, and more generally in financial markets, can be considered as a hedging option with the benefits of low or negative correlation with other investments and to have the benefits of diversification in a portfolio.

Looking at average returns, at times of the predefined crisis periods, we observe the returns of equities to be around 68.7% in real terms for Turkey. Since 1999 was

**Table 3** Sales prices and painting characteristics

Variables	(1) Log of sales price (in USD)	(2) Log of sales price (in TL real)	(3) Log of sales price (in TL nominal)
Signed	0.296*** (0.0739)	0.291*** (0.0686)	0.297*** (0.0690)
Oil	0.596*** (0.0647)	0.595*** (0.0672)	0.593*** (0.0676)
Watercolor	0.0123 (0.0880)	0.00544 (0.0903)	0.0201 (0.0909)
Figurative	0.662*** (0.177)	0.652*** (0.199)	0.648*** (0.201)
Landscape	0.556*** (0.177)	0.539*** (0.199)	0.549*** (0.200)
Abstract	0.220 (0.181)	0.221 (0.214)	0.198 (0.215)
Portrait	0.331* (0.184)	0.316 (0.205)	0.329 (0.206)
Still life	0.555*** (0.183)	0.537*** (0.204)	0.559*** (0.205)
Modern	0.698*** (0.238)	0.708*** (0.260)	0.664** (0.261)
Historic	0.431 (0.303)	0.406 (0.299)	0.429 (0.300)
Design	0.274 (0.252)	0.279 (0.289)	0.217 (0.290)
Interior	0.734*** (0.221)	0.722*** (0.227)	0.723*** (0.228)
Turkish	-0.553*** (0.0878)	-0.545*** (0.0711)	-0.552*** (0.0715)
Provenance	0.299*** (0.104)	0.331*** (0.0917)	0.302*** (0.0923)
Log of size	0.558*** (0.0261)	0.561*** (0.0236)	0.554*** (0.0237)
1995	0.433*** (0.141)	0.346*** (0.129)	0.723*** (0.130)
1996	0.597*** (0.166)	0.454*** (0.147)	1.572*** (0.148)
1997	0.792*** (0.147)	0.635*** (0.137)	2.473*** (0.138)
1998	0.789*** (0.162)	0.582*** (0.154)	2.900*** (0.155)
1999	0.915*** (0.146)	0.664*** (0.142)	3.604*** (0.143)

**Table 3** (continued)

Variables	(1) Log of sales price (in USD)	(2) Log of sales price (in TL real)	(3) Log of sales price (in TL nominal)
2000	1.052*** (0.147)	0.791*** (0.135)	3.978*** (0.136)
2002	1.062*** (0.153)	0.833*** (0.142)	4.900*** (0.143)
2003	1.138*** (0.169)	0.698*** (0.174)	4.948*** (0.175)
2005	1.131*** (0.163)	0.451** (0.175)	4.870*** (0.176)
2006	1.246*** (0.161)	0.439*** (0.151)	4.972*** (0.152)
2007	1.524*** (0.160)	0.522*** (0.144)	5.175*** (0.145)
2008	1.641*** (0.189)	0.625*** (0.162)	5.339*** (0.162)
2009	2.038*** (0.204)	1.027*** (0.172)	5.854*** (0.174)
2010	1.458*** (0.184)	0.365** (0.157)	5.273*** (0.158)
2011	2.261*** (0.216)	1.116*** (0.176)	6.098*** (0.177)
2013	2.153*** (0.255)	1.063*** (0.241)	6.162*** (0.242)
2014	1.388*** (0.208)	0.446** (0.193)	5.658*** (0.194)
Fikret Mualla	0.816*** (0.101)	0.806*** (0.112)	0.858*** (0.113)
Bedri Rahmi Eyuboglu	0.169* (0.0915)	0.165 (0.121)	0.206* (0.122)
Hoca Ali Riza	1.404*** (0.137)	1.410*** (0.141)	1.408*** (0.142)
Nejad Devrim	-0.329*** (0.119)	-0.315** (0.152)	-0.358** (0.152)
Ibrahim Safi	0.165** (0.0812)	0.167 (0.137)	0.163 (0.137)
Abidin Dino	-0.628*** (0.146)	-0.652*** (0.167)	-0.603*** (0.168)
Zeki Faik Izer	-0.347*** (0.104)	-0.332** (0.158)	-0.341** (0.159)
Ibrahim Calli	1.577*** (0.123)	1.577*** (0.154)	1.561*** (0.155)



**Table 3** (continued)

Variables	(1) Log of sales price (in USD)	(2) Log of sales price (in TL real)	(3) Log of sales price (in TL nominal)
Sukriye Dikmen	−0.675*** (0.0927)	−0.644*** (0.167)	−0.712*** (0.168)
Nazmi Ziya	2.183*** (0.121)	2.185*** (0.184)	2.177*** (0.185)
Avni Arbas	−0.217* (0.130)	−0.223 (0.195)	−0.207 (0.196)
Nazli Ecevit	1.219*** (0.130)	1.215*** (0.201)	1.241*** (0.202)
Sevket Dag	−1.023*** (0.113)	−1.036*** (0.194)	−1.019*** (0.195)
Esref Uren	−0.378*** (0.116)	−0.388* (0.198)	−0.374* (0.199)
Migirdic Civanian	−0.402*** (0.118)	−0.414** (0.207)	−0.401* (0.208)
Halil Pasa	2.053*** (0.171)	2.051*** (0.206)	2.063*** (0.207)
Nuri Iyem	0.189 (0.137)	0.186 (0.211)	0.195 (0.213)
Eren Eyuboglu	0.128 (0.175)	0.108 (0.21)	0.137 (0.211)
Fahrelnissa Zeid	0.394*** (0.152)	0.388* (0.224)	0.380* (0.226)
Seref Akdik	−0.118 (0.176)	−0.125 (0.228)	−0.119 (0.229)
Orhan Peker	0.581*** (0.206)	0.584** (0.236)	0.610** (0.238)
Constant	−1.676*** (0.301)	−1.185*** (0.292)	−0.961*** (0.294)
	2391	2391	2391
	0.511	0.444	0.812

This table presents results on regressions of sales prices of paintings on painting characteristics. Dependent variables are: (1) log of sales price in USD nominal terms (2) the log of sales price in TL adjusted for inflation and (3) log of sales price in TL nominal terms. Real sales price in TL is adjusted using CPI. CPI adjustment is made by taking 1994=100 and adjusting the prices on the dates of auctions. Similarly, sales prices are converted to USD using the exchange rates on the date of the auction. Artist name dummies are included for artists with total sales above the median sales in the sample. The base group of comparison is a category called other which includes all unidentified artists and artists with less than or equal to sales below median. Robust standard errors are reported in parentheses. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10%, respectively

Robust standard errors in parentheses

\*\*\* $p < 0.01$ ; \*\* $p < 0.05$ ; \* $p < 0.1$

**Table 4** Art price index calculation

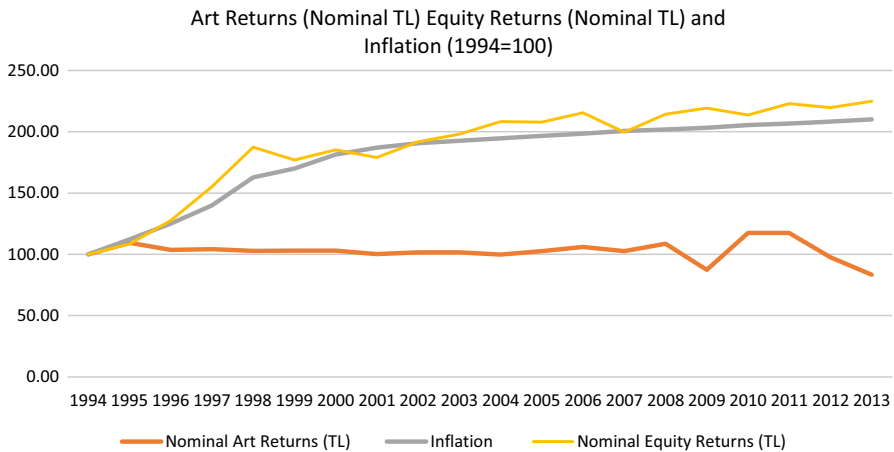
Nominal prices (USD)			Real prices (TL)			Nominal prices (TL)		
Year	Index	% Change	Year	Index	% Change	Year	Index	% Change
1994	1.00		1994	1.00		1994	1.00	
1995	1.54	54.26	1995	1.41	41.38	1995	2.06	106.07
1996	1.18	-23.69	1996	1.11	-21.25	1996	2.34	13.46
1997	1.22	3.29	1997	1.20	7.66	1997	2.46	5.23
1998	1.00	-18.01	1998	0.95	-20.89	1998	1.53	-37.66
1999	1.13	13.83	1999	1.09	14.47	1999	2.02	31.81
2000	1.15	1.06	2000	1.14	4.64	2000	1.45	-28.11
2002	1.01	-11.93	2002	1.04	-8.19	2002	2.51	72.92
2003	1.08	6.80	2003	0.87	-16.26	2003	1.05	-58.23
2005	0.99	-8.00	2005	0.78	-10.53	2005	0.92	-11.96
2006	1.12	13.05	2006	0.99	26.43	2006	1.11	19.82
2007	1.32	17.74	2007	1.09	10.02	2007	1.23	10.67
2008	1.12	-14.87	2008	1.11	2.00	2008	1.18	-3.92
2009	1.49	32.25	2009	1.50	34.86	2009	1.67	42.12
2010	0.56	-62.35	2010	0.52	-65.50	2010	0.56	-66.57
2011	2.23	298.52	2011	2.12	310.67	2011	2.28	307.70
2013	0.90	-59.78	2013	0.95	-55.22	2013	1.07	-53.25
2014	0.47	-48.15	2014	0.54	-43.10	2014	0.60	-43.33
	Arith. avg.	11.41		Arith. avg.	12.42		Arith. avg.	18.05
	Geom. avg.	-3.75		Geom. avg.	-3.04		Geom. avg.	-2.49

The table provides the index created using the hedonic pricing regression in Table 3. Index is created by adjusting the ratio of geometric means of prices by the mean character differences as suggested in Kraeussl and van Elsland (2008) for each year. The percent changes here are calculated as the percent change between  $t$  and  $t+1$  index values. There are no sales in 2001, 2004 and 2012. As a result, percent change calculations for missing years start from the previous year available. Average arithmetic returns are calculated over the number of observations available. Geometric averages are calculated over 20 years including missing years

a special case as a result of the earthquake, excluding that year, the returns for BIST 100 are observed to be around 9.3%. In nominal terms, MSCI Global and MSCI Emerging Markets returns are observed to be around 10.7, and 31.7%, respectively. During crisis periods, overnight lending rates average to 56.9% and gold prices yield 6% on average. The VIX index shows high volatility levels during crisis periods of this emerging market at an average value of 381.

At times of the expansionary periods, real returns on art index provided a higher return than all other assets compared. Average real return on art was observed to be at 93.9% whereas BIST 100 returns were around 18%, overnight lending rates at 27.7%, and gold returns around 4.6%.

Before crisis years, real art returns were observed to be at (-4.7) % (-10.6% nominal US and -23.2% nominal TL) compared to a real return of (-55.7) % for equities (-38.1% nominal), and (-0.1) % for gold. The years immediately after the crisis, real art returns averaged at (-6.9) % (-4.7% nominal USD and -6.9% nominal TL)



**Fig. 2** Log of nominal art returns equity returns and inflation

as compared to real equity returns of  $(-24.1)\%$  (2.3% nominal) and gold returns of 12.4%. Turkish Banking Association reports show that, at its peak, the share of foreign exchange deposits were 67% and 70% in 1994 and 2001 financial crisis years. In 2009, the global financial crisis did not create a demand in foreign exchange 45% as the policy implementation was intact; and in 2010, at 41%, it was at a minimum. The share of foreign exchange deposits as a sign of decreased confidence in the investment environment increased afterward up to 56% in 2017 (Table 5).

Our results are in line with previous literature in developed and emerging markets where art prices yield lower returns compared to equities. The standard deviation of the art index is higher than other mainstream asset classes. This is also consistent with lower liquidity and higher volatility of art in Turkey found in the two prior studies of Seçkin and Atukeren (2006) and Atukeren and Seçkin (2009). The standard deviation for the real art TL returns is about 82% compared to 69% for CPI-adjusted BIST 100, and 19% for MSCI World Total Return Index. The USD nominal return standard deviation is observed to be 80%.

In 2009, the global financial crisis did not create a high demand in foreign exchange deposits 45% as the policy implementation was intact; and in 2010, at 41%, the foreign deposit share was minimum. The share of foreign exchange deposits as a sign of decreased confidence in the investment environment increased afterward up to 56% in 2017.

A simple pairwise correlation matrix inquires whether portfolios can be hedged by including art in Turkey as an investment option in the portfolio. The results are provided in Table 6. Overall, we observe that CDS spreads 0.32 with nominal TL returns is positively correlated with art returns. Art investment in Turkey might have higher liquidity in times of volatility. On the other hand, looking at the number of sales for art, we do observe an increase in sales immediately at the years after economic crises, which may be an indication for supporting that the art investors in need of liquidity choose the option of the fire sales.

**Table 5** Return comparisons for various investment alternatives and other macroeconomic and volatility variables (panels A and B)

Year	Number of paintings sold	Return on art index (USD nominal)	Return on art index (TL nominal)	Return on art index (TL—adjusted for inflation)	BIST 100 return adjusted for inflation (TL) (%)	BIST 100 index return (TL) (%)	MSCI world total return (USD) (%)	MSCI emerging markets index (USD) (%)	Overnight lending rates (%)
<i>Panel A</i>									
All years									
1995–2014 arithmetic mean	136	11.4%	18.0%	12.4%	18.7	60.7	9.4	8.4	41.7
1995–2014 geometric mean	N/A	-3.8%	-2.5%	-3.0%	3.5	33.3	7.6	3.4	35.8
Crisis years and earthquake of 1999									
1994, 1999, 2001, 2009 arithmetic mean <sup>(1)</sup> (financial crises and earthquake)	N/A	N/A	N/A	N/A	68.7	163.3	10.7	31.7	56.9
1994, 2001, 2009 arithmetic mean (excluding earthquake of 1999)	N/A	N/A	N/A	N/A	9.3	55.9	5.9	20.2	52.5
1999, 2009 arithmetic mean (years when auctions are held)	118	23.0%	37.0%	24.7%	165.7	291.0	28.1	70.1	38.2

**Table 5** (continued)

Year	Number of paintings sold	Return on art index (USD nominal)	Return on art index (TL nominal)	Return on art index (TL—adjusted for inflation)	BIST 100 return adjusted for inflation (TL) (%)	BIST 100 index return (TL) (%)	MSCI world total return (USD) (%)	MSCI emerging markets index (USD) (%)	Overnight lending rates (%)
Crisis years – I									
1998, 2000, 2008 arithmetic mean	145	– 10.6%	– 23.2%	– 4.7%	– 55.7	– 38.1	– 9.4	– 38.2	94.1
Crisis years + I									
1995, 2000, 2002, 2010 arithmetic mean	239	– 4.7%	21.1%	– 6.9%	– 24.1	2.3	0.3	– 7.3	84.8
All other years when auctions are held									
1996, 1997, 2003, 2005, 2006, 2007, 2011, 2013, 2014 arithmetic mean	103	22.2%	21.1%	23.2%	22.0	63.1	14.7	12.0	26.8
Years when no auctions are held									
2001, 2004, 2012		N/A	N/A	N/A	17.7	44.2	4.9	10.2	27.7

Table 5 (continued)

Year	Gold/USD returns (%)	% total foreign currency deposits in banks (%)	VIX (annualized)	Inflation (December percentage change) 1994 = 100 (%)	Real GDP growth (%)
<i>Panel B</i>					
All years					
1995–2014 arithmetic mean	7.0	55.0	233.17	44.7	4.9
1995–2014 geometric mean	5.8	54.7	N/A	28.8	4.8
Crisis years and earthquake of 1999					
1994, 1999, 2001, 2009 arithmetic mean <sup>(1)</sup> (financial crises and earthquake)	6.0	60.9	381.28	66.0	-4.9
1994, 2001, 2009 arithmetic mean (excluding earthquake of 1999)	8.0	60.7	378.78	65.1	-5.4
1999, 2009 arithmetic mean (years when auctions are held)	12.2	53.1	445.96	37.7	-4.1
Crisis years - 1					
1998, 2000, 2008 arithmetic mean	-0.1	56.3	327.54	39.6	3.5
Crisis years + 1					
1995, 2000, 2002, 2010 arithmetic mean	12.4	59.6	261.60	37.8	7.2
All other years when auctions are held					
1996, 1997, 2003, 2005, 2006, 2007, 2011, 2013, 2014 arithmetic mean	5.0	53.1	277.24	28.0	7.3
Years when no auctions are held					
2001, 2004, 2012	5.0	56.9	314.01	28.0	2.8

The table provides summary return data for art and various alternative investment opportunities over the 1994–2014 time frames both in real and nominal terms. Real TL adjustments are made based on the inflation figures using 1994 as the base year. All returns for various investment opportunities are calculated using the last day of the year in December as annual percentage changes. One-year bond yields (in TL) for 2001 and 2004 are for June 8 and September 8, respectively, as that is the most recent data available for that year. One-year bond yields' first-year returns are based on the first available date in January of the following year as seen in "Appendix 2" section because they start in 1998 for the first year are based on the first available date in January of the following year. Average arithmetic returns are calculated over the number of observations available. "All years" geometric means are calculated over 20 years including missing years

Turkish art index emerges as an investment alternative for portfolio diversification with its low or negative correlation with other investment assets. Nominal USD Art returns have low correlation with gold prices (USD) and negatively correlated with equity, 1-year bond returns, and overnight interest rates. Nominal art returns in the USD are also negatively correlated with nominal USD MSCI World and MSCI Emerging market indices.

As a result, we suggest art to be used as a hedging option in a portfolio for diversification benefits but that using art as a safe haven should not be discarded as an alternative as these findings are not mutually exclusive.

It is worthwhile to note that the number of units of art sales all increase 1 year after the main contraction years of the economy (1995, 2000, 2002, 2010). In sum, this comparison suggests Turkish art market returns are quite volatile; therefore, one should interpret the results of return calculations for such a volatile market for a limited time span carefully. Additionally, the Turkish art market seems to provide a good hedging option; and it especially performs better than other investment options if not at but around periods of crises. Art investments' diversification potential around crisis periods is challenged by the lack of supply and demand and thin markets at crisis years. Investors have difficulty considering art as a hedging alternative during periods of extreme volatility when the economy contracts at a crisis period. Hence, at slow contractions, art investment is a good solution for diversification, and to decrease risk with its low correlation. We may explain the increase in the number of transactions in the after crisis years with the necessity of liquidity for some art owners. If the slowdown in the economy is not very strong, leading to a very severe financial crisis, the investors in need of liquidity may provide an investment opportunity to new art investors, but if there is a severe financial crisis, then the art market is affected as well as other investment options, and the transactions cease. Consequently, art can be suggested as an investment to improve diversification because of its negative correlation with equities to enhance portfolio returns with the limitation of high transaction costs and information asymmetry.

## 5 Conclusion

We use a unique data set of art auction sales of a very volatile market including several financial crisis periods as well as a period of macroeconomic reforms and restructuring in financial markets during 1994–2014. Our findings suggest that Turkish art index emerges as a good “hedge” alternative for improving portfolio diversification with its low or negative correlation with other investment assets overall. We also observe weak evidence for “safe-haven” hypothesis. Results suggest that hedge and safe haven findings are not mutually exclusive and investors might choose art as a hedge not just specifically during volatile times but throughout their life cycle. The art index reflects the negative environment of the financial crisis, but it performs better before and after crisis years. Therefore, art may be used to improve diversification and to enhance returns though volatile periods and art can be considered a hedging option, especially for decreasing the volatility of the portfolios during uncertain times. Before crisis years, real art returns were observed to be at (−4.7) %

**Table 6** Correlation of returns on investment alternatives

	Return on art index (USD nominal)	Return on art index (nominal TL)
BIST 100 return nominal (TL)		-0.03
MSCI world total return (USD)	-0.12	
MSCI emerging markets index (USD)	-0.07	
Overnight lending rates		-0.05
One-year bond yield (TL)	-0.12	-0.15
Gold/USD returns	0.29	0.24
Turkey 5 years CDS spreads (starts from 2004)	0.28	0.32

This table presents the pairwise correlation coefficients for returns of various asset classes over the period 1994–2014 (when available). Definitions and sources for all indices are provided in “Appendix 1” section. All returns for various investment opportunities are calculated using the last day of the year in December as annual percentage changes. One-year bond yields (in TL) for 2001 and 2004 are for June 8 and September 8, respectively, as that is the most recent data available for that year. One-year bond yields’ first-year returns are based on the first available date in January of the following year. Turkey 5 years CDS Spread data starts from 2004

compared to a real return of (-55.7) % for equities and (-0.1) % for gold. The years immediately after the crisis, real art returns averaged at (-6.9) % as compared to real equity returns of (-24.1) % and gold returns of 12.4%.

In line with previous research, art returns yield lower than equities in this emerging market for the whole data period. One can observe, in general, that around crisis periods, especially 1 year before and after crisis periods, art yields generally higher returns than other investments. One year after the crisis years, art has a higher return than BIST, except for the year 2010. Results hold with and without the earthquake year and at crisis years, art yields are lower. 2005 was the year of the implementation of macroeconomic reforms, and this created a bull market for art and other investments. For 2011, at the peak of the macroeconomic positive environment of the high growth years for Turkey, we observe that art returns reflect this growth at their highest level.

One caveat is that standard deviation of art is much higher than the stock market. In years when the growth in the economy is not very strong, an opportunity to use art as an investment option may arise; and the investors in need of liquidity might provide an investment opportunity to new investors. If there is a financial crisis, then the art market is affected severely as other investments, and the transactions tend to cease in art market.

There is not a clear trend for the years when there is no art auction. BIST has real positive return in 2004 and 2012, but it has a negative return in 1994 and 2001 crisis years when there were no auctions held. The investors seem to choose foreign exchange at uncertain times. The share of foreign exchange deposits as a refuge of assets reflects at crisis periods a high uncertainty with 67% and 70% in 1994 and 2001 financial crisis years.

This paper has implications for asset managers to include art investment as a hedge in their portfolio. The study can be renewed with a broader art investment data set, including extended crisis years in the transaction data; and multiple emerging market countries can be included to have more significant results. The findings



increase support for the use of art for diversification and hedging in investment portfolios but also keep an open door for investing in art as a safe haven.

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### Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest, they received no Grant for this work and this study complies with ethical standards.

## Appendix 1

See Table 7.

**Table 7** Variable definitions

Variable	Definition
<i>Market characteristics</i>	
One-year bond yield (TL)	Turkey government benchmark bid yield (1 year). <i>Source:</i> Thomson Reuters Eikon
BIST 100 return	Borsa Istanbul Stock Exchange largest 100 firms index returns. Returns are calculated from daily return data as the percent change in values between last day of trading in December in two consecutive years. These returns are adjusted for inflation using the Consumer Price Index returns during that year. <i>Source:</i> Datastream (Thomson Reuters)
Consumer confidence index	Monthly consumer confidence index (unadjusted). <i>Source:</i> Turkish Statistical Institute
Gold	XAU/USD. <i>Source:</i> Thomson Reuters
Inflation (December YOY percentage growth) 1994 = 100	Consumer price index, December year over year percentage growth. 1994 = 100. <i>Source:</i> Turkish Statistical Institute
MSCI emerging markets return	Morgan Stanley Capital International emerging markets index captures large and mid-cap representation across 24 emerging markets (EM) countries. The index covers approximately 85% of the free float-adjusted market capitalization in each country ( <a href="http://www.msci.com">www.msci.com</a> ). Returns are calculated from daily return data as the percent change in values between last day of trading in December in two consecutive years. <i>Source:</i> Thomson Reuters Eikon

**Table 7** (continued)

Variable	Definition
MSCI total return	Morgan Stanley Capital International total return is a broad global equity index that represents large and mid-cap equity performance across 23 developed markets countries. It covers approximately 85% of the free float-adjusted market capitalization in each country and MSCI world index does not offer exposure to emerging markets ( <a href="http://www.msci.com">www.msci.com</a> ). Returns are calculated from daily return data as the percent change in values between last day of trading in December in two consecutive years. <i>Source</i> : Thomson Reuters
Overnight lending rates	Central bank of turkey overnight lending rates. <i>Source</i> : Thomson Reuters Eikon
Percent of foreign currency deposits	Total foreign currency deposits in banks as a percent of total savings in banks. <i>Source</i> : Turkish Banking Association Database
Real estate index (real return)	Index of residential property prices over time. Included are rent prices, real and nominal house prices, and ratios of price to rent and price to income. In most cases, the nominal house price covers the sale of newly built and existing dwellings, following the recommendations from RPPI (residential property prices indices) manual. The real house price is given by the ratio of nominal price to the consumers' expenditure deflator in each country, both seasonally adjusted, from the OECD national accounts database. <i>Source</i> : OECD
Real GDP growth	Real GDP growth represents the changes in value at constant prices of final goods and services produced within a country during two consecutive years. <i>Source</i> : IMF World Economic Outlook
Turkey 5 years CDS spreads	5 Years credit default swap spreads for Turkey. End of day values. <i>Source</i> : Thomson Reuters Eikon
VIX	Market's expectation of future volatility. The VIX Index is based on options of the S&P 500 <sup>®</sup> Index. <i>Source</i> : Thomson Reuters Eikon
<i>Painting characteristics</i>	
Abstract	An indicator variable equal to 1 if a painting is marked as abstract and zero otherwise. <i>Source</i> : Auction data set
Design	An indicator variable equal to 1 if a painting is marked as design and zero otherwise. <i>Source</i> : Auction data set
Detail	An indicator variable equal to 1 if a painting is marked as detail and zero otherwise. <i>Source</i> : Auction data set
Figurative	An indicator variable equal to 1 if a painting is marked as figurative and zero otherwise. <i>Source</i> : Auction data set
Historic	An indicator variable equal to 1 if a painting is marked as historic and zero otherwise. <i>Source</i> : Auction data set
Interior	An indicator variable equal to 1 if a painting is marked as interior and zero otherwise. <i>Source</i> : Auction data set
Landscape	An indicator variable equal to 1 if a painting is marked as landscape and zero otherwise. <i>Source</i> : Auction data set
Modern	An indicator variable equal to 1 if a painting is marked as modern and zero otherwise. <i>Source</i> : Auction data set
Oil	An indicator variable equal to 1 if a painting is marked as oil and zero otherwise. <i>Source</i> : Auction data set
Portrait	An indicator variable equal to 1 if a painting is marked as portrait and zero otherwise. <i>Source</i> : Auction data set

**Table 7** (continued)

Variable	Definition
Provenance	An indicator variable equal to 1 if a painting is marked as having provenance information and zero otherwise. <i>Source:</i> Auction data set
Sales price (nominal in TL after adjusting for TL to YTL conversion)	Sales price of a painting in TL terms, adjusted for the conversion from TL to YTL during January 1, 2005. The sales prices before January 1, 2005 are divided by 1,000,000. The prices are from each auction conducted. <i>Source:</i> Auction data set
Sales price (real in TL)	Sales price of a painting in real TL terms. Each price at a certain auction date is converted to real prices by using the consumer price index during that auction date. <i>Source:</i> Auction data set
Sales price in USD	Sales price of a painting in USD terms. TL/USD exchange rate is used to convert the TL nominal prices to USD. <i>Source:</i> Auction data set
Signed	An indicator variable equal to 1 if a painting is marked as signed and zero otherwise. <i>Source:</i> Auction data set
Size (in CM <sup>2</sup> )	Size of the painting in CM squared. <i>Source:</i> Auction data set
Still life	An indicator variable equal to 1 if a painting is marked as still life and zero otherwise. <i>Source:</i> Auction data set
Turkish	An indicator variable equal to 1 if a painting is marked as Turkish and zero otherwise. <i>Source:</i> Auction data set
Watercolor	An indicator variable equal to 1 if a painting is marked as watercolor and zero otherwise. <i>Source:</i> Auction data set

## Appendix 2

See Table 8.

**Table 8** Return comparisons for various investment alternatives and other macroeconomic and volatility variables by year (panels A and B)

Year	Number of paintings sold	Return on art index (USD nominal) (%)	Return on art index (TL nominal) (%)	Return on art index (TL—adjusted for inflation) (%)	BIST 100 return adjusted for inflation (TL) (%)	BIST 100 index return (TL) (%)	MSCI 100 total return (USD) (%)	MSCI emerging markets index (USD) (%)	Overnight lending rates (%)	One-year bond yield (TL) bid (%)
<i>Panel A</i>										
Individual years										
1994	78				-43.2	25.1	3.4	-8.7	92.0	
1995	440	54.3	106.1	41.4	-16.6	46.8	21.3	-6.5	106.3	
1996	139	-23.7	13.5	-21.2	35.6	143.8	14.0	3.1	73.8	
1997	228	3.3	5.2	7.7	77.6	253.6	16.2	-13.4	77.9	
1998	105	-18.0	-37.7	-20.9	-55.6	-24.7	24.8	-27.5	79.0	135.0
1999	168	13.8	31.8	14.5	246.8	485.4	25.3	66.0	70.0	40.6
2000	241	1.1	-28.1	4.6	-55.4	-37.9	-12.9	-32.8	187.5	79.9
2001					-13.3	46.0	-16.5	-4.8	59.0	75.0
2002	167	-11.9	72.9	-8.2	-42.0	-24.8	-19.5	-7.4	44.0	54.9
2003	65	6.8	-58.2	-16.3	51.7	79.6	33.8	53.3	26.0	25.8
2004					22.7	34.1	15.0	20.3	19.1	24.2
2005	64	-8.0	-12.0	-10.5	44.1	59.3	10.0	30.4	13.6	13.8
2006	116	13.0	19.8	26.4	-10.3	-1.7	20.7	29.1	17.5	20.6
2007	173	17.7	10.7	10.0	31.0	42.0	9.6	36.5	16.0	16.6
2008	89	-14.9	-3.9	2.0	-56.1	-51.6	-39.9	-54.4	15.8	16.6
2009	68	32.3	42.1	34.9	84.6	96.6	30.8	74.1	6.5	8.0
2010	106	-62.3	-66.6	-65.5	17.4	24.9	12.3	17.6	1.6	6.6
2011	72	298.5	307.7	310.7	-29.7	-22.3	-5.0	-21.2	5.0	11.3
2012					43.7	52.6	16.2	15.1	5.0	6.2
2013	25	-59.8	-53.3	-55.2	-19.3	-13.3	27.4	-5.0	3.5	9.9

**Table 8** (continued)

Year	Number of paintings sold	Return on art index (USD nominal) (%)	Return on art index (TL nominal) (%)	Return on art index (TL—adjusted for inflation) (%)	BIST 100 return adjusted for inflation (TL) (%)	BIST 100 index return (TL) (%)	MSCI world total return (USD) (%)	MSCI emerging markets index (USD) (%)	Overnight lending rates (%)	One-year bond yield (TL) bid (%)
2014	47	-48.2	-43.3	-43.1	16.9	26.4	5.5	-4.6	7.5	8.6
2015					-23.1	-16.3	-0.3	-17.0	7.3	10.8
2016				0.4		8.9	8.2	8.6	7.3	9.6
2017				31.9		47.6	23.1	34.3	7.3	13.6
2018						-20.9	-8.2	-16.6	22.5	22.0
Standard deviation (1994–2014)		80	88	82	68	119	19	33	47	35
<i>Source</i>	Portakal Auction House	Calculated	Calculated	Calculated	Thomson Reuters Eikon (returns calculated)	Thomson Reuters Eikon (returns calculated)	Thomson Reuters Eikon (returns calculated)	Thomson Reuters Eikon (returns calculated)	Thomson Reuters Eikon	Thomson Reuters Eikon (returns calculated)
Year	House price index (real return) (%)	Gold/USD returns (%)	% total foreign currency deposits in banks (%)	Turkey 5 years CDS spreads	VIX (annualized)	Consumer confidence index (unadjusted)	Inflation (December YOY percentage change 1994=100 (%))	Real GDP growth (%)		
<i>Panel B</i>										
Individual years										
1994		-2.77	66.91		222.74		120.3	-5.5		
1995		1.11	66.63		197.57		76.0	7.2		

Table 8 (continued)

Year	House price index (real return) (%)	Gold/USD returns (%)	% total foreign currency deposits in banks (%)	Turkey 5 years CDS spreads	VIX (annualized)	Consumer confidence index (unadjusted)	Inflation (December YOY percentage change 1994=100 (%))	Real GDP growth (%)
1996		-4.92	62.19		262.25		79.8	7.0
1997		-21.45	64.96		357.41		99.1	7.5
1998		-0.28	62.66		407.63		69.7	3.1
1999		0.17	61.38		388.75		68.8	-3.4
2000		-5.66	60.86		54.68		39.0	6.6
2001		2.40	70.38		410.45		68.5	-6.0
2002		24.39	69.38		434.31		29.7	6.4
2003		19.58	62.44		351.08		18.4	5.6
2004		5.66	57.68	232.50	246.80	91.94	9.3	9.6
2005		18.05	50.12	149.00	204.08	86.23	10.5	9.0
2006		23.03	50.89	159.80	204.09	78.82	9.7	7.1
2007		30.86	46.15	169.91	278.70	80.67	8.4	5.0
2008		5.78	45.30	412.60	520.30	56.68	10.1	0.8
2009		24.31	44.77	188.00	503.17	65.57	6.5	-4.7
2010		29.79	41.43	142.00	359.86	77.77	6.4	8.5
2011	-2.0	9.93	43.72	289.07	384.85	78.82	10.5	11.1
2012	1.6	7.03	42.67	128.11	284.79	73.59	6.2	4.8
2013	6.4	-27.96	48.47	242.50	227.25	74.97	7.4	8.5
2014	5.1	-1.83	48.54	176.54	225.49	67.75	8.2	5.2
2015	7.5	-10.39	54.26	267.52	266.70	73.58	8.8	6.1
2016	6.6	8.56	53.95	268.30	253.39	63.38	8.5	3.2
2017	-0.3	13.05	55.72	166.60	177.33	65.12	11.9	7.4

Table 8 (continued)

Year	House price index (real return) (%)	Gold/USD returns (%)	% total foreign currency deposits in banks (%)	Turkey 5 years CDS spreads	VIX (annualized)	Consumer confidence index (unadjusted)	Inflation (December YOY percentage change 1994 = 100 (%))	Real GDP growth (%)
2018	-6.3	-1.50		358.81	266.58	58.20	20.3	2.6
Standard deviation (1994–2014)	4	16	10	83.43	115.02	9.78	36	5
Source	OECD	Calculated	Banks Association of Turkey	Thomson Reuters Eikon	Thomson Reuters Eikon (returns calculated)	Turkey Stat (TUIK)	Turkey Stat (TUIK). <a href="https://www.infla-tion.eu">https://www.infla-tion.eu</a>	IMF Statistics

## Appendix 3

See Table 9.

**Table 9** Summary of the literature on art (sorted by year of publication)

References	Years covered	Countries covered	Findings (art returns and other asset returns)	No. of obs.	Methodology used
Anderson (1974)	1653–1970 (repeat sales) 1780–1970 (all sales)	Various (times—Sotheby index)	Art price appreciation of 4.9% per year (same painting returns). If we look at all paintings, then 3.3%	1730 (repeat sales) more than 1500 (all sales)	Hedonic, repeat sales
Stein (1977)	1946–1968	The US and the UK	Art returns 10.5% for the US-based paintings and 10.3% for the UK based paintings. Stocks 14%	8950	CAPM
Baumol (1986)	1652–1961	The UK Sales (Reitlinger book)	Art real returns of 0.55% return (2% lower than government securities)	5900 (final: 640 resales)	
Buelens and Ginsburgh (1993)	1652–1961	The UK Sales (Reitlinger book) but this time all resales included	Art real return of 0.65% and 0.87% for the restricted sample but there are segments in the market where returns are higher than bonds or stocks over long periods (no bond or stock return information provided except one where bond return is 2.5% all years excluding 1914–1949)	5900	Hedonic
Goetzmann (1993)	1715–1986	The UK sales (Reitlinger book)	Art 3.2% versus bonds 4.3% and stock 1.5% (1716–1986). SD of art is higher	3329 pairs	Repeat sales regression



Table 9 (continued)

References	Years covered	Countries covered	Findings (art returns and other asset returns)	No. of obs.	Methodology used
Pesando (1993)	1977–1992	The US sales (Gordon's print price annual) first market mainly	Art real return of 1.51%. 8.14% for stocks, 2.23% for <i>t</i> -bills and 2.54% for bonds	27,961 repeat sales	Repeat sales regression
De la Barre et al. (1994)	1962–1991	French sales (Mayer's)	Returns for paintings and stocks (S&P composite total return index) comparable for 1962–1991. Grand master painting returns higher than stocks especially between 1986 and 1991	30,950	Hedonic
Agnello and Pierce (1996)	1971–1992	The US	Art returns are lower at 9.3% (nominal) versus 13.1% for stocks but comparable to bonds and bills (9.7% and 7.4%)	15,216	Hedonic (use all sales not just resales)
Chanel et al. (1996)		N/A	N/A		Use full set of sales not just repeat sales
Czujack (1997)	1963–1994	Picasso sales only (from the US, the UK, France)	N/A	921	Hedonic
Burton and Jacobsen (1999)		Literature review	N/A	N/A	N/A
Burton and Jacobsen (1999)	1970–1997	20 Countries, 101 cities	Nominal returns similar for both stocks and art (geometric average, buy and hold returns: art-7.6%, stocks-8.7%)	10,598 sales (71 painters)	Hedonic

Table 9 (continued)

References	Years covered	Countries covered	Findings (art returns and other asset returns)	No. of obs.	Methodology used
Mei and Moses (2002)	1875–2000	The US	Art real annual compounded return is 8.2% which is comparable to stocks (8.9% S&P 500, 9.1% Dow Jones). Art returns outperformed fixed income. Standard deviation of art returns higher. Corporate bonds 2.2% government bond returns 1.9%	4896 pairs	Repeat sales regression
Edwards (2004)	1977–2001	Latin America (17 countries)	For the total portfolio and the complete 1981–2000 period, the overall mean annual (real) return for art: 9%, with a standard deviation of 12.6%. During the same period the following real rates of return (and standard deviations) were observed: Argentina: 3.8% (standard deviation of 57.3%); Brazil: 7.3% (54.0%); Chile: 7.3% (41.0%); South Korea: 1.1% (55.0%); and Mexico: 5.5% (56.0%)	12,690 (115 artists)	Hedonic, CAPM
Hodgson and Vorkink (2004)	1968–2001	Canada	Lower than stock (market provides 14.2%—Canadian MSCI) whereas art provides 7.6% nominal. Risk free rate is 8.2%. Real returns are higher for stock market as well		Hedonic, CAPM

**Table 9** (continued)

References	Years covered	Countries covered	Findings (art returns and other asset returns)	No. of obs.	Methodology used
Bley and Zanola (2005)	1988–1995	Picasso	N/A	1665	Hedonic and repeat sales regression
Seçkin and Atukeren (2006)	1990–2005	Turkey	Worse in returns compared to equity (art market index 54.87% nominal compared to BIST ISE 100 60.36%). Interest rates returns are comparable at 57.46%. 1999–2005 volatility of art market is lower than stock market and nominal returns are comparable	1030	Hedonic
Worthington and Higgs (2006)	1973–2003	Australia	Returns on Australian modern and contemporary art averaged 4.82% as compared to the stock market returns of 7.0%	30,227	Hedonic
Kraeussl and Schellart (2007)	1986–2006	German art	Art returns of 1.5% (geometric—nominal) versus 8.7% S&P 500 returns. Art returns are even lower than 3-month 7-bill returns	1688	
Pesando and Shum (2007)	1977–2004	Picasso	Lower in terms of real return (especially Picasso, 2.91% but Mei-Moses art index is also lower 6.47%) but higher than bills (1.03%) and bonds (4.98%). S&P 500 returns: 8.55%	1002 pairs	Law of one price

Table 9 (continued)

References	Years covered	Countries covered	Findings (art returns and other asset returns)	No. of obs.	Methodology used
Campbell (2008)	1980–2006	The US and the UK	Art returns are lower (6.56% vs. 10.88% world equities; 8.36% US 10YR Government bond returns)		
Campos and Barbosa (2008)	1995–2002	Latin American paintings in Sotheby's	Art returns are lower than many other asset returns at 5.23% (but no other asset return is provided)	1663	Hedonic
Kraeussl and Logher (2008)	Russia (1985–2008), China (1990–2008), and India (2002–2008)	Russia, China and India	Geometric art returns 10.00% (Russia) versus 25.88% for Russian stocks, 5.70% (China) versus 21.73% for Chinese stocks, and 42.20% (India) versus 33.08% for Indian stocks. Russian art beats the S&P 500 by 0.77% annually. S&P 500 returns 9.23% and 10 years <i>t</i> -bond 4.3%	34,554	Hedonic and CAPM
Kraeussl and van Elsland (2008)	1985–2007	German art	Geometric annual return of 3.8%. Equities bring in 8.4% and Citigroup World Government Bond index returns of 8.34%. Art returns are even lower than private equity 7.5%	61,135	2 Step hedonic
Atukeren and Seçkin (2009)	1990–2005	Turkish art	Turkish art return 6.8% nominal USD terms versus Borsa Istanbul equity returns of 10%	1030	Hedonic regression and CAPM

Table 9 (continued)

References	Years covered	Countries covered	Findings (art returns and other asset returns)	No. of obs.	Methodology used
Renneboog and Spaenjers (2009)	1920–2007	US and UK sales	1951–2007 art real returns (average) of 4.03% overall compared to <i>t</i> -bills of 1.29% and 8.9% for S&P 500, but during the 2002–2007 art boom 11.6% (S&P 500 8.9%)	More than 1 million	Hedonic regression
Higgs (2012)	1986–2009	Australian art	Nominal art returns annual 1% compared to housing returns of 1.8% and stock market of 1.5% (but standard deviation is much higher)	64,203	Hedonic regression
Hodgson (2011)	1968–2005	French Canadian art	4.34% [higher than real interest 2.79% but lower than stock market (5.69%)]	4135	Hedonic and CAPM
Hodgson and Seçkin (2012)	1968–2008	Canadian and international markets	Provide Sharpe ratios (Dow Jones 0.387 vs. Canadian art 0.271)	25,003	Hedonic and CAPM
Lucińska (2015)	2007–2012	Polish art market	Nominal annual average art returns of 5.51% in Poland (2008–2012) compared to 0.47% and –0.68% in British and French markets. Does not compare with alternative assets	1708	Hedonic

**Table 9** (continued)

References	Years covered	Countries covered	Findings (art returns and other asset returns)	No. of obs.	Methodology used
McQuillan and Lucey (2016)	1998–2007	London auction sales of Islamic art	Art outperformed both equity (S&P 500) markets (13% vs. 8.49%) and debt markets (does not provide data for bond returns)	4047	Hedonic
Charlin and Cifuentes (2017)	1985–2014	4 different data sets—European art	N/A		Hedonic corrected by a wild bootstrap method

N/A not applicable

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