# Art Price Index

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## 1 Introduction

Contemporary African art, long seen as a niche market, has experienced a surge in popularity over the last few decades. The South African art market in particular has received a lot of attention and has grown markedly over the last two decades, both in terms of the number of transactions and total turnover (Fedderke and Li 2014). Artworks by South African artists have reached record prices at international and local auctions, both for the country's "masters" - including Irma Stern, Walter Battiss, and JH Pierneef - and contemporary artists like William Kentridge (Naidoo 2013). For example, in 2011 Irma Stern's "Arab Priest" set a world record hammer price of £2.7 million at auction (Bonhams), while "Two Arabs" sold for R19 million, a record for a South African auction house (Strauss & Co).

The increase in interest in South African art, both locally and abroad, has sparked a vibrant market for investors (Naidoo 2013). This increase in the popularity of art, partly as an investment vehicle, is commensurate with international trends, where fine art has become an important asset class in its own right. In 2010 the Wall Street Journal reported that around 6% of total wealth was held in so-called passion investments, which include art, wine, antiques and jewellery. Of all these luxury goods, art is the most likely to be acquired for its potential appreciation in value (Capgemini 2010). Passion investments, and art in particular, are interesting examples of alternative assets, as they are durable goods with investment as well as consumption characteristics (Renneboog and Spaenjers 2014).

In times of economic uncertainty there is often an increase in demand for physical assets: as these have limited supply they are often considered relatively safe in times of financial turmoil (Warwick-Ching 2013). In addition, the demand for alternative assets is supported by their imperfect correlation with the stock market, which is thought to aid portfolio diversification. Alternative assets are also used as collateral for loans, or to take advantage of slacker regulatory and tax provisions.

To date there has been little research on the South African art market and particularly trends in art prices. It is important to analyse price movements over time in order to understand the dynamics of the market and to answer some question around the development of this market. However, accurate valuation of real alternative assets like art can be difficult. These assets are heterogeneous and often involve large transaction costs for both buyers and sellers. They are less liquid than traditional assets and have a low transaction frequency, which makes it difficult to measure the state of the overall market, as only a small part of the overall market is traded at any given time.

This paper will attempt to estimate an accurate price index for South African art. The price indices are intended to be a summary of overall price movements in the art market. The indices are then be used to try to answer the questions of whether there was a large increase in prices in the run-up to the Great Recession and whether there is evidence for the presence of a bubble in the market, as is often claimed? Section 2 provides an outline of the methodologies applied in the literature and provides a brief literature review. Section 3 looks at the available data for South Africa. Section 4 reports the results from a number of potential estimation methods. Section 5 evaluates these results and compares the indices to international art price indices. Section 7 introduces the bubble detection methodology and briefly looks at the literature. Section 8 reports the results of the bubble detection evidence. Section 9 concludes.

## 2 Estimation methodologies

An accurate measure is a prerequisite to analysing the art market to try and examine whether there was evidence of a bubble. The aim of this section is to establish a range of measures to answer the questions of .

The construction of price indices for real alternative asset markets is challenging for at least two reasons (Jiang, Phillips, and Yu 2014). Firstly, the low frequency of trading means that only a subset of the market is traded at a given time, while the prices of non-transacted assets are unobservable. Secondly, the heterogeneity of individually unique assets means that the quality of assets sold is not constant over time. Thus, the composition of assets sold will generally differ between periods, making it difficult to compare prices over time (Hansen 2009). Constructing an index for individually unique assets, like art, therefore requires a different approach than is used for indices of stocks, bonds and commodities. Four broad measurement techniques have been used to construct these indices (Eurostat 2013):

a) Naïve or central tendency methods
b) Hedonic regressions
c) Repeat sales regressions
d) Hybrid models

The following sections provide a brief introduction to these methodologies. The literature does not provide an a priori indication of the most appropriate method and, in practice, the data dictates the choice.

## 2.1 Central Tendency or naïve methods

The simplest way to construct a price index is to calculate a measure of central tendency from the distribution of prices. As price distributions are generally skewed, the median is often preferred to the mean. These average measures have the advantage that they are simple and easy to construct and do not require detailed data.

However, an index based on average prices does not account for the difficulties mentioned above. For assets like artworks, naïve indices may therefore be more dependent on the mix of objects that come to market, than changes in the underlying market. For instance, if there is an increase in the share of higher quality assets, an average measure will show an increase in price, even if the prices in the market did not change (Hansen 2009). Hence, such a measure may not be representative of the price movements of all the assets in the market. If there is a correlation between turning points in asset price cycles and compositional and quality changes, then an average could be especially inaccurate (Eurostat 2013).

An improvement can be made by stratification of the data. Stratified measures control for variations in prices across different types of assets by separating the sample into subgroups according to individual characteristics such as artist and medium.[1] Stratified measures are currently used by ABSA, FNB and Standard Bank, for instance, to construct property price indices for South Africa. However, scholarly work rarely employs central tendency indices. The repeat sales and the hedonic regression methods have dominated in the international literature.

## 2.2 2.1.1.2 Hedonic regression methodology

Artworks are heterogeneous assets, with a variety of characteristics that make them unique. The hedonic regression method recognises that the prices of heterogeneous goods can be described to some extent by their characteristics (Eurostat 2013). In the context of art, characteristics may include physical (e.g. medium) and non-physical attributes (e.g. artist reputation). The hedonic approach estimates the value attached to each of these attributes.

The hedonic approach entails regressing the logarithm of the sales price on the relevant attributes, as well as time dummies, which capture the "pure price effect" (Kräussl and Lee 2010). The standard hedonic model usually takes the following form:

[1] Ek het weergawes van hierdie indekse bereken, so ons kan hulle insluit as dit nodig is. The Fisher ideal index is often the recommended index formula, as it can be justified from several different perspectives (Eurostat, 2013). It is the geometric mean of the Laspeyres and Paasche indices. The Laspeyres index holds the quantity weights fixed in the base period, while the Paasche index holds the quantity weights fixed at the comparison period.

$$\ln P_{it} = \alpha + \sum_{j=1}^{z} \beta_j X_{ij} + \sum_{t=0}^{\tau} \gamma_t D_{it} + \epsilon_{it}$$

where $P_{it}$ represents the price of artwork $i$ at time $t$, $X_{ij}$ is a series of characteristics of item $i$ at time $t$, and $\beta_j$ reflects the coefficient values (implicit prices) of the attributes, $D_{it}$ is the time dummy variable, which takes the value 1 if item $i$ is sold in period $t$ and 0 otherwise, and $\epsilon_{it}$ represents the error term.

The hedonic method therefore controls for quality changes by attributing implicit prices to a set of value-adding characteristics of the individual asset. Hedonic regressions control for the observable characteristics of an asset to obtain an index reflecting the price of a "standard asset" (Renneboog and Van Houtte 2002). It is also possible to allow the coefficients (the implicit prices assigned to characteristics) to evolve over time with the adjacent-period method (Triplett 2004).

Thus, the hedonic approach can circumvent the problems of heterogeneity of individually unique assets, changes in composition and quality, as well as the exclusion of single-sale data (a problem with repeat sales regressions) (Hansen 2009). However, the choice of the attributes in a hedonic regression and involves subjective judgement and is limited by data availability. If relevant variables are omitted or the functional form is incorrectly specified, it will result in omitted variable or misspecification bias, which will bias the parameter estimates and therefore the indices (Jiang, Phillips, and Yu 2014). Various studies have attempted to improve upon the basic methodology.

## 2.3 Repeat Sales Regression Method

The repeat sales methodology overcomes many of the problems by tracking the repeated sale of a specific asset over time. This method aggregates sales pairs and estimates the average return on the set of assets in each period (Kräussl and Lee 2010). The repeat sales method has often been applied in the construction of real estate indices, where there is a lack of detailed information on each sale (which is necessary for the hedonic method).

In the standard repeat sales model the dependent variable is regressed on a set of dummy variables corresponding to time periods. The coefficients are estimated only on the basis of changes in asset prices over time. The basic regression takes the following form:

$$\ln \frac{P_{t+1}}{P_t} = \sum_{i=1}^{t} \gamma_i d_i + \epsilon_i$$

where $P_t$ is the purchase price for time $t$; $\gamma_i$ is the parameter to be estimated for time $i$; $d_i$ represents the monthly dummy variables (-1, 0, 1) indicating the occurrence of $P_t$; and $\epsilon_i$ is a white noise residual.

The repeat sales method avoids having to correctly specify the characteristics that determine asset value (a problem with hedonic models). By only using assets that have been sold at least twice, the method controls for other factors contributing to the variation in price growth. It also has the advantage of not being data intensive, as the only information required to estimate the index is the price, the sales date and a unique identifier (e.g. the address of the property).

A disadvantage of the repeat sales method is that single-sale data is discarded. This is problematic for these assets because the resale of a specific item may only occur infrequently, which reduces the total number of available observations substantially. Another problem is the possibility of sample selection bias. Assets that have traded more than once may not be representative of the entire population of assets. For example, if cheaper artworks sell more frequently than expensive artworks, but high-quality artworks appreciate faster, a repeat sales index will tend to have a downward bias (Eurostat 2013). Several studies have investigated this source of bias and the size and direction of the bias has varied between samples. Various studies have improved on the basic repeat sales approach in order to overcome some of these difficulties.

### 2.4 Hybrid Models

A hybrid model approach involves a combination of the repeat sales and hedonic approaches. The hybrid formulation exploits the control of variation inherent in repeat sales pairs and avoids the problems of possible misspecification inherent in the hedonic methodology (Bester 2010). By combining the two methods, a hybrid approach tries to exploit all the sales data, and to address sample selection bias and inefficiency problems, in addition to the quality change problem (Eurostat 2013).

In the context of real estate, for instance, Case and Quigley (1991) used samples of single-sale and repeat-sale properties to jointly estimate price indices using generalised least squares regressions. More recently, Guo et al. (2014) developed a "pseudo repeat sales" procedure to construct more reliable price indices for newly constructed homes. Their procedure matched the sales prices of very similar new units in order to construct a large pseudo repeat sales sample. This approach is discussed in more detail below.

As mentioned, the specific methodology adopted is dependent on the data available. Art price indices tend to employ some variant of the hedonic method, due to the availability of more detailed data on characteristics and a lack of repeat sales of artworks. The following section provides a brief literature review of the estimation of art price indices.

### 2.5 South African literature

## 3 The South African Art Auction Data

Daar was baie groei.

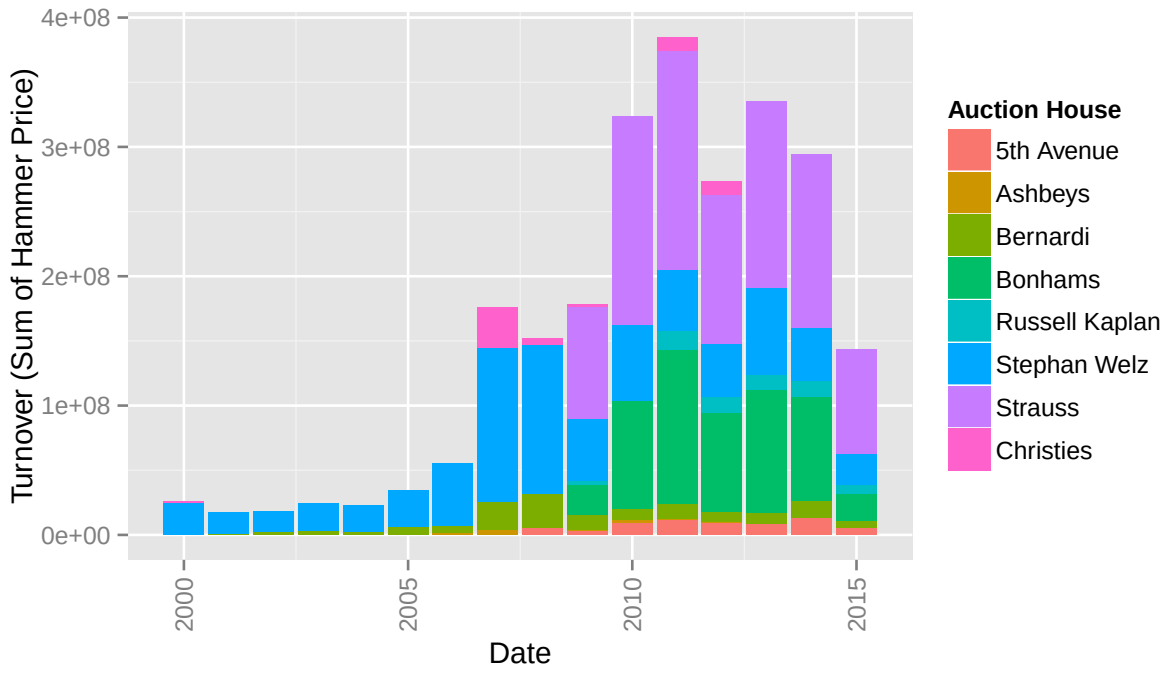


Figure 1: Turnover (sum of hammer prices) by auction house (2000-2015YTD)

En die pryse het gestyg.

Summary van die pryse

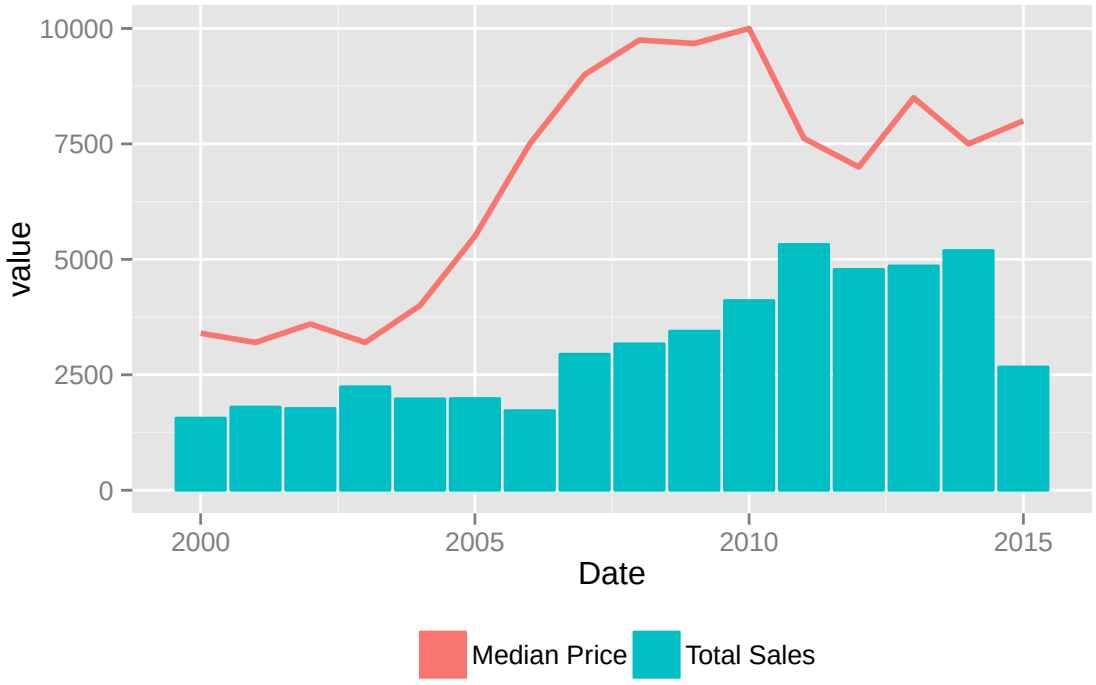


Figure 2: Median hammer prices and total sales (lots) at auction (2000-2015YTD)

| Min. | 1st Qu. | Median | Mean | 3rd Qu. | Max. |
|---|---|---|---|---|---|
| 20.00 | 2600.00 | 7000.00 | 49667.59 | 24000.00 | 30147660.00 |

Table 1: Descriptive statistics of auction hammer prices

# 4 Results

## 4.1 Hedonic

### 4.1.1 Reputaion variable

$$Index = \frac{\prod_{i=1}^{n}(P_{i,t+1})^{\frac{1}{n}}}{\prod_{i=1}^{m}(P_{i,t})^{\frac{1}{m}}} / \text{hedonic adjustment}$$

$$\text{hedonic adjustment} = \exp\left[\sum_{j=1}^{z}\beta_j(\sum_{i=0}^{n}\frac{X_{ij,t+1}}{n} - \sum_{i=1}^{m}\frac{X_{ij,t}}{m})\right]$$

$$\text{Artist reputation index} = \frac{\prod_{i=1}^{n}(P_{i,y})^{\frac{1}{n}} / \prod_{i=1}^{m}(P_{i,0})^{\frac{1}{m}}}{\exp\left[\sum_{j=1}^{z}\beta_j(\sum_{i=0}^{n}\frac{X_{ij,y}}{n} - \sum_{i=1}^{m}\frac{X_{ij,0}}{m})\right]}$$

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