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An Exploration of Auction Price Concentration at the Artist Level

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ABSTRACT

Auction price studies have typically had an object-based focus, employing models to understand the prices of artworks. In this paper, we take an alternative focus on price heterogeneity, considering the artist, not the artworks, as the level of observation. Understanding how factors relating to the artist, such as gender and region, and their work, such as how diverse their oeuvre is, provides new insights into our overall understanding of price heterogeneity in the art auction market. Using panel data from the Australian Art Sales Digest for auctions containing artworks by Australian Indigenous artists, we investigate artist-level price heterogeneity. We find significant impacts of product and supply diversity, regions, fame and the living status of the artist, particularly a strong death effect. Conversely, there are no significant effects of artist supply factors (number of works offered) or the gender of the artist.

JEL Classification: Z11, D44, L22

1 | Introduction

Studies of auction prices have typically had an object focus, employing models to associate the hammer price of individual artworks with either characteristics of the artwork and the auction (Fedderke and Li 2020; Forster and Higgs 2018; Hawkins and Saini 2016; Hodgson and Hellmanzik 2019; Ursprung and Wiermann 2011) or with pre-sale information on the artwork (Bauwens and Ginsburgh 2000; Czujack and Martins 2004; Ekelund et al. 2013; Farrell et al. 2018). Variability across artists has received much less attention but is, however, consistent with the literature that suggests an artist's name (or lack thereof) has a large impact on the evaluation of artworks (Cleeremans et al. 2015; Oosterlinck and Radermecker 2019; Radermecker 2021; Thompson 2010), the existence of price segments in art auction markets (Fry 2020; Prieto-Rodriguez and Vecco 2021), the existence of superstars (Candela et al. 2016) and the finding that in estimating hedonic models, data should not be pooled as individual artists are significantly different (Farrell et al. 2018). Thus, an alternative way to capture price variability is to consider the artist, not the artworks (objects) as the level of observation (Candela et al. 2016; Castellani et al. 2012). This approach therefore takes a measure of price variability for artworks at the artist level and seeks to relate this to characteristics of the artist and their work. Such analysis also moves from model specifications, such as hedonic regression models, for the expected value (or mean) of artworks to models for the dispersion of the prices of artworks produced by an individual artist in a given period (e.g., a year). Models for means and dispersion are obviously related, and thus, it is likely that similar factors will play a role in both. This link is useful in specifying models for dispersion (price concentration).

In this paper, we use a panel of Australian Indigenous artists to study variability at the artist level using an index of price concentration—the Gini coefficient (Gini 1921). Australian Indigenous

art has made the transition from the primary gallery or dealer market into the secondary auction market and appears not just in auctions of ethnographic and cultural material but also in auctions of modern and contemporary art (Aboriginal Arts and Crafts Industry Review Committee 1989). Australian Indigenous art ranges from the traditional dot paintings from the Western Desert region through to more contemporary dot paintings from the Central Desert, X-ray paintings from Arnhem Land in the North, the traditional ochre paintings from the Kimberley region and the watercolour landscapes of the Hermannsburg school of artists (Artlandish 2019). This diversity of artists and artworks facilitates understanding price variability at the artist level for this market. This genre of contemporary art has several parallels to abstract art (Myers 2002; Smith 2008) and attracts buyers from around the globe. Thus, whilst this market is the context in which we conduct our study, the findings will also have implications for art auctions more broadly.

The plan for the rest of this paper is as follows. In the next section, we provide some background to our paper. We then present the modelling framework that we use. This is followed by a description of the data that is used. Next, we present the results of our analysis and discuss our findings and their implications. Finally, we present some conclusions.

2 | Background

The fact that the reputation of the artist can play an important role in hedonic models and in models of returns has been recognised (Throsby 1994). Indeed, the presence or absence of an artist's name (Cleeremans et al. 2015; Oosterlinck and Radermecker 2019; Radermecker 2019, 2020), a signature (Black 2017; Zhou 2017), winning a prize or exhibiting at a major exhibition (Johanson, Coate, Vincent, and Glow 2022; Pénet and Lee 2014) or the gender of the artist (Bocart et al. 2021; Farrell et al. 2021; LeBlanc and Sheppard 2021) can all influence the valuation of a work. Similarly, the lack of authenticity can lead to reduction in value (Bocart and Oosterlinck 2011; Coslor 2016; Scorcu et al. 2021). Additionally, the interaction of an artist's talent and fame creates both cultural and economic value and plays a role in determining price (Angelini and Castellani 2019; Beckert 2020; Beckert and Rossel 2013).

Increasingly, artists resemble or act as brands (Angelini et al. 2019; Gandini 2016; Muñiz Jr. et al. 2014; Petrides and Fernandes 2020) and cultural institutions use artists as key drivers of recognition (Ferreiro-Rosende et al. 2021). Artworks are often considered an extension of the artist (Candela et al. 2016; Newman and Smith 2019) and so we may view the artist, or her name, as a brand name (Belk 1995; Hernando and Campo 2017b, 2017a). Thus, we consider artists as producer brands who create outputs (their oeuvre) that generate revenue through the sale of their individual products (artworks). The value is co-created by other agents in art markets—dealers, auction houses, galleries, museums and collectors (including art funds) (Angelini and Castellani 2021; Cellini and Cuccia 2014; Crane 2009; Piano and Al-Bawwab 2021; Velthuis 2012) and the use of both private and public information by those agents (De Silva, Gertsberg, Kosmopoulou, and Pownall 2022). The central role of the artist in the art market is recognised as a contributory factor in the operation of global art markets (Codignola 2003) and an artist's reputation can impact upon their public funding or commissions (Peters and Roose 2022; Piano 2021).

Given the critical role of the artist in creating value, it is appropriate to take an artist-based approach to understanding price variability. Whilst this approach is less common than the object (artwork)-based, there have been some studies that have taken an artist-based approach. Using the capital asset pricing model and data on price indices for specific artists, Agnello (Agnello 2016) finds that returns on artists do not have a strong association with market returns. Understanding artist 'style' has been studied by (Goetzmann et al. 2016) who use factor models and clustering algorithms based on price data for artists to empirically identify five groups that themselves relate to a standard classification used by art historians. Rankings and classifications of artists have also used artist-level data (Galenson 2002; Ginsburgh and Weyers 2014; Vermeylen et al. 2013).

A notable feature of the ranking of artists that used data on images reproduced in asset of seminal art history texts to rank 35 artists using the total number of illustrations is the use of a Gini coefficient (Gini 1921) to measure how equally an artist's paintings are illustrated (Galenson 2002). The estimated Gini coefficients are also used to highlight differences between painters who were innovative or experimental. This approach to rank and categorise artists by a Gini coefficient is exploited to examine whether returns or prices of artworks differ between artists with high or low Gini values (Buchbinder 2014). The use of the Gini coefficient occurs elsewhere in the literature. It has been used in the way originally designed, to measure (in)equality in resource allocation (Blau et al. 1985; Urrutiaguer 2005), to act as a control variable for the distribution of revenues in the film or the DVD market (McKenzie 2010; McKenzie and Smirnov 2018) and to investigate the concentration of the market for art experts (Prinz 2022).

The art market is one of differentiated products and producers (artists) and their outputs (artworks) will be promoted and positioned in the overall market to obtain the best value (Leifer and White 2004). In such situations, product diversification and differential pricing can provide gains (Eckard and Smith 2012). Artists may diversify through producing more than one category of works—say, both acrylic paintings and decorative objects. Such diversification will attract buyers at different prices in different segments of the overall market and will produce a higher level of price heterogeneity than that of an artist who only produces one product (e.g., watercolours). The existence of diversification will also drive the segmentation of the market into schools of art (such as types of surrealism), price segmentation and the emergence of superstars (Candela et al. 2016; Fry 2020; Prieto-Rodriguez and Vecco 2021). Additionally, dealers, galleries and auction houses can benefit from such diversification, and collectors can form their "portfolios" based on the attendant price heterogeneity (Castellani et al. 2012).

3 | Modelling Framework

Our analysis will take a summary measure of variability for the hammer prices of artworks by an artist, the Gini coefficient

(Gini 1921), and relate the Gini coefficient to the characteristics of the artist and their work. The Gini coefficient is commonly used as a measure of inequality or concentration of income. Here we use it with the hammer prices of an artist's oeuvre, and the Gini coefficient represents the dispersion, or heterogeneity, of the hammer prices. The more (less) evenly spread the prices, the lower (higher) the Gini. Additionally, we choose to use the Gini coefficient for consistency with Castellani et al. 2012, which also allows for the inclusion of average price into our two-equation model. Future work might consider other measures of concentration, such as generalised entropy measures.

The Gini coefficient, G, is defined as a function of the mean difference, Δ, and the mean, μ, of the hammer price data ($G = \Delta / 2\mu$) (Stuart and Ord 1987). It is particularly useful as it ranges from zero for a homogenous price distribution to one as the degree of heterogeneity or asymmetry in the price distribution increases. Thus, the Gini coefficient is a standardised measure of concentration, or dispersion, of the hammer price distribution.

In each year we will estimate the Gini coefficient based on the realised ('hammered down') prices for the artworks by the artist. To ensure that we have sufficient hammer prices to estimate the Gini coefficient we will only use artists with ten or more sales in the year. It is well known, (Deltas 2003), that the use of small samples to estimate the Gini coefficient can lead to biased estimates and, in the statistical modelling of the determinants of the Gini coefficient, lead to a spurious relationship with the sample size. Thus, in our analysis, we will use the correction proposed in (Deltas 2003) and scale the estimated Gini coefficient by $n/(n-1)$ where n is the number of artworks sold in the year and is used to estimate the Gini coefficient. Restricting our attention to those artists with at least 10 sales in a year excludes artists with consistently low numbers of sales (less established artists) and years when artists who have reasonable annual sales numbers have had a dip in sales that year. Thus, our data will tend to represent more established artists. As art auction markets tend to be dominated by a relatively few artists (e.g., (Farrell et al. 2021) show 84% of sales are accounted for by just 100 artists) the results from the analysis of our data are likely to be representative of the price heterogeneity in the market as a whole.

The artist as a producer brand who has an oeuvre that produces value is consistent with the structural model in (Leifer and White 2004) for markets with differentiated products. In this model, producers, in our case artists, share a common context of costs and buyer valuations that shapes both the way that their market will function and will shape the inequality in their outcomes (price concentration and associated Gini coefficient). Artists who can diversify their products (artworks) or are in segments of the market that attract investors, such as particular schools or types of art, will potentially have high levels of price heterogeneity. Thus, the Gini coefficient will be related to both demand factors (e.g., buyer preferences) and supply factors (e.g., quality differentiation). Such factors are typically unobservable.

There are several observable factors that may act as proxies for the unobservable determinants and thus be related to the Gini coefficient. The number of artworks offered by an artist potentially measures both supply and potential demand for the artist and may therefore influence price heterogeneity. As described by (Castellani et al. 2012) the average price of works sold (average realised sales value) represents the quality of the artworks where artists with high realised sales value (average price) are likely to be perceived by the market to be of high quality and be artists with higher degrees of market power and supply diversity. In addition, by definition, the Gini coefficient depends on the average price. Thus, the average realised sales value will itself be endogenous, and this needs to be accounted for in our model specification. Consistent with previous work (Bauwens and Ginsburgh 2000; Czujack and Martins 2004; Ekelund et al. 2013; Farrell and Fry 2017), we will specify the realised sales value to depend upon the pre-sale estimated sales value (mid-point of the auction house low and high pre-sale value estimates). Additionally, given the clear price segmentation in art markets (Farrell and Fry 2017; Fry 2020) the relationship of the realised sales value with the pre-sale estimate value may differ for the top end of the market.

Specialisation or diversity in an artist's work and in the auction market will play a role in price dispersion. To capture the diversity, or more specifically the concentration, in the oeuvre of an artist or in the auction market itself we use the Herfindahl index (Herfindahl 1950; Hirschman 1964). The art auction market comprises several auction houses and is highly segmented since auction houses tend to specialise in different types of art (segments) of the market. To measure concentration, using the Herfindahl index, in the auction market we use the auction house shares of an artists' works offered. Since the auction market comprises auction houses that tend to specialise in particular fields, the more concentrated an artist's offerings in the auction houses (market) the lower the predicted level of the Gini value. To understand diversity for the artist herself, we use two measures. First, we use the Herfindahl index from the category (paintings, works on paper, photographs, prints and graphics and objects) shares of their works offered in a year. An artist who has a high concentration of her offered works is predicted to have lower levels of the Gini value. Second, we consider the diversity in terms of the physical size of the artworks, predicting that if an artist has a wide range of artwork sizes offered for sale—measured by the coefficient of variation of surface area (in metres squared) – more price dispersion is predicted.

There is evidence in the literature of significant effects of artist gender (Bocart et al. 2021) and fame (Pénet and Lee 2014) on artwork price. Thus, to investigate this, we include indicators for gender and fame (that the artist features in the Oxford Online collection (Rodenbeck and Olivier 2021) that incorporates both the Grove and Benezit collections) in our model. Whilst it is not clear whether the Gini value for the artist is impacted by their gender, we might expect fame to increase the Gini value. Most artists, especially emerging artists, are likely to operate in the lower end of the market with lower levels of the Gini, whereas famous artists are more established and likely to have more market power and supply diversity across the market.

The living status of an artist will also play a role in determining the Gini value. For living artists, their age will both reflect

their career stage and, as they age, reflect an increased overall supply of their works. Both will increase the Gini value for the artist. An artist's death restricts the production of new works and potentially will raise artwork prices for the artist (Ekelund et al. 2000; Ursprung and Wiermann 2011). It can also lead to an increase in the supply of works being offered for sale at auction. This may then act to reduce the initial price premium after death. For the artist, the Gini value for the established artists in our data, we might expect this to first increase in the year of death and then decrease yearly until the market for the artist adjusts to the death of the artist. Such a response to the death of an artist is also consistent with the analysis in (De Silva, Gertsberg, Kosmopoulou, and Pownall 2022) where the price decline after death is driven, in part, by the posthumous trading patterns of art dealers. To capture this death effect, we include an indicator variable for any observation (year) for which the artist is deceased and a continuous variable measuring the number of years (0, 1, ...) that the artist has been deceased. Consistent with these arguments, we expect a positive coefficient on the indicator variable and a negative coefficient on the continuous variable.

A final artist characteristic of interest is the region to which the artist belongs (North, Kimberley, Desert). This is an important variable in the context of Australian Indigenous art, as different regions are known for different types of art (Coslor and Fry 2024) and those represent niches in the differentiated market that will have different levels of price dispersion. For example, Hermannsburg artists using watercolours have a more homogeneous oeuvre, and a lower Gini value is expected. Finally, to ensure that we control for unobservable factors over time, such as changes in buyer preferences (tastes) or artist reputation, we also include a set of year fixed effects in our model.

Our empirical analysis uses the following two-equation specification:

$$G_{it} = \beta_1 P_{it} + \boldsymbol{x}'_{\boldsymbol{it}}\boldsymbol{\gamma} + \theta_t + u_{it}$$

$$P_{it} = \alpha_1 + \alpha_2 D_{it} + \alpha_3 M_{it} + \alpha_4 \left(D_{it} \times M_{it}\right) + v_{it},$$

where G_{it} is the Gini coefficient for artist i in year t, P_{it} is the average realised sales value for artworks sold by artist i in year t (Price), D_{it} is an indicator for the top end of the market, M_{it} is the average pre-sale estimated sale value for works by artist i in year t and $\boldsymbol{x}_{\boldsymbol{it}}$ is a vector of variables that includes artist characteristics and θ_t are year fixed effects. This two-equation model is estimated by three-stage least squares (3SLS) allowing both the Gini coefficient and price (average realised sales value), G_{it}, P_{it}, to be endogenous. In this specification characteristics of the artist, their oeuvre, and the market along with average realised value and time effects influence the dispersion (Gini coefficient) and pre-sale information, in turn, is related to the average realised value. Further to assess the sensitivity of our results to the estimation procedure we also use single equation estimation techniques that correct for the endogeneity of average realised price. The techniques used are a single equation instrumental variable procedure (two-stage least squares—2SLS) and a panel random effects instrumental variable procedure to estimate the single Gini coefficient equation.

4 | Data

Our data comes from The Australian Art Sales Digest (AASD) (Furphy 2021). The AASD contains every artwork created by an Australian Indigenous artist listed for sale at auction. As prior to 1987 very few such works were listed (Farrell and Fry 2017), our period covers 1987–2020. From this object (artwork) data, we create our data at an artist level for analysis. We additionally confine our data to artists who sell at least 10 artworks in a year to ensure that the Gini coefficient is not estimated from too small a sample. These estimated coefficients are then adjusted to account for the presence of small sample bias (Deltas 2003). The characteristics of our data can be found in Table 1.

We have 433 observations on 83 artists. Most of our artists have 5 or less years of data and only one Albert Namatjira is present for all years. Just over a third (37.3%) of the artists are female accounting for 35.1% of observations. Living artists (24.1%) account for 14.1% of the observations and artists who died before our period (26.5%) account for 36% of the observations. Close to a third of the observations (33.5%) are from

TABLE 1 | Characteristics of the data.

	Artists	Observations
Total	83	433
Region		
Desert, non-Hermannsburg artist	16	92
Desert, Hermannsburg artist	20	151
Kimberley	8	38
North	8	12
Other regions	11	37
Western Desert	20	103
Oxford online entry	16	145
Gender		
Male	52	281
Female	31	152
Living status		
Deceased before 1987	22	156
Died between 1987 and 2020	41	216
Alive in 2020	20	61
Observations		
1	19	
2–5	41	
6–10	11	
11–20	10	
21+	2	

the 16 (19.3%) of artists who feature in the Oxford Online reference source. Different regions are known for different types of art. One style of Australian Indigenous art is that of the Hermannsburg School. Artworks by these artists are watercolours of Australian landscapes. Although these artists come from the Desert region of Australia, their art is distinct from artworks created from artists from other regions and so they are categorised separately. Apart from the Hermannsburg artists and their works, it is the Desert and Western Desert that accounts for most of our data. Thus, to avoid small sample sizes, in our subsequent analysis we will only consider Hermannsburg, Desert, Western Desert and Other Regions (that incorporates Kimberley, North and all other regions) classifications.

For each observation (artist in a year), we know the number of works offered and sold, the realised ('hammered down') sales value, the pre-sale estimated value for works sold, the number of categories (objects, paintings, watercolours, prints/graphics) of works by the artist and the number of auction houses that dealt with works by the artist. We also estimate the coefficient of variation for the area (in metres squared) of artworks by the artist in the year. For each artist, we use the hammer prices, in Australian dollars, to estimate adjusted

TABLE 2 | Descriptive statistics.

	Observations	Mean	Std. dev.	Minimum	Maximum
Average sales value ($10,000)	433	1.146	1.696	0.017	12.408
Average pre-sale value ($10,000)	433	1.195	1.750	0.015	12.783
Gini coefficient	433	0.460	0.157	0.146	0.901
Coefficient of variation average value	433	0.975	0.505	0.249	4.315
Coefficient of variation area (m^2)	433	0.662	0.321	0	3.243
Number of works offered	433	23.824	13.934	10	102
Number of works sold	433	16.707	8.480	10	61
Number of categories	433	1.614	0.749	1	4
Herfindahl—categories	433	0.897	0.154	0.387	1
Number of auction houses	433	6.342	2.568	1	14
Herfindahl – auction houses	433	0.317	0.184	0.108	1
Years since death	307	19.762	14.881	0	61
Age in years (living artist)	126	65.468	12.686	38	87

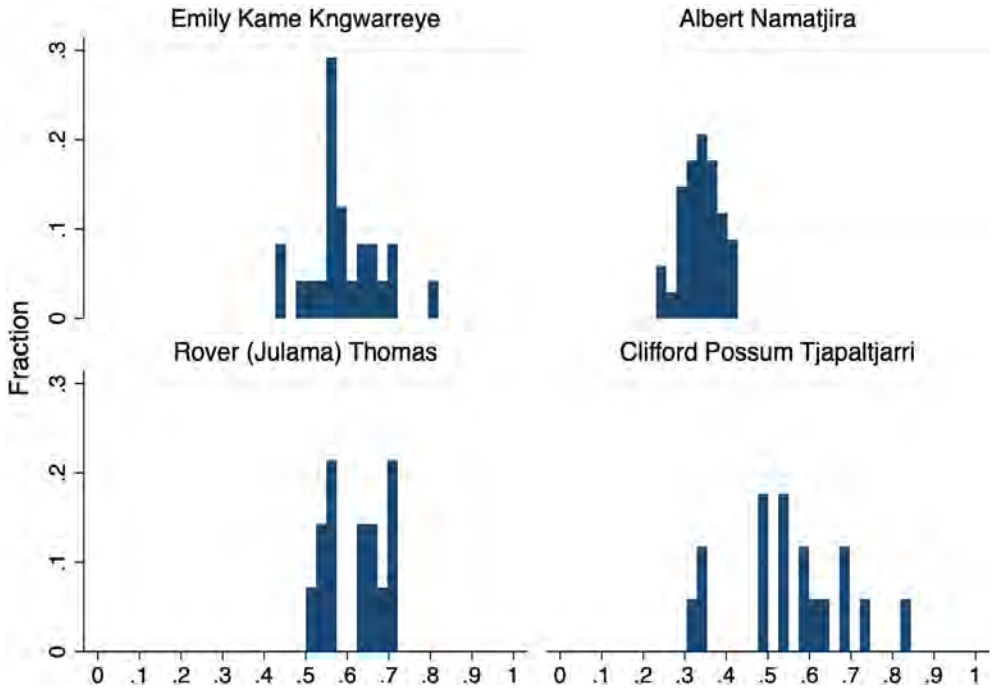

FIGURE 1 | Distribution of the Gini coefficient for selected artists. [Color figure can be viewed at wileyonlinelibrary.com]

Gini coefficients by year and artist. We also use the hammer prices to estimate the coefficient of variation of hammer prices. As we create our artist-level panel data for analysis from the Australian Art Sales Digest, the data precludes the creation of artist-level measures of quality dimensions such as those used by Lazzaro (2006). Table 2 contains descriptive statistics for the variables in our data.

The annual number of artworks offered (sold) ranges from 10 to 102 (10 to 61) with an average of 23.8 (16.7). Artists work in up to 4 categories and between 1 and 14 auction houses deal with the artists in a year. For deceased artists, the average number of years since death ranges from 0 to 61, averaging 16.3 years. The average realised ('hammered down') sales value is $11,460, which is slightly lower than the average pre-sale estimated value for works sold of $11,950. Average realised sales value ranges from $170 to $124,080, indicating that our data covers a wide range of artists in the market, from those who sell artworks at low prices through to artists with high sales value.

Our analysis looks at the variation of the Gini coefficient across artists and time. In Figure 1 we present the distribution of the Gini coefficient for four selected artists from different regions—Emily Kame Kngwarreye (Desert, Non-Hermannsburg), Albert Namatjira (Desert, Hermannsburg), Rover Thomas (Kimberley) and Clifford Possum Tjapaltjarri (Western Desert). We see that Albert Namatjira—the founder of the Hermannsburg school of watercolourists—typically has lower values of the Gini coefficient than the other artists. In contrast, Clifford Possum Tjapaltjarri, a Western Desert artist, has somewhat higher values for the Gini coefficient.

TABLE 3 | The top end of the market.

Artist	Observations	Total—all years
Bedford, Paddy Nyunkuny	5	5
Kngwarreye, Emily Kame	13	24
Napangardi, Dorothy Robinson	1	7
Onus, Lin	1	11
Thomas, Rover (Julama)	11	14
Tjapaltjarri, Clifford Possum	2	17
Tjapaltjarri, Mick Namarari	1	8
Total Observations (Artist × year)	34	86
Number of artists	7	
Percentage of artists	8.43	
Percentage of observations	7.85	

To account for any price segmentation in the market, we determine the observations (artists, years) that relate to the 'top end' of the market. We rank our observations by average realised sales value. The values used for this ranking are deflated using the overall consumer price index to account for general inflation. Rankings use both the mean and the median of the realised sales values in a year for the artist. We then define the top of the market to be the observations (artist, year) with the biggest realised sales values. A 'top end' observation is an observation that is in the top decile of ranked average values for both mean and median measures of realised sales value. Table 3 gives details of the top end of the market.

Seven artists (8.43%) appear in the top of the market that comprises 34 of the 433 observations (7.85%). Paddy Nyunkuny Bedford from the Kimberly region appears for all five years for which he has data. The other two artists who feature prominently

TABLE 4 | Three-stage least squares estimation results.

Gini equation	Coefficient	s.e.
Average sales value	0.0197	0.0048***
Number of works offered	−0.0005	0.0005
Coefficient of variation area (m^2)	0.0527	0.0186***
Herfindahl—categories	−0.1234	0.0445***
Herfindahl—auction houses	−0.0685	0.0348**
Female	−0.0080	0.0163
Oxford online entry	0.0542	0.0163***
Region: Desert, non-Hermannsburg		
Desert, Hermannsburg	−0.1071	0.0274***
Other regions	−0.0525	0.0237**
Western Desert	0.0611	0.0194***
Age in years (living artist)	0.0020	0.0008**
Artist deceased	0.1807	0.0548***
Years since death	−0.0015	0.0006**
Year fixed effects	Yes	
R^2	0.5513	
Chi-squared goodness of fit	517.17	
Price equation		
Average pre-sale value	1.0132	0.0253***
Top end × average pre-sale value	−0.4209	0.0545***
Top end	1.6680	0.2821***
Constant	−0.0162	0.0360
R^2	0.8823	
Chi-squared goodness of fit	3246.74	

Note: ***, ** and * denote significance at 1%, 5% and 10%, respectively.

are Emily Kame Kngwarreye from the Desert region and Rover (Julama) Thomas from the Kimberley region.

5 | Results and Discussion

We estimate our two-equation model presented above using three-stage least squares, thus allowing the Gini coefficient and the average realised sales value to be endogenous. The results of the estimation are presented in Table 4.

Our regression modelling framework does not bound the Gini coefficient, to the unit interval. As can be seen from Table 2 above our data ranges from 0.146 to 0.901 and thus lies away from the limiting values of zero and one which suggests the regression models will be appropriate. Fitted values from our estimation also lie within the unit interval which support the use of this modelling framework.

We see that an increase in the average realised sales value will increase price heterogeneity (the Gini coefficient) with an increase of $10,000 in annual realised value increasing the Gini coefficient by 0.0197. There are no significant effects of the artist supply factors (number of works offered that year). As predicted above, product concentration, as measured by the Herfindahl index for the categories the artist works in, reduces price heterogeneity. The less concentrated their works, the higher the price heterogeneity. We also see that product diversity, measured by the variability of the physical area of an artist's works, as predicted above, increases the Gini value. A similar result is found for the concentration of auction houses offering works by the artists. The more (less) concentrated the supply through auction houses, the lower (higher) the price heterogeneity for the artist. It should be noted that whilst an artist may choose to vary the sizes of their works, they do not have the ability to influence the number of auction houses offering their works for sale in the secondary (auction) market.

In terms of the artist characteristics, we see no effect of the gender of the artist. However, artist fame (an entry in Oxford Online) increases price heterogeneity. For living artists, we find a positive effect—as artists age, price heterogeneity increases. There is additionally an impact on price heterogeneity for deceased artists. Consistent with (De Silva, Kosmopoulou, Pownall, and Press 2022; Ursprung and Wiermann 2011), in the year of death the Gini coefficient increases by 0.1807 and then falls by 0.0015 each subsequent year. Finally, we find strong regional effects, which are related to artistic styles in the market. Relative to the non-Hermannsburg artist from the Desert region, the watercolourists of the Hermannsburg school and the non-Desert artists have lower levels of price heterogeneity, while those from the Western Desert have higher levels of price heterogeneity.

The second equation in our model relates realised sales value with the auction house pre-sale estimate of that value. Similar to the quantile regression of (Farrell and Fry 2017) and the finite mixture model of (Fry 2020), we see that this relationship is different for the top end of the market compared to the rest of

TABLE 5 | Instrumental variable estimation results.

	2SLS		Panel random effects	
Gini equation	**Coefficient**	**s.e.**	**Coefficient**	**s.e.**
Average sales value	0.0184	0.0049***	0.0161	0.0060***
Number of works offered	−0.0006	0.0005	−0.0003	0.0006
Coefficient of variation area (m^2)	0.0574	0.0189***	0.0536	0.0194***
Herfindahl—categories	−0.1348	0.0450***	−0.0913	0.0527*
Herfindahl—auction houses	−0.0755	0.0352**	−0.0869	0.0417**
Female	−0.0080	0.0165	−0.0167	0.0304
Oxford online entry	0.0577	0.0166***	0.0682	0.0334**
Region: Desert, non-Hermannsburg				
Desert, Hermannsburg	−0.1090	0.0277***	−0.1020	0.0512**
Other regions	−0.0500	0.0240**	−0.0569	0.0404
Western Desert	0.0592	0.0196***	0.0773	0.0380**
Age in years (living artist)	0.0022	0.0008***	0.0004	0.0012
Artist deceased	0.1888	0.0554***	0.0762	0.0804
Years since death	−0.0014	0.0006**	−0.0017	0.0011
Year fixed effects	Yes		Yes	
R^2	0.5520		0.5337	
Chi-squared goodness of fit	514.88		165.87	

***, ** and * denote significance at 1%, 5% and 10%, respectively.

the market. For the top end of the market, the pre-sale estimated value is an overestimate of the realised value, whereas for the rest of the market, it is a good estimate of the realised value, with a coefficient of one. Our model has a good overall level of fit, and the fitted values of the Gini coefficient are bounded to the unit interval, with an average of 0.460 and ranging from 0.165 to 0.813.

To assess whether our results are sensitive to the estimation procedure to account for the endogeneity of average realised price, we present the results of estimating the Gini coefficient equation using single equation techniques—two-stage least squares (2SLS) and random effects panel data instrumental variable estimation. Table 5 contains these estimation results.

The single equation estimation techniques give broadly the same results as the 3SLS estimation. Indeed, the 2SLS results (coefficients and levels of significance) are very similar to those from the 3SLS estimation. Whilst the coefficients are similar, the estimated significance levels for the panel random effects are lower than the other two estimation techniques. These results suggest that our results are not particularly sensitive to the choice of estimation technique.

Importantly, our analysis extends and corrects that of Castellani et al. (2012) by accounting for the endogeneity of average realised value (price) in the model. It controls for unobserved time effects and for the endogeneity of realised sales value (price) in modelling artist-level price heterogeneity. It has shown that average realised price (indicating quality and/or market power) matters. It has also shown that artists who diversify their products (artworks) or have a wider range of auction houses offering their works or are from different regions of Australia (segments of the market) have higher or lower levels of price concentration. Famous artists, appearing in Oxford Online, have higher levels of price heterogeneity, and the living status of an artist has an impact on price heterogeneity. For living artists, price heterogeneity increases with age. There is a strong "death effect" with price heterogeneity initially increasing and then reducing over the years after death. Conversely, there are no significant effects of the artist supply factors (number of works offered) or of the gender of the artist.

6 | Conclusions

Models of price dispersion (concentration) of artworks created by an artist and sold in a fixed period (e.g., year) complement models for individual artwork prices. Understanding how factors relating to the artist, such as gender and styles of artworks, and their work, such as how diverse their oeuvre is, provides additional insights to our overall understanding of prices in the art auction market. Using panel data for auctions containing artworks by Australian Indigenous artists, we investigated artist-level price heterogeneity. Unlike previous work (Castellani et al. 2012), we correct for the endogeneity of both the measure of price concentration (the Gini) and average realised price. We find significant impacts of product and supply diversity, regions, fame and the living status of the artist, in particular a strong death effect. Conversely, there are no significant effects of artist supply factors (number of works offered) or the gender of the artist.

In future work, it would be interesting to see if similar results are obtained for other artists and markets. For Australian Indigenous artists, the geographic region is associated with particular 'broad styles' of art, and we see different levels of price heterogeneity by region. For other artists, say Surrealists, it may be possible for an artist to specialise (or diversify) their style whilst still being a member of the broad school. Such diversification within a school may yield similar results on artist-level price heterogeneity. Moreover, as artist price heterogeneity is associated with product diversity, other avenues for future work would be to investigate the impact of artwork colour on heterogeneity and whether diversifying their oeuvre is a viable strategy for artists who are early rather than established in their career and how that might ultimately relate to fame and changes in reputation. Similarly, what strategy should investors follow? Is the best strategy to balance a portfolio between artists with high and low levels of price heterogeneity? Finally, we find that market structure plays a role in determining price heterogeneity for artists. A relatively large number of auction houses sell works by Indigenous artists; the auction market is both highly concentrated and segmented. Again, an investigation of the relationship between market structure and artist price heterogeneity in other markets, both art markets and other markets with differentiated products, would be required to understand if this is specific to this market or more general.

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Ethics Statement

The author has nothing to report.

Conflicts of Interest

The author declares no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from Australian Art Sales Digest. Restrictions apply to the availability of these data, which were used under license for this study. Data are available from the author(s) with the permission of Australian Art Sales Digest.

References

Aboriginal Arts and Crafts Industry Review Committee. 1989. *The Aboriginal Arts and Crafts Industry: Report of the Review Committee, July 1989*. Australian Govt. Pub. Service.

Agnello, R. J. 2016. "Do U.S. Paintings Follow the CAPM? Findings Disaggregated by Subject, Artist, and Value of the Work." *Research in Economics* 70, no. 3: 403–411. https://doi.org/10.1016/j.rie.2016.06.002.

Angelini, F., and M. Castellani. 2019. "Cultural and Economic Value: A Critical Review." *Journal of Cultural Economics* 43, no. 2: 173–188. https://doi.org/10.1007/s10824-018-9334-4.

Angelini, F., and M. Castellani. 2021. "Art Market Stakeholders' Actions and Strategies for the Co-Creation of Artists' Brands." In *Researching*

art Markets: Past, Present and Tools for the Future, edited by E. Lazzaro, N. Moureau, and A. Turpin, 75–85. Taylor and Francis Group.

Angelini, F., M. Castellani, and P. Pattitoni. 2019. "Artist Names as Human Brands: Brand Strategies in the Italian Gallery Art Market." https://ssrn.com/abstract=3495474.

Artlandish. 2019. "Styles of Aboriginal Art." Artlandish Aboriginal Art Gallery. https://www.aboriginal-art-australia.com/aboriginal-art-library/aboriginal-art-styles/.

Bauwens, L., and V. Ginsburgh. 2000. "Art Auctions and Experts: Are Pre-Sale Estimates Unbiased and Fully Informative?" *Recherches Economiques Louvain* 66, no. 2: 131–144. https://doi.org/10.1017/s0770451800083834.

Beckert, J. 2020. "Markets From Meaning: Quality Uncertainty and the Intersubjective Construction of Value." *Cambridge Journal of Economics* 44, no. 2: 285–301. https://doi.org/10.1093/cje/bez035.

Beckert, J., and J. Rossel. 2013. "The Price of Art. Uncertainty and Reputation in the Art Field." *European Societies* 15, no. 2: 178–195. https://doi.org/10.1080/14616696.2013.767923.

Belk, R. W. 1995. *Collecting in a Consumer Society*. Routledge.

Black, H. 2017. "Seven Important Things to Know About Artist Signatures." Christies Auction House. https://www.christies.com/features/7-things-to-know-about-artist-signatures-8365-1.aspx.

Blau, J. R., P. M. Blau, and R. M. Golden. 1985. "Social Inequality and the Arts." *American Journal of Sociology* 91, no. 2: 309–331. https://doi.org/10.1086/228279.

Bocart, F., and K. Oosterlinck. 2011. "Discoveries of Fakes: Their Impact on the Art Market." *Economics Letters* 113, no. 2: 124–126. https://doi.org/10.1016/j.econlet.2011.06.013.

Bocart, F. Y. R. P., M. Gertsberg, and R. A. J. Pownall. 2021. "An Empirical Analysis of Price Differences for Male and Female Artists in the Global Art Market." *Journal of Cultural Economics* 46, no. 3: 543–565. https://doi.org/10.1007/s10824-020-09403-2.

Buchbinder, K. H. 2014. "Picking Picassos: Differentiating Artists by Gini Ratio as a Measure of Brand and Innovative Style [Senior Thesis, Princeton University]." http://arks.princeton.edu/ark:/88435/dsp016w924b973.

Candela, G., M. Castellani, P. Pattitoni, and F. M. L. Di Lascio. 2016. "On Rosen's and Adler's Hypotheses in the Modern and Contemporary Visual Art Market." *Empirical Economics* 51, no. 1: 415–437. https://doi.org/10.1007/s00181-015-1002-3.

Castellani, M., P. Pattitoni, and A. E. Scorcu. 2012. "Visual Artist Price Heterogeneity." *Economics and Business Letters* 1, no. 3: 16–22. https://doi.org/10.17811/ebl.1.3.2012.16-22.

Cellini, R., and T. Cuccia. 2014. "The Artist–Art Dealer Relationship as a Marketing Channel." *Research in Economics* 68, no. 1: 57–69. https://doi.org/10.1016/j.rie.2013.12.003.

Cleeremans, A., V. Ginsburgh, O. Klein, and A. Noury. 2015. "What's in a Name? The Effect of an Artist's Name on Aesthetic Judgements." *Empirical Studies of the Arts* 34, no. 1: 126–139. https://doi.org/10.1177/0276237415621197.

Codignola, F. 2003. "The Art Market, Global Economy and Information Transparency." *SYMPHONYA Emerging Issues in Management* 2: 73–93. https://doi.org/10.4468/2003.2.07codignola.

Coslor, E. 2016. "Transparency in an Opaque Market: Evaluative Frictions Between "Thick" Valuation and "Thin" Price Data in the Art Market." *Accounting, Organizations and Society* 50: 13–26. https://doi.org/10.1016/j.aos.2016.03.001.

Coslor, E., and T. R. L. Fry. 2024. "Misattribution Stigma and Contagion: How Did the Art Auction Market React to Australian 'Black Art Scandals'?" *Journal of Cultural Economics*: 1–32. https://doi.org/10.1007/s10824-024-09526-w.

Crane, D. 2009. "Reflections on the Global Art Market: Implications for the Sociology of Culture." *Sociedade E Estado* 24, no. 2: 331–362. https://d10.1590/s0102-69922009000200002.

Czujack, C., and M. F. Martins. 2004. "Do Art Specialists Form Unbiased Pre-Sale Estimates? An Application for Picasso Paintings." *Applied Economics Letters* 11, no. 4: 245–249. https://doi.org/10.1080/1350485041000167489 4.

De Silva, D. G., M. Gertsberg, G. Kosmopoulou, and R. A. J. Pownall. 2022. "Evolution of a Dealer Trading Network and Its Effects on Art Auction Prices." *European Economic Review* 144: 104083. https://doi.org/10.1016/j.euroecorev.2022.104083.

De Silva, D. G., G. Kosmopoulou, R. A. J. Pownall, and R. Press. 2022. "Posthumous Trading Patterns Affecting Artwork Prices." *Oxford Economic Papers* 74, no. 2: 453–472. https://doi.org/10.1093/oep/gpab024.

Deltas, G. 2003. "The Small-Sample Bias of the Gini Coefficient: Results and Implications for Empirical Research." *Review of Economics and Statistics* 85, no. 1: 226–234. https://doi.org/10.1162/rest.2003.85.1.226.

Eckard, E. W., and M. A. Smith. 2012. "The Revenue Gains From Multi-Tier Ticket Pricing: Evidence From Pop Music Concerts." *Managerial and Decision Economics* 33, no. 7–8: 463–473. https://doi.org/10.1002/mde.2549.

Ekelund, R. B., J. D. Jackson, and R. D. Tollison. 2013. "Are Art Auction Estimates Biased?" *Southern Economic Journal* 80, no. 2: 454–465. https://doi.org/10.4284/0038-4038-2012.087.

Ekelund, R. B., R. W. Ressler, and J. K. Watson. 2000. "The 'Death-Effect' in Art Prices: A Demand-Side Exploration." *Journal of Cultural Economics* 24, no. 4: 283–300. https://doi.org/10.1023/A:1007618221648.

Farrell, L., J. M. Fry, and T. R. L. Fry. 2018. "Determinants of Sales and Price at Auction for Three Australian Indigenous Artists." *Journal of Cultural Economics* 42, no. 3: 507–520.

Farrell, L., J. M. Fry, and T. R. L. Fry. 2021. "Gender Differences in Hammer Prices for Australian Indigenous Art." *Journal of Cultural Economics* 45: 1–12. https://doi.org/10.1007/s10824-020-09382-4.

Farrell, L., and T. R. L. Fry. 2017. "Pre-Sale Information and Hammer Prices for Australian Indigenous Artists." *Scottish Journal of Political Economy* 64, no. 2: 483–500. https://doi.org/10.1111/sjpe.12136.

Fedderke, J. W., and K. Li. 2020. "Art in Africa: Hedonic Price Analysis of the South African Fine Art Auction Market, 2009–2014." *Economic Modelling* 84: 88–101. https://doi.org/10.1016/j.econmod.2019.03.011.

Ferreiro-Rosende, É., L. Fuentes-Moraleda, and N. Morere-Molinero. 2021. "Artists Brands and Museums: Understanding Brand Identity." *Museum Management and Curatorship* 38, no. 2: 1–18. https://doi.org/10.1080/09647775.2021.1914143.

Forster, J., and H. Higgs. 2018. "Artwork Characteristics and Prices in the New Zealand Secondary Art Market, 1998-2014." *New Zealand Economic Papers* 52, no. 3: 150–169. https://doi.org/10.1080/00779954.2016.1254674.

Fry, T. R. L. 2020. "Heterogeneity in Auction Price Distributions for Australian Indigenous Artists." *Economic Record* 96: 177–186. https://doi.org/10.1111/1475-4932.12535.

Furphy, J. 2021. "Australian Art Sales Digest." http://www.aasd.com.au.

Galenson, D. W. 2002. "Quantifying Artistic Success: Ranking French Painters—And Paintings—From Impressionism to Cubism." *Historical Methods: A Journal of Quantitative and Interdisciplinary History* 35, no. 1: 5–19. https://doi.org/10.1080/01615440209603140.

Gandini, A. 2016. "Digital Work: Self-Branding and Social Capital in the Freelance Knowledge Economy." *Marketing Theory* 16, no. 1: 123–141. https://doi.org/10.1177/1470593115607942.

Gini, C. 1921. "Measurement of Inequality of Incomes." *Economic Journal* 31, no. 121: 124–126. https://doi.org/10.2307/2223319.

Ginsburgh, V., and S. Weyers. 2014. "Evaluating Excellence in the Arts." In *The Wiley Handbook of Genius*, edited by D. K. Simonton, 511–532. John Wiley and Sons.

Goetzmann, W. N., P. W. Jones, M. Maggioni, and J. Walden. 2016. "Beauty Is in the Bid of the Beholder: An Empirical Basis for Style." *Research in Economics* 70, no. 3: 388–402. https://doi.org/10.1016/j.rie.2016.05.004.

Hawkins, J. R., and V. Saini. 2016. "Returns on Indian Art During 2000-2013." *Eastern Economic Journal* 42, no. 2: 302–310. https://doi.org/10.1057/eej.2015.39.

Herfindahl, O. 1950. "Concentration in the US Steel Industry." [Dissertation]. Columbia University.

Hernando, E., and S. Campo. 2017a. "An Artist's Perceived Value: Development of a Measurement Scale." *International Journal of Arts Management* 19, no. 3: 33–47.

Hernando, E., and S. Campo. 2017b. "Does the Artist's Name Influence the Perceived Value of an Art Work?" *International Journal of Arts Management* 19, no. 2: 46–58.

Hirschman, A. 1964. "The Paternity of an Index." *American Economic Review* 54, no. 5: 761–762.

Hodgson, D. J., and C. Hellmanzik. 2019. "Relationships Between Artistic Movements and Careers of Modern Artists: Evidence From Hedonic Regressions With Auction Data." *Journal of Cultural Economics* 43, no. 2: 309–337. https://doi.org/10.1007/s10824-019-09343-6.

Johanson, K., B. Coate, C. Vincent, and H. Glow. 2022. "Is There a 'Venice Effect'? Participation in the Venice Biennale and the Implications for Artists' Careers." *Poetics* 92: 101619. https://doi.org/10.1016/j.poetic.2021.101619.

Lazzaro, E. 2006. "Assessing Quality in Cultural Goods: The Hedonic Value of Originality in Rembrandt's Prints." *Journal of Cultural Economics* 30: 15–40. https://doi.org/10.1007/s10824-005-1918-0.

LeBlanc, A., and S. Sheppard. 2021. "Women Artists: Gender, Ethnicity, Origin and Contemporary Prices." *Journal of Cultural Economics* 46, no. 3: 439–481. https://doi.org/10.1007/s10824-021-09431-6.

Leifer, E. M., and H. C. White. 2004. "A Structural Approach to Markets." In *The New Economic Sociology: A Reader*, edited by F. Dobbin. Princeton University Press.

McKenzie, J. 2010. "How Do Theatrical Box Office Revenues Affect DVD Retail Sales? Australian Empirical Evidence." *Journal of Cultural Economics* 34, no. 3: 159–179. https://doi.org/10.1007/s10824-010-9119-x.

McKenzie, J., and V. Smirnov. 2018. "Blockbusters and Market Expansion: Evidence From the Motion Picture Industry." *Journal of Cultural Economics* 42, no. 2: 341–352. https://doi.org/10.1007/s10824-017-9308-y.

Muñiz, A. M., Jr., G. Norris, and A. Fine. 2014. "Marketing Artistic Careers: Pablo Picasso as Brand Manager." *European Journal of Marketing* 48, no. 1/2: 68–88. https://doi.org/10.1108/ejm-01-2011-0019.

Myers, F. R. 2002. *Painting Culture: The Making of an Aboriginal High Art*. Duke University Press.

Newman, G. E., and R. K. Smith. 2019. "Artworks Are Evaluated as Extensions of Their Creators." In *Advances in Experimental Philosophy of Aesthetics*, edited by F. Cova and S. Réhault, 1st ed., 103–120. Bloomsbury Academic.

Oosterlinck, K., and A.-S. V. E. Radermecker. 2019. "'The Master of …': Creating Names for Art History and the Art Market." *Journal of Cultural Economics* 43, no. 1: 57–95. https://doi.org/10.1007/s10824-018-9329-1.

Pénet, P., and K. Lee. 2014. "Prize and Price: The Turner Prize as a Valuation Device in the Contemporary Art Market." *Poetics* 43: 149–171. https://doi.org/10.1016/j.poetic.2014.01.003.

Peters, J., and H. Roose. 2022. "The Matthew Effect in Art Funding. How Reputation Affects an Artist's Chances of Receiving Government Support." *Poetics* 92, no. A: 101578. https://doi.org/10.1016/j.poetic.2021.101578.

Petrides, L., and A. Fernandes. 2020. "The Successful Visual Artist: The Building Blocks of Artistic Careers Model." *Journal of Arts Management, Law, and Society* 50, no. 6: 305–318. https://doi.org/10.1080/10632921.2020.1845892.

Piano, E. E. 2021. "Specialization and the Firm in Renaissance Italian Art." *Journal of Cultural Economics* 46, no. 4: 659–697. https://doi.org/10.1007/s10824-021-09434-3.

Piano, E. E., and R. Al-Bawwab. 2021. "The Artist as Entrepreneur." *Review of Austrian Economics* 36, no. 1: 23–41. https://doi.org/10.1007/s11138-021-00547-8.

Prieto-Rodriguez, J., and M. Vecco. 2021. "Reading Between the Lines in the Art Market: Lack of Transparency and Price Heterogeneity as an Indicator of Multiple Equilibria." *Economic Modelling* 102: 105587. https://doi.org/10.1016/j.econmod.2021.105587.

Prinz, A. L. 2022. "The Concentration of Power in the Market for Contemporary Art: An Empirical Analysis of ArtReview's "Power 100"." *SN Business and Economics* 2, no. 1: 11. https://doi.org/10.1007/s43546-021-00182-2.

Radermecker, A.-S. V. E. 2019. "Artworks Without Names: An Insight Into the Market for Anonymous Paintings." *Journal of Cultural Economics* 43, no. 3: 443–483. https://doi.org/10.1007/s10824-019-09344-5.

Radermecker, A.-S. V. E. 2020. "Buy One Painting, Get Two Names. On the Valuation of Artist Collaborations in the Art Market." *Arts and the Market* 10, no. 2: 99–121. https://doi.org/10.1108/aam-10-2019-0030.

Radermecker, A.-S. V. E. 2021. *Anonymous Art at Auction. The Reception of Early Flemish Paintings in the Western Art Market (1946–2015)*. Koninklijke Brill NV.

Rodenbeck, J., and V. C. Olivier. 2021. "Oxford Art Online." Oxford University Press. https://www.oxfordartonline.com/.

Scorcu, A. E., L. Vici, and R. Zanola. 2021. "To Fake or Not to Fake: An Empirical Investigation on the Fine Art Market." *Journal of Cultural Economics* 45, no. 1: 143–152. https://doi.org/10.1007/s10824-020-09394-0.

Smith, T. 2008. "Creating Value Between Cultures: Contemporary Australian Aboriginal Art." In *Beyond Price: Value in Culture, Economics, and the Arts*, edited by M. Hutter and D. Throsby, 23–40. Cambridge University Press.

Stuart, A., and J. K. Ord. 1987. "Distribution Theory." In *Kendall's Advanced Theory of Statistics*, vol. 1, 5th ed. Charles Griffin and Company Ltd.

Thompson, D. 2010. *The $12 Million Stuffed Shark: The Curious Economics of Contemporary Art*. Palgrave Macmillan.

Throsby, D. 1994. "The Production and Consumption of the Arts: A View of Cultural Economics." *Journal of Economic Literature* 32, no. 1: 1–29.

Urrutiaguer, D. 2005. "French Decentralisation of the Performing Arts and Regional Economic Disparities." *Journal of Cultural Economics* 29, no. 4: 299–312. https://doi.org/10.1007/s10824-005-0491-x.

Ursprung, H. W., and C. Wiermann. 2011. "Reputation, Price and Death: An Empirical Analysis of Art Price Formation." *Economic Inquiry* 49, no. 3: 697–715. https://doi.org/10.1111/j.1465-7295.2009.00279.x.

Velthuis, O. 2012. "The Contemporary Art Market Between Stasis and Flux." In *Contemporary Art and Its Commercial Markets. A Report on Current Conditions and Future Scenarios*, edited by M. Lind and O. Velthuis, 17–52. Sternberg Press.

Vermeylen, F., M. Van Dijck, and V. De Laet. 2013. "The Test of Time: Art Encyclopedias and the Formation of the Canon of 17th-Century Painters in the Low Countries." *Empirical Studies of the Arts* 31, no. 1: 81–105. https://doi.org/10.2190/em.31.1.e.

Zhou, Y. 2017. "Narcissism and the Art Market Performance." *European Journal of Finance* 23, no. 13: 1197–1218. https://doi.org/10.1080/1351847x.2016.1151804.