



Evaluating the impact of the global COVID-19 pandemic on Banksy's limited edition print market

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Abstract

The global COVID-19 pandemic profoundly impacted almost all aspects of people's lives. Economic disruptions were felt across various sectors, including the art market. This study analyses the market for the renowned niche street artist, Banksy, specifically focusing on his limited-edition prints. By examining auction price data, the aim is to identify whether a pandemic-induced bubble inflated the prices of these prints. Employing a random effects model, variations in the bubble's extent across different print images are estimated. The findings provide evidence of a link between high print prices and the pandemic, further suggesting the presence of a bubble in this market. This bubble peaked in the second half of 2020 but had largely receded by mid-2023, with prices returning to roughly expected pre-pandemic levels. As hypothesised, certain print images, notably 'Love is in the Air', experienced more pronounced inflation compared to others.

Keywords Street art · Banksy · Hedonic regression · Bubble · COVID-19

Introduction

The outbreak of the COVID-19 pandemic in early 2020 was the start of a series of events that had not been witnessed in modern history, causing a shock to global society. It had a profound effect on many aspects of life, including health (Coyle 2022; Pilbeam et al. 2022), employment (Deole et al. 2021; Mayhew and Anand 2020), education (Bayrakdar and Guveli 2020; Nixon et al. 2021), travel (Harrington and Hadjiconstantinou 2022; Seyfi et al. 2020) and leisure (Bryson et al. 2020; Probert and Pywell 2021). Governments were faced with challenges on how to best manage the pandemic, whilst struggling to find some way to return to a potential new normal (Shafi and Mallinson 2022).

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The pandemic also impacted the cultural economy, disrupting how people experienced culture through cinemas (Chatterjee 2022), the performing arts (Brooks and Patel 2022), and even influencing their choice of medium (Bakhshi et al. 2022). The art market, in particular, faced the need for rapid adaptation (Buchholz et al. 2020; Radermecker 2020; Sidorova 2022). Art museums initiated digitisation projects, offering virtual tours of their collections (Noehrer et al. 2021). Galleries shifted to online catalogues and sales (Habelsberger and Bhansing 2021), while auction houses rescheduled or embraced online-only auctions (Bourron 2021).

Given these adaptations, it was possible to conduct business in the art market during the pandemic, and there is considerable interest in how the art market performed, in a financial sense (Citi 2020; Wang 2021), relative to other markets such as stocks or gold (Akhtaruzzaman et al. 2021). There were many reports of how resilient and attractive the art market was during the initial stages of the pandemic (Evlanova 2022), particularly the contemporary art market (Sulley 2022). However, there is evidence that the attractiveness of this market has diminished (Citi 2022), and that there may have been a pandemic induced ‘pricing bubble’ in this market (Carraro 2021).

This article examines if there is an association between the auction price of prints by the street artist Banksy (Ellsworth-Jones 2013; Gough 2012) and the period of the COVID-19 pandemic (Stewart 2020). If there was such an association, what was its profile and could it be considered an asset bubble (Brunnermeier 2016)? Also, which of his works were most impacted during this time? The next section of this article introduces the genre of graffiti art (or as it is alternatively termed, ‘street and urban art’), with latterly an emphasis on the artist Banksy. This section also includes some discussions on the operation of the art auction market, models that are used to understand this market, and the features and identification of pricing bubbles. Section three introduces the source and characteristics of the data and the methods used in the analysis. The aim of the model is to investigate the factors that influence the value of the Banksy print market and, after controlling for these, estimate a separate COVID-19 effect. The model has no predictive capability. The results are described in section four and the article finishes with a discussion of these findings and ways in which the analysis may be improved and taken forward.

Background

This section sets two distinct contexts for this study; street and urban art as a genre, and the science of estimation.

The art

Street art is a form of visual art that covers art created in public locations, including unsanctioned artwork and graffiti (Bacharach 2015). This artistic movement emerged in the 1960s and 1970s in urban areas like New York City, drawn to its abundance of vacant buildings, closed factories, and construction sites—privately

owned spaces offering public visibility (Visconti et al. 2010). Some of the earliest expressions of street art were the graffiti that started showing up on the sides of train cars and walls, transforming those surfaces into canvases for a generation of young creatives (Green 2014). Today, street art has blossomed into one of the world's largest art movements, and is distinct from its graffiti roots (Türe and Türe 2021). Its immense popularity continues to propel its growth and evolution (Molnár, 2018).

This article is concerned with perhaps the most famous street artist in the world, Banksy. Banksy is an anonymous British street artist and activist. What little is known about his early life identifies him as been born in Bristol, England, around 1974. Banksy began his career as a freehand graffiti artist in the early 1990s, but started using stencils in 2000 to enhance his speed of execution. Information on the location of these stencils has been used by Hauge et al., (2016) to hypothesise the identity of the artist, with some controversy (Bengtson 2016). Banksy's artwork is characterised by striking images, often combined with slogans, and his work engages with cultural and political themes, satirically critiquing wars, capitalism, hypocrisy, and greed. Whilst this all may sound challenging, his works also combines dark humour with messages about art, philosophy and politics (Banksy Explained 2023).

Away from the street, Banksy's works have appeared both as originals and limited edition prints. The originals are one off paintings or prints produced in very small numbers and sold through galleries and high end auction houses. For example during the pandemic a 'superhero nurse' print was produced by Banksy and auctioned for £16.7 m in aid of UK health charities (Brown 2021). There are also the more mass market signed and unsigned limited edition prints which were produced in editions sizes ranging from 10s to 1000s (Gonçalves and Milani 2022; Mouate et al. 2023). These were primarily sold through either the 'Pictures on Walls (POW)' web site or through the organisation that now handles Banksy affairs, 'Pest Control' (PC) (Pest Control 2023a). According to the Banksy Explained web site (2023) there have been 49 such prints, with 29.5 k copies, of which 9.9 k were signed by Banksy, 16.4 k unsigned and the rest being either Artists Proofs (APs) or colour variations. These 'mass-market' prints are the focus of this study. Their popularity has resonated with fans drawn to Banksy's social critiques, and also with investors, as pre-pandemic, his prints consistently held or saw healthy growth in value (Stewart 2023). These editions of 750 or more copies would typically sell out within minutes of release.

The science

While art serves to inspire beauty and admiration, certain artists and movements spark a collector's desire to own a piece of their work, often at extravagant prices (Anderson 1974). Investing in art offers unique benefits absent in traditional asset classes like bonds, stocks, or real estate, since beyond any financial appreciation, owning art allows immediate enjoyment (Maddox Gallery 2022). However, unlike property rents or stock dividends, art rarely generates income directly. From a financial standpoint, then, the value of art lies solely in its potential appreciation

(Zhukova et al. 2020). Understanding how the artwork's attributes influence this appreciation has motivated numerous studies (Li et al. 2022; Renneboog and Spaenjers 2013).

Price modelling

Two main techniques are used to measure an artwork's appreciation, repeat sales and hedonic regression (Galbraith and Hodgson 2018; Wang and Zheng 2018). Repeat sales link specific artworks over time, building an index from price differences and time intervals between successive sales of the work. This method accurately reflects value changes, but suffers from potential selection bias, small sample sizes, and a significant research effort (Garay et al. 2022). Hedonic regression offers an alternative. Here the price (or more commonly log price) of an item is related to its various attributes (Rosen 1974). Whilst most often applied in the property and labour markets (Guignet and Lee 2021), the technique has also been widely used to model diverse art markets (Li et al. 2022). These have covered both specific genres, including modern art (Hodgson and Hellmanzik 2019), abstract art (Sproule and Valsan 2006), and fine art (Hodgson and Hellmanzik 2019) and various markets, such as Italy (Marinelli and Palomba 2011), Poland (Witkowska 2014), Australia (Worthington and Higgs 2006) and the Netherlands (Rengers and Velthuis 2002).

Pricing bubbles

Markets where valuations are difficult to establish and susceptible to sentiment or speculation are prone to developing bubbles (Scherbina and Schlusche 2014). Such bubbles are observed in markets as diverse as the property market (Black et al. 2006; Glaeser et al. 2008), financial markets (Vogel 2018) and collectables (Bissonnette 2015; Citi 2022, Chapter 2; Zakonnik et al. 2022). Ackert and Deaves (2009, p. 244) define a bubble “... to exist when high prices seem to be generated more by traders' enthusiasm than by economic fundamentals. Notice that a bubble must be defined *ex-post*—at some point the bubble bursts and prices adjust downwards, sometimes very quickly”⁴. There are five stages to a bubble according to Aliber et al., (2015, pp. 38–43):

- i. Expectations. A change occurs in the economic system and this creates an expectation of growth in a particular asset or class of asset. In particular there is an assumption/expectation that the asset's value will be a one-way bet in the near to medium term;
- ii. Boom. Following on from this expectation the price of the asset begins to increase. Investors keen to see a return on their funds begin to invest in the asset. If the supply of the asset is restricted or limited, then as demand increases the prices rise quicker;
- iii. Euphoria. The existence of the boom stage creates interest in the asset and begins to attract speculators into the market who may have little understanding of the fundamentals of the market for the asset. Individuals who own the assets are tempted to sell at the high prices;

- iv. Profit-taking. At this stage the early investors in the asset see the profits that have been generated and start to sell the asset to realise these profits or repay any loans taken to purchase the asset. The market still contains active buyers at this point;
- v. Panic. The late investors and speculators see prices either no longer rising or actually falling and start to sell. Buyers are in short supply and require discounts from sellers. This is where the bubble either deflates or, more dramatically, bursts.

While price increases often signal bubbles, Kräussl et al. (2016) and Pénasse and Renneboog (2021) note rising trading volume as another indicator, with individuals keen to realise any perceived increase in value from their holdings.

Data and methods

This study uses data obtained from the owner of banksy-value.com, a web site which has tracked the auction sale price of Banksy art works since 2006 (Banksy Value 2023). The information available is listed below along with the attribute name used in Eq. (1):

- The realised price at auction (p). This includes the buyer's fee, any Value Added Tax (VAT) and Artists Resale Rights fees due. For non-UK sales, this price is converted into pounds Sterling using the contemporary exchange rate;
- The title of the image and its variant (i). There are 50 Banksy print images used in this study. Variants include colourways, where a dominant colour in the image is substituted for another;
- The date of the sale (T). This is rounded to the month of the sale;
- Whether it is unsigned/signed/AP (S). Signed images are considered to be more valuable than unsigned images since they have been handled by Banksy, and each signature is unique. APs are more valuable still, typically they are prints outside of the edition and are gifted by Banksy;
- The stated condition of the print, if provided (C). The auction listing does not always specify the condition of the print (Not specified), although potential buyers can request a condition report from the auction house. Sometimes the listing will explicitly include the statement 'Not examined'. When grades are used they are: Excelled, Good, Poor or Damaged.;
- The location of the sale (L). This is the location of the auction house. In Fig. 1 below it is seen that the majority of the sales take place in the 'Anglosphere' of the UK or North America;
- The auction house conducting the sale (A). Each auction house has a reputation within the sector. This is conferred by historic precedence and the backing that it is able to provide to an auction, through a marketing campaign or access to a mailing list of potential buyers;

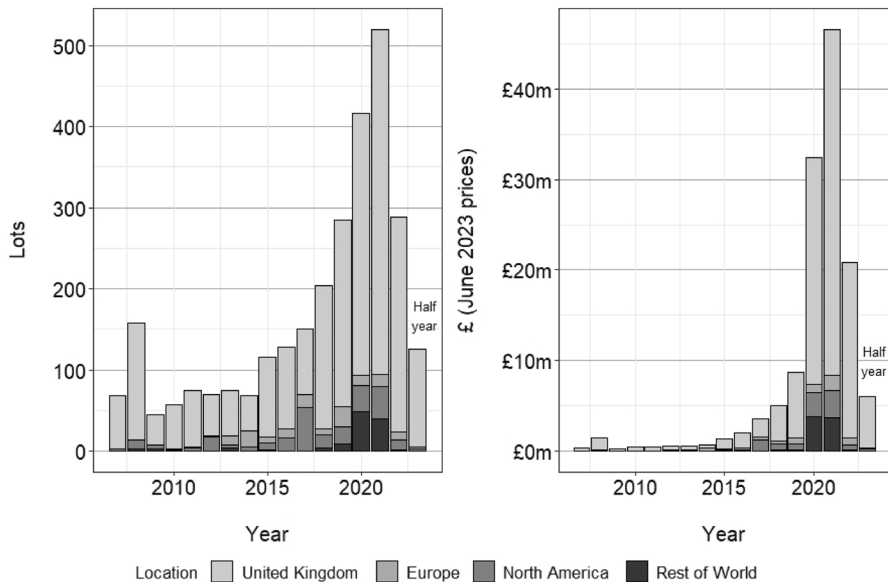


Fig. 1 Number of auction lots (lhs) and value of sales (rhs) over time

- The size of the edition for the image variant (E). The smaller the edition, the rarer the print is, and the more exclusive the print is the greater is its perceived value. Typically each image is released in separate signed and unsigned editions, with the signed editions been smaller in number.
- Based on the auction description, whether a certificate of authenticity (CoA) issued by Pest Control is mentioned (Pest Control 2023b) (PC). CoAs were initially offered by Pest Control starting in late 2009;
- Eight COVID-19 half-year 0/1 indicator attributes (C19). The first attribute covers the last pre-COVID-19 half year, July 2019 to December 2019 (Quarters 3 and 4). Thereafter each half year is represented by its own attribute, until January 2023 to June 2023 (Quarters 1 and 2). These attributes estimate any COVID-19 impact not accounted for by the other attributes.

There cannot be any CoA's for auctions conducted before 2010 and for this reason, pre-2010 auctions are excluded from this analysis. Starting with 2884 lots in this database, 2610 remain after excluding those auctioned before 2010. Thirty prints are excluded that have a condition of Damaged (this will be discussed later), and a further 3 for data quality issues, leaving 2577 auction results for analysis. The number of lots and the total value of these lots over time by the location of the sale are shown in Fig. 1 (with pre 2010 data retained for context).

In 2020, there was a distinct upswing in both auction activity and the value of Banksy works. As prices rose, owners of prints were enticed to offer them for sale. More recently the number of lots looks to have returned to their immediate pre-pandemic levels.

To assess the association between print sale prices and various attributes, this study employs a random effects model. This model allows the intercept and COVID-19 terms to vary across different print images, providing insights into the potential bubble's impact on each print image (Rengers and Velthuis 2002). Due to the skewed nature of price distributions, a generalised linear model, either Poisson or negative binomial, is usually considered suitable for analysis of these types of data (Hilbe 2011). To accommodate potential over-dispersion within the data, of these two options, the negative binomial formulation is selected. The regression equation is as follows:

$$p = \exp(\alpha_{[i]} + \beta_1 S + \beta_2 C + \beta_3 PC + \beta_4 E + \beta_5 L + \beta_6 A + \beta_7 T + \beta_{8[i]} C19) \quad (1)$$

where p is the price in £ Stirling paid by the buyer, converted to June 2023 prices using the UK Consumer Price Index. S is whether the print is Unsigned, Signed or an Artist Proof. C is the condition of the print: Excellent; Good; Poor; Not examined or Not specified. PC is whether the existence on a Pest Control CoA is mentioned: Yes or No. E is the size of the edition, normally ranging from 6 to 1000, but here scaled to lie between 0 and 1. L is the location of the sale: United Kingdom; (continental) Europe; North America or Rest of the World. A is the auction house, one of Sotheby's; Barnebys; Bonhams; Christie's; Phillips; Tate Ward; Forum Auctions; Live Auctioneers or Other. T is a time attribute counting the month of sale since January, 2010 but here scaled to lie between 0 and 1. $C19$ are a series of eight COVID-19 dummies, each marking a half year between quarters 3 and 4, 2019 and quarters 1 and 2, 2023. $\alpha_{[i]}$ is the random intercept on image i . $\beta_1 \dots \beta_7$ are fixed-effect parameter estimates. $\beta_{8[i]}$ are the random effects of the eight COVID-19 dummy on image i .

The model parameters are estimated using a Bayesian Regression Modelling framework provided in the R package brms (Bürkner 2017). The model is estimated using 4 chains of 12,000 iterations, each with a warm up of 6000 iterations and a thinning of 3 iterations.

Results

To provide an initial overall perspective on the dynamics of the value of Banksy prints, a monthly index termed the Banksy Print Index (BPI) is available on the Banksy Value web site (2023). It is calculated as "... a blended index based on realized auction prices of all Banksy prints (Signed and Unsigned prints are included; unique and Artist Proof prints are excluded). The impact of each print on the index is weighted by its relative value." This index is reproduced in Fig. 2. To provide context, a simple exponential regression model is fitted using data exclusively from January 2010 to December 2019, employing time as the sole explanatory variable. This model captures the BPIs trend just before the pandemic's onset and has been extrapolated to June 2023 to provide further insight.

The simple model accurately reflects the data until late 2018, when a slight upward shift in the BPI emerges. This is itself a noteworthy finding, that even before the pandemic the rises in Banksy price are modelled well by an exponential

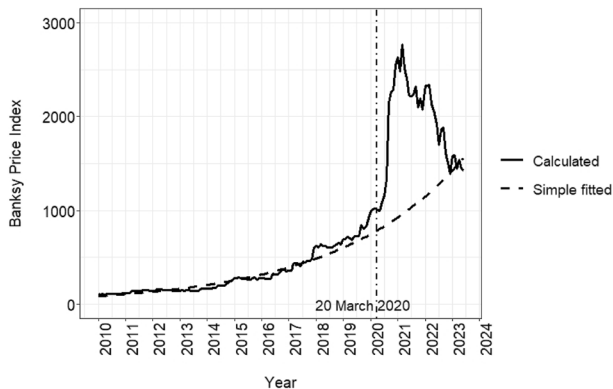


Fig. 2 The calculated values of the Banksy Price Index and a simple model fitted using time

model! This perception becomes relevant when considering COVID-19—as Pénasse and Renneboog (2021) hypothesise that ‘... *extrapolative beliefs fuel speculation*’, potentially contributing to bubbles.

A divergence between this simple model and the BPI starts to occur in mid-2020, and persists until early 2023 when the two series come back into sync. An Augmented Dickey-Fuller test confirms this pattern, yielding a statistic of -2.1644 with a lag order of 5 (p -value = 0.5078). This suggests the null hypothesis of non-stationarity cannot be rejected, providing *prima facie* evidence for a possible bubble formation in this market from 2020 to late 2022.

Leaving the BPI now and returning to the individual auction results, the estimates of the fixed effects in the Bayesian random effects model are shown in Table 1, along with counts for the categorical attributes and ranges for the continuous attributes. The Bayesian R^2 value for this model is high at 0.8927 (Gelman et al. 2019), and the largest \hat{R} is 1.0023, which is below the 1.01 rule of thumb threshold used to indicate poor convergence between the chains.

Whilst it is the pandemic dummies that are the main interest for this study, it is worth examining the associations of the non-pandemic estimates for their signs and magnitude. Signed prints command higher prices than unsigned ones, with artist proofs fetching the most, which accords with prior beliefs. Compared to prints in Excellent condition, all others sell for less, though not significantly. The price reduction for prints with a Not Specified condition is the least of all the categories—that this should be a smaller reduction than prints in a Good condition is unexpected. Also surprisingly, prints with certificates of authenticity (CoAs) perform slightly worse than those without a certificate, though not significantly so. It may be the case that some authenticity as to the print being genuine is implied by including the print for sale by a reputable auction house, and a CoA provides little extra value. Sotheby’s outperforms other auction houses, while the other top-tier houses of Christie’s and Phillips fall midway on the scale, somewhat lower than Sotheby’s performance. Sale location shows no significant difference between the UK and the rest of the world, but North

Table 1 Fixed effect estimates from the Bayesian random effects model

Attribute	N	Estimate	Error of Estimate	Estimate/Error	e ^{Estimate}	
S	Constant	2577	8.4115	0.0940	89.48	
	Unsigned	1360				
	Signed	1115	0.6597	0.0217	30.40	193.4
C	Artists Proof	102	0.9053	0.0416	21.76	247.3
	Excellent	154				
	Good	239	- 0.0230	0.0338	- 0.68	97.7
	Poor	133	- 0.0649	- 0.0649	1.00	93.7
	Not examined	70	- 0.0851	0.0486	- 1.75	91.8
PC	Not specified	1981	- 0.0084	0.0326	- 0.26	99.2
	CoA mentioned	2033				
A	No CoA mentioned	544	0.0172	0.0194	0.89	101.7
	Sotheby's	329				
	Other	223	- 0.0247	0.0356	- 0.69	97.6
	Forum Auctions	568	- 0.0715	0.0248	- 2.88	93.1
	Christies	224	- 0.0720	0.0298	- 2.42	93.1
	Phillips	157	- 0.1228	- 0.0323	- 3.47	88.4
	Tate Ward	185	- 0.1340	0.0310	- 4.32	87.5
	Bonhams	276	- 0.1727	0.0274	- 6.30	84.1
	Live Auctions	126	- 0.3390	0.0361	- 9.39	71.2
	Barnebys	489	- 0.3484	0.0282	- 12.35	70.6
L	UK	2094				
	Rest of World	109	0.0603	0.0390	1.55	106.2
	North America	236	- 0.0779	0.0240	- 3.25	92.5
	Europe	138	- 0.1228	0.0354	- 3.47	88.4
E	Edition Size†	6 ... 1000	- 0.3572	0.0508	- 7.03	70.0
T	Time†	0 ... 161	2.4072	0.0580	41.50	1110.3
C19	Pre Q3 and Q4 2019	1045				
	Q3 and Q4 2019	182	0.0493	0.0371	1.33	105.1
	Q1 and Q2 2020	134	0.2573	0.0465	5.53	129.3
	Q3 and Q4 2020	282	1.0134	0.0376	26.95	275.5
	Q1 and Q2 2021	320	0.9460	0.0391	24.19	257.5
	Q3 and Q4 2021	200	0.5791	0.0423	13.69	178.4
	Q1 and Q2 2022	173	0.3710	0.0443	8.37	144.9
	Q3 and Q4 2022	116	0.0253	0.0536	0.47	102.6
	Q1 and Q2 2023	125	- 0.2677	0.0477	- 5.61	76.5

†These ranges are re-scaled to 0 ... 1 prior to estimation

America and continental Europe see lower prices. Larger edition sizes result in lower prices, with prints from small editions regarded as being more exclusive and therefore valuable. Over the thirteen and a half years of these data there is

an impressive increase in the price of prints, an equivalent of an annual + 19.5% compounded increase in value. However, the pandemic significantly enhanced this growth.

During the peak of the pandemic effect in late 2020, prices reach nearly triple their expected level. Thereafter there is a gradual reduction in the pandemic effect. Only in the second half of 2022 do prices return to pre-pandemic expectations, and for the first half of 2023 the pandemic effect on prices is negative. To see an overall impact in monetary terms, and one that also includes the time trend, the conditional effects from the model are shown in Fig. 3.

Before the pandemic, a ‘typical’ Banksy print fetched around £10,000. By the second half of 2019, this average price had doubled to £25,000 and continued climbing to £32,000 in the first half of 2020. However, the second half of that year saw a dramatic surge, with typical prices nearly tripling to around £75,000. This peak price held steady through the first half of 2021, before gradually declining. By the first half of 2023, prices had largely returned to pre-pandemic levels.

Since the model includes random effects for the pandemic shocks by image, it is possible to differentiate the image impacts seen in Table 1. In Fig. 4 six images have been selected, three that show the greatest fall over the pandemic period and three that show the least fall.

The ‘Love is in the Air’ image experienced the steepest price surge during the pandemic peak, reaching an estimated pandemic effect nearly four times its pre-pandemic price. However, this effect had significantly diminished by the first half of 2023. The three lowest-performing prints showed only moderate pandemic effects, initially doubling in value, before eventually following the general trend with a fading pandemic impact, similar to the higher-performing prints.

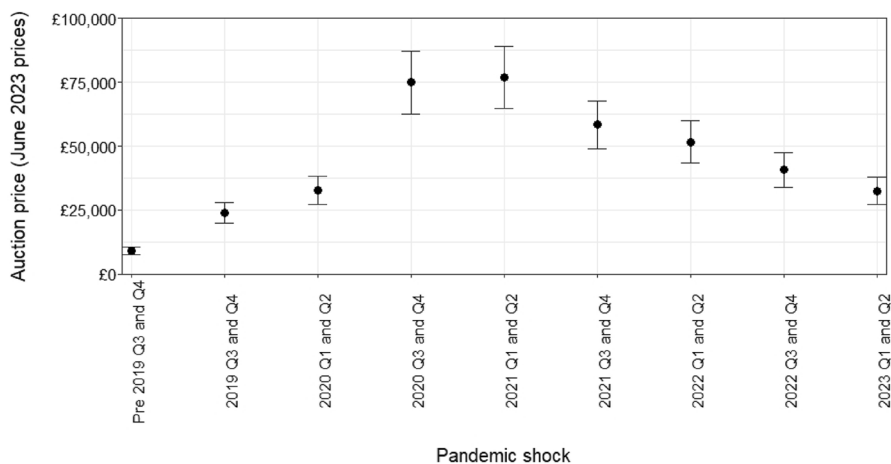


Fig. 3 Conditional effects attributable to pandemic effect

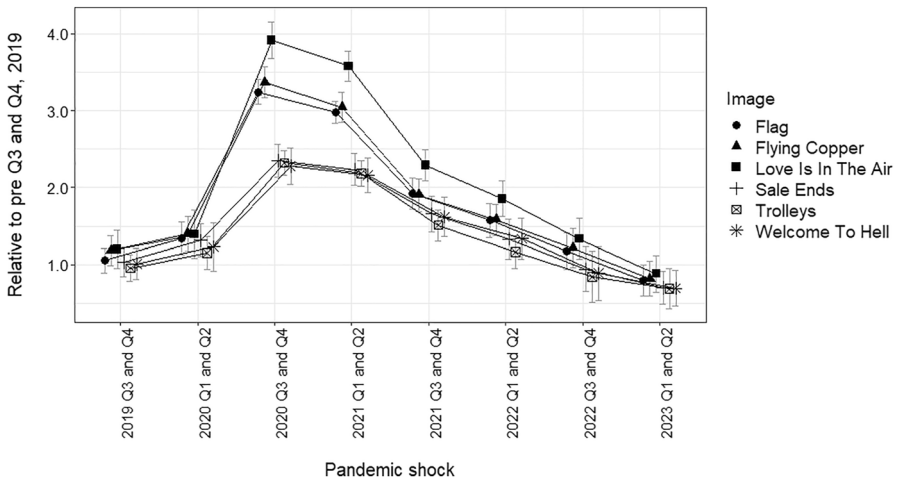


Fig. 4 Pandemic estimates for 3 biggest and 3 smallest reductions (NB points have been dithered on the x axis to allow differentiation)

Discussion

Inspection of Fig. 2 and the associated estimates from Table 1 clearly illustrate abnormal behaviour in the Banksy art market just after the start of the pandemic in early 2020, but does this constitute a bubble? Returning to the five stages of a bubble, it is possible to speculate as to whether each stage can be recognised.

- i. **Expectations:** with a global pandemic being a relatively unknown phenomena for society, it is difficult to discern what people's expectations for their immediate future were. Other than health worries, perhaps the greatest concern would be their economic and financial security. Governments tried to help by introducing schemes such as furloughs (Mayhew and Anand 2020) or stimulus checks (US Department of the Treasury 2023). For individuals with capital to invest, art became a potential haven, particularly contemporary art, and an artist whose name they may have heard of. Banksy clearly fits these criteria, and coupled with the reputation for his art not to lose value, it is likely that many, especially those in the UK, considered investing in his works as a financial refuge.
- ii. **Boom:** during the pandemic, articles soon start to appear in mainstream and social media on the performance of art as an investment, and in particularly highlighting the initial gains seen by Banksy works (Stewart 2020). This fuelled speculation among owners, prompting many to consider selling prints, even those previously deemed difficult to sell (Guignet and Lee 2021). This is evident in Fig. 1's increased number of Banksy lots being sold at auction, and even at the micro level, by the appearance of damaged prints at auction. Notably, all 30 prints listed as Damaged were sold from March 2021 onwards, a period of such inflated demand that even this flaw was readily overlooked. This phenomena

- reached a peak such that in an earlier model that included these damaged prints, they actually commanded a positive price premium over Excellent prints!
- iii. Euphoria: as sellers begin to capitalise on the Boom stage, the buyers begin to desire to acquire a Banksy print or a portfolio of prints, with an expectation of future profit taking in a heady market of double and even triple digit price rises. Again this is encouraged by articles in mainstream and social media.
 - iv. Profit-taking: as the pandemic progresses and vaccines become available, people begin to take a more rational view of their situation, conditioned by what their expectations were pre-pandemic. Experienced buyers, having capitalised on the boom, sought to secure realised profits before a potential market correction. In a climate of rising interest rates, some buyers, especially those who financed their purchases, looked to sell and realise a profit while eliminating any outstanding debt.
 - v. Panic: the inevitable consequence of the profit taking was that prices begin to fall from what were historic highs. People for whom Banksy's held no artistic or cultural value, or have borrowed/risked funds in the purchase are keen to leave the market. This happens gradually over a year and a half (see Fig. 3), until eventually the prices actually fall below pre-pandemic prices.

Based on this analysis, it is evident that the Banksy print market indeed experienced a bubble. Also, by mid-2023, from our vantage point, that bubble has undoubtedly deflated (or burst?). Notably, the market has returned to a state resembling pre-pandemic expectations, as reflected by the simple fitted model in Fig. 2. Future auctions in autumn 2023 will reveal whether prices stabilise at this pre-pandemic level.

While all Banksy images contributed to this bubble, some did to greater and lesser extents. Take for example unsigned copies of the image 'Love is in the Air' (aka 'Flower Thrower') arguably Banksy's second most iconic image after 'Girl with Red Balloon.' At the bubble's peak in October 2020 and March 2021, unsigned copies fetched just under £250,000 at Sotheby's. Just two years later, by early 2023, they had fallen to less than £50,000—a fifth. At the other end of the spectrum, the unsigned 'Trolley Hunters' print saw its peak price of £66,000 nearly halve, settling at around £30,000 in early 2023.

Banksy was a prolific artist, producing most of these print editions during the first decade of this century, but the actual number of works in this niche market is 'supply constrained' and few prints actually come to market. This has a number of impacts on his market. Firstly there is the possibility that there may be, as Pénasse and Renneboog (2021) highlight, "... a representativeness heuristic in which subjects draw strong conclusions from small samples of data" and that such conclusions are not borne out in reality, hence the end of the bubble. Secondly, Bernales et al. (2022) also consider as one of their three components on the dynamics in the art market, the role of supply constraints (albeit in the dramatic context of the artists death). Except for 'Banksquiat' (released in 2019), it has been nearly 10 years since a limited edition print by Banksy has appeared on the primary art market, which means that the elasticity of supply here is virtually

zero. This situation fuels an optimism effect for the artist and their work, leading to an increased bubble size.

Banksy's messaging, style, and humour resonate strongly with English-speaking cultures, reflected in the frequent auctioning of his work in these countries. This implies that his financial appreciation is likely tied, to some extent, to the economic performance of those nations, similar to how Chinese art's value is linked to the Chinese market's performance and regulations (Li et al. 2020). Notably, the UK economy faced a "cost of living crisis" during the latter part of this study period (Institute for Government 2022).

This is the first occurrence of such a bubble in the Banksy art market. While pre-pandemic the market boasted impressive annual returns, even exponential growth, such unsustainable increases were unlikely to last. Eventually, a correction was inevitable, and perhaps the pandemic served as that reset. Other established markets, like finance and property, regularly encounter such bubbles (Carraro 2021). Granted, the Banksy market is far less mature than these markets, and historical data shows it to be more stable than other modern artists' markets (e.g., Damien Hirst; Kraeussl, 2015) or modern asset classes like cryptocurrency (Kyriazis et al. 2020) or NFTs (Barbon and Ranaldo 2023). In fact, Assaf (2018) observed that art markets generally become more stable and resilient over time. However they also assert that economic and "[G]eopolitical risks engulfing the global economy may trigger speculation in the art markets, distort prices, increase market inefficiency and as a result may lead to the formation of bubbles". COVID-19 certainly qualifies as one such risk. Importantly, Banksy prints no longer hold the 'one-way bet' reputation they once did; even Banksy prices can fall.

Limitations and future research

This study has used just one source of information for the price of Banksy's works. There will have been sales conducted during this time which are not included, most notably from galleries and private sales. In contrast to publicly available auction prices, the sale prices for works at a gallery are less publicised. Even when available, the listing price provides no guarantee that the work was sold by the gallery at that price—discounts may have been offered. Private sales of Banksy works can also take place, with one popular place being the Urban Arts web site (Urban Art Association 2023). The use of such sites involves no fees for either the seller or the buyer, but there are some risks to both parties, and if the print is sold through a private sale (or a transient gallery), the existence of a CoA would be an important consideration. Here again the sales price is not always disclosed. However, as the most publicised source of information for the price of Banksy prints, the auction price for a print will have an influence on what gallery and private individuals believe that people are willing to pay, so there may be some correspondence between the three pricing mechanisms, although dealers may still have some influence (Prinz 2022).

Some prints at auction fail to reach their reserve price and remain unsold (so called 'buy-ins'). Including information on these unsold prints, if available, could enrich future models. Various techniques exist to incorporate such data, for example

using a hurdle model to predict the probability of a print selling, followed by a separate price model for those that do sell (Marinelli and Palomba 2011; Hilbe 2011, Chapter 11). While these data are missing from the current dataset, it could be a valuable addition for future research. Another outcome is that unsold prints can sometimes be purchased immediately after the sale if an interested buyer contacts the auction house. These sales prices are subject to time limited negotiations between the seller and buyer, mediated by the auction house. If a price is agreed then the sale goes ahead but is typically not included in the published auction results.

Auction listings typically provide a sale price estimate or an expected range for the sale price. Some models have included this information, either as part of a hedonic model or as an alternative. Sproule and Valsan (2006) find in their study of abstract art, that pre-auction estimates account for much of the information usually included in hedonic model attributes, in effect knowledge of the pre-sale estimate (or the range) is as useful as the publicly available information. However they acknowledge that “*By choosing abstract art we seek to control for the influence of subject matter—a crucial determinant of art prices that is poorly understood and difficult to quantify.*” Banksy art is not abstract and much of its value lies in its subject matter, to the extent that the model used here specifically accounts for variations in price and COVID-19 impact by image. Marinelli and Palomba (2011) augment their hurdle analysis with the inclusion of pre-sales estimates. They test whether a function that takes into account the pre-sales estimates is ‘sufficient’ (meaning that when the pre-sale estimates are known, all other information becomes irrelevant). Their analysis concludes that pre-sales are not sufficient and does not “*contain all the relevant information*”. For these reasons, pre-sales estimates have not been used in this model, but is a potential avenue for further research.

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Data availability The datasets generated during the current study are not publicly available due to being the property of the www.banksy-value.com web site owner. Readers may contact the web site owner to request these data.

Declarations

Conflict of interest There are no competing interests.

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