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# The efficiency of the art market: Evidence from variance ratio tests, linear and nonlinear fractional integration approaches<sup>☆</sup>



Goodness C. Aye<sup>a</sup>, Luis A. Gil-Alana<sup>b,1</sup>, Rangan Gupta<sup>a</sup>, Mark E. Wohar<sup>c,d,\*</sup>

<sup>a</sup> Department of Economics, University of Pretoria, Pretoria, 0002, South Africa

<sup>b</sup> University of Navarra, Faculty of Economics and ICS (NCID), Edificio Amigos, E-31080, Pamplona, Spain

<sup>c</sup> College of Business Administration, University of Nebraska at Omaha, 6708 Pine Street, Omaha, NE 68182, USA

<sup>d</sup> School of Business and Economics, Loughborough University, Leicestershire, LE11 3TU, UK

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## ABSTRACT

This paper investigates the weak-form efficiency hypothesis for the art market. We consider 15 art price indices namely: Contemporary, Drawings, France, Global index (Euro), Global index (USD), Modern art, Nineteenth century, Old Masters, Paintings, Photographies, Postwar, Prints, Sculptures, UK and US. We use quarterly data from 1998:1 to 2015:1. We employ both standard and non-parametric single and joint variance ratio tests while accounting for small sample bias through the use of the wild bootstrapping. We show that the majority of the art markets are inefficient with the exception of the Old Masters that consistently prove efficient under both individual and joint variance ratio tests. To a lesser extent Contemporary, US and UK markets are also efficient. However, confronting the data with both linear and nonlinear long memory models as robustness check, we observe that Paints, Prints, Photographies, Nineteenth century, Modern Art, US, France and Drawings have unit roots and are therefore efficient. Others such as Post war Sculpture, and Contemporary have values of the fractional parameter  $d$  significantly different from 0 to 1 and they may be considered efficient as well in a number of cases. The US and Contemporary art markets appear to be efficient irrespective of the method used.

## 1. Introduction

Investors often seek alternative assets and sophisticated solutions to acquire high returns while minimizing risk, especially when faced with under-performing portfolios. This has become more important since the aftermath of the recent financial crisis with a serious weakening in the value of most financial assets. The average annual returns from art have been as high as 10% for a very long period (Munteanu & Pece, 2015). Campbell (2008) also examines the financial gains that artworks have exhibited historically while including transaction costs, and show that arts offer diversification benefits as an investment portfolio given its low correlation with other asset classes. Also optimal portfolio allocations using historical returns make a case for investors to consider art as an attractive, albeit small addition to their investment strategy. Louargand and McDaniel (1991), Ashenfelter and Graddy (2003), after examining the auction market, argue that the increase in liquidity, better information in art auction catalogues, globalization, access to financing options, and the increase of participation in the auction markets are among the reasons that the art market has become more efficient. This suggests

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<sup>\*</sup> Corresponding author. College of Business Administration, University of Nebraska at Omaha, 6708 Pine Street, Omaha, NE 68182, USA.

E-mail addresses: [goodness.aye@gmail.com](mailto:goodness.aye@gmail.com) (G.C. Aye), [alana@unav.es](mailto:alana@unav.es) (L.A. Gil-Alana), [rangan.gupta@up.ac.za](mailto:rangan.gupta@up.ac.za) (R. Gupta), [mwohar@unomaha.edu](mailto:mwohar@unomaha.edu) (M.E. Wohar).

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that art prices should be unpredictable or random (Louargand & McDaniel, 1991). Further estimates based on hedonic price index of oil paintings, watercolors and drawings by Renneboog and Spaenjers (2013) show that between 1982 and 2007, art prices rose 3.97% annually thus outperforming returns from physical and financial assets: commodities (3.3%), gold (2.35%), US real estate (1.06%) and T-Bills (1.39%). This view is challenged recently by Korteweg, Kräussl, and Verwijmeren (2016) who argue that investors tend to overestimate the returns and underestimate the risks involved in selling and buying art work. Korteweg et al. (2016) show that average annual return for art investment decline from 10% to 6.2% making it less appealing than stock (10.95%), corporate bonds (8.94%) and commodities (10.21%).

Although there are many studies on different aspects of the art market, there is a dearth of studies on art market efficiency as is evidenced in the literature section below. Under the weak-form efficiency, the returns are purely unpredictable and no investors are able to make abnormal profit consistently over time by exploiting past price information (Fama, 1970). However, if the art market is not efficient, as a result of price formation which is opaque to outsiders who lack information on unsold artworks, then investors can easily capitalize on this to make excess profits. Therefore, the understanding of the efficiency or otherwise of the art market may be useful to investors in their portfolio diversification decisions and risk management. Market efficiency gives investors confidence in the fairness of market valuation. Some developments in the art market may support its efficiency namely increase in liquidity, better information in art auction catalogues, globalization, access to financing options, and the increase of participation in the auction markets are among others thus suggesting that art prices should be unpredictable or random (Louargand & McDaniel, 1991). This argument has however been countered by some researchers. For instance, David, Oosterlinck, and Szafarz (2013) argued that it is structurally impossible for auction prices to be efficient. This is because sellers set a minimum transaction price on the artworks for which they have a monopoly and hammer prices are determined solely by bidding, so that there is no upper limit. Consequently, relying on realized prices is insufficient to build unbiased predictions of future prices. Empirically, as will be seen in the literature review part, the conclusions are also mixed.

In this study we contribute by investigating the art market efficiency (i.e. return predictability) for the recent period 1998 to 2015 using data from [Artprice.com](http://Artprice.com). We consider conventional and non-parametric variance ratio tests for both individual and multiple tests namely Lo and MacKinlay (1988), Wright (2000) ranks and signs tests, Chow and Denning (1993) and Belaire-Franch and Contreras (2004) joint tests. Our choice of variance ratio tests instead of the unit root tests as in Çevik, Atukeren, and Korkmaz (2013) and related papers is motivated by the fact that the former is a volatility-based test. This feature is important given that most asset returns often exhibit volatility and deviations from normality (Belaire-Franch, McGreal, Opong, & Webb, 2007). Hence tests such as the variance ratio tests which are robust to heteroskedasticity and non-normality become important. Earlier, Poterba and Summers (1988) investigate the power of different random walk tests and find that variance ratios are among the most powerful tests and it has even more power than the Fama and French (1988) regression based procedure. In addition, studies like that of Summers (1986), Poterba and Summers (1988), Cochrane (1988), Fama and French (1988), Lo and MacKinlay (1988), Liu and He (1991), Erdős and Ormos (2010) and Mobarek and Fiorante (2014) have argued that unit root tests have very low power against stationary alternatives and it is difficult to reject a false null hypothesis of random walk.<sup>2</sup> Note that from the perspective of data, our paper is closest to that of Çevik et al. (2013), as we use the same set of indices, but an updated period until 2015 and employ variance ratio tests rather than unit root tests. However, unlike a recent and closely related study on art market efficiency by Munteanu and Pece (2015) who, using our approach of the variance ratio tests, focused on four major auction houses – Sotheby's, Turners Auctions Ltd, Mallett PLC and Mowbray Collectables- we, as in Çevik et al. (2013), study a wider set of art indices including Contemporary, Drawings, France, Global (Euro), Global (USD), Modern art, Nineteenth century, Old Masters, Paintings, Photographies, Postwar, Prints, Sculptures, UK and US indices. Finally, for the conventional variance ratio tests which ordinarily use asymptotic normal probabilities to evaluate statistical significance, we use Kim (2006) wild bootstrap p-values to guard against small sample bias.

As a robustness check, we also analyze the efficiency of the art market using fractional techniques based on long memory models. Though the fractional integration models are new in the art market efficiency analysis, they have been used successfully in other academic research (Arouri, Hammoudeh, Lahiani, & Nguyen, 2012; Gil-Alana, 2008; Gil-Alana & Moreno, 2012; Gil-Alana, Aye, & Gupta, 2015). These models are able to account for long memory behavior and nonlinearities evidenced in most financial and economic time series. The fractional integration framework allows us to simultaneously and endogenously determine the order of integration of the art market indices without restricting us to choose a priori between zero and one. It is flexible and simply lets the data speak. The order of integration could be zero, a fraction of one, or it could even be above one. Therefore, the approach is agnostic with respect to the order of integration of the art market indices. The fractional integration approach achieves the goal of establishing the existence or otherwise of a random behavior or return independence with much more flexibility than most standard unit root test techniques.

The remainder of the paper is organized as follows: Section 2 reviews the literature, while section 3 discusses the data. The empirical models used are presented in section 4. Section 5 presents the results, and section 6 concludes.

## 2. Literature review

Many time series variables exhibit trend behavior and they are relevant to the study of market efficiency. According to Fama (1970), to be efficient, an asset should follow a random walk. In this case, the direction and prices of art should not be predictable. Investors must not profit from information already available. A market is said to be efficient if prices fully reflect all available information. According to

<sup>2</sup> Unit root tests most commonly employed in the literature (Dickey & Fuller, 1979; Phillips & Perron, 1988; Kwiatkowski, Phillips, Schmidt, & Shin, 1992; etc.) have very low power against trend-stationarity (DeJong, Nankervis, Savin, & Whiteman, 1992), structural breaks (Campbell & Perron, 1991; Perron, 1989), regime-switching (Nelson, Piger, & Zivot, 2001), or fractional integration (Diebold & Rudebusch, 1991; Hassler & Wolters, 1994; Lee & Schmidt, 1996).

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