

Market Evolution of Art Dealers

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Abstract

Using a unique historical data set, we show the value of expertise and reputation during the evolution of the art market. First, we illustrate how market dynamics encourage entry of dealers with heterogeneous characteristics. Second, our results provide evidence that relatively larger dealers pay about 21% more for an artwork of the same quality than smaller dealers as a result of their accumulated experience and reputation. Third, our results indicate that larger dealers are more likely to survive in the market. Our evidence outlines the importance of accumulation of market power in an emerging market characterized by uncertainty and heterogeneity.

KEYWORDS: Auctions, Art Dealers, Market Evolution, Reputation, Experts

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1 Introduction

In this study, we use a rare London-based fine art auction data set with buyer and seller identities, which provides us with a unique opportunity to examine a market evolution, where value is created through the accumulation of market share resulting in a better reputation and more expertise. Tracking the evolution of the market, we observe dealers' entry, bidding, and survival patterns from 1800 to 1913. As trading volume increases, market entry is encouraged and total purchases by dealers triples over the period. Through the evolution, we observe dealers accumulating different amounts of market share. We demonstrate that larger dealers bid more aggressively as a result of more expertise and better reputation. We further show that more market power in form of higher market shares enables large dealers to survive longer. Our empirical findings emphasize the importance of firm size in a market characterized by high heterogeneity and uncertainty.

Gains from superior expertise and reputation can be large. Experts accumulate unique industry knowledge and provide informal unwritten guarantees on the quality of the products. They perform a crucial role in markets acting as certifying bodies. Due to specialization and the resulting economies of scale, information can be collected and processed more efficiently. As a result, experts create value for which a premium can be charged. This added value is intangible in nature and, thus, difficult to quantify. The importance of the value of expertise becomes apparent when considering the prolific use of consultants in order to maintain and sustain a competitive edge.

Dealers and intermediaries are crucial in helping to establish prices across many markets. In markets where heterogeneous goods and services are traded, information asymmetries between buyers and sellers are magnified. In this case, the buyer is uncertain about the value of a good as quality is not directly observable at the time of the purchase. In markets such as real estate and art, asymmetric information or uncertainty concerning the value of a good is more prevalent than in others and, therefore, there is more opportunity to extract higher rents (or profits) for experts who can resolve this uncertainty.

The art market offers us an excellent setting with which to examine the role of expertise and reputation as a result of a growing firm size. It also has the advantage of not having been subject to radical changes. The mechanism with which trade takes place in the art market at auction is essentially the same as in its outset, more than two centuries ago. Art dealers are the brokers of

the art market; they produce information and coordinate demand and supply as intermediaries. A good dealer is able to remove uncertainty from the buying decision of a client by certifying the value of an artwork. This is usually materialized by a further price appreciation. Art collectors are, therefore, willing to pay a premium for this uncertainty alleviation. Buying from a reputable dealer is like being a member in an exclusive club whose aesthetics are determined by the dealer. Highly prominent art dealers, such as Larry Gagosian (who runs a chain of galleries), exert great influence on buyer preferences and can, therefore, have decisive power over the success of an artist. The attainment of a sufficiently high standing in the market enables the dealer to effectively promote an artist and get access to a wealthy clientele. However, the accumulation of market share and thus expertise and reputation requires time and depends on relationships with other key players such as prominent collectors, curators, critics or auction houses.

This is the first study, as far as we are aware, to empirically investigate the role of expertise throughout the evolution of a new industry within the context of the art market. We are also the first to empirically analyze acquisition strategies in auctions using information on individual art dealer characteristics. The findings have implications for market evolution research by providing evidence of the determinants that drive entry and survival in the art market. Furthermore, we contribute to the body of literature on the role of institutions and their added value in markets characterized by information asymmetries. We demonstrate the importance of expertise and reputation in such settings. We show that it is crucial to accumulate market share in order to survive.

There has been a large number of studies on the importance of intermediaries for information production and value certification, especially in the area of financial advisory and intermediation (Brealey et al., 1977; Chemmanur and Fulghieri, 1994; Campbell and Kracaw, 1980). Among others, these studies find evidence that advisers with more industry expertise and/or a better reputation are more likely to be selected for mandates and achieve higher returns for their clients, particularly in the presence of information asymmetries (Ertugrul and Krishnan, 2011; Golubov et al., 2012; Song et al., 2013). Thus, while there is empirical evidence that firms can benefit from more expertise, these studies do not consider its impact on the overall industry structure and the evolutionary path of an emerging market. Our analysis extends this literature by demonstrating how differences in market power influence the evolution of a market. Additionally, we show how firm size in the market influences survival.

Many studies analyze industry evolutions of new products from their birth until maturity (Agarwal and Gort, 1996; Carroll and Hannan, 1989; Dunne et al., 1988; Gort and Klepper, 1982). These efforts focus on empirically deriving stylized facts which explain evolutionary paths of new industries along the different stages of the product life-cycle. Most studies analyze how various market characteristics such as technology (Agarwal and Audretsch, 2001; Doms et al., 1995), competition (Bresnahan and Reiss, 1991), or the stage of the product cycle (Agarwal and Gort, 1996; Gort and Klepper, 1982) affect the probability of entry, growth and survival rates. Other studies (Carroll et al., 1996; Mitchell, 1991) solely concentrate on entry timing and probability investigating the competitive dynamics between start-ups and incumbents (Schumpeterian competition). While these studies consider market characteristics, we extend these studies by taking into account the effect of individual characteristics of market players on the evolution of an industry. Our dataset provides us with the identities and characteristics of buyers and sellers and, therefore, give us the unique opportunity to establish historically who the major market players at auction are. We determine the characteristics of dealers, such as market share, experience and financial capacity, which contribute to the differential bidding strategies and survival in the market.

Klepper (1996); Klepper and Simons (2000) and Klepper (2002) extend this analysis to include the effect of differences in capabilities between firms on market structure. For instance, Klepper and Simons (2000) finds that entrants with previous experience in related industries were more likely to enter. Additionally, they show that these firms experienced higher innovation rates and market shares as well as longer survival. In another study, Klepper (2002) concluded that entering earlier with previous industry experience increased competitiveness through higher returns from investments in R&D. The investigations mentioned above focus on homogeneous industrial products whose evolution is tightly linked to technological change and returns from R&D. We extend this line of literature by focusing on heterogeneous goods. Specifically, in markets with more heterogeneity of goods and services, inefficiencies are not only introduced but magnified. This generally gives opportunities for dealers who understand the intangible value of these types of products. Dealers are able to extract value. Rather than selling lemons, experts are able to put a cherry on top of the cake.

In the domain of art market research, few empirical studies are available on the competitive conduct of professional intermediaries and the industry dynamics that govern their entry, growth, and exit. As buyer identities in the secondary as well as primary art market usually remain undisclosed,

research in this field has been limited to qualitative socio-economic studies (Arora and Vermeulen, 2013; Bayer, 2015; Montias, 1988; Stourton and Sebag-Montefiore, 2012; Velthuis, 2003, 2013). In a recent study on the French art critic Roger de Piles (1635-1709) Graddy (2013) provided early evidence on the significance and reliability of an expert's opinion in the art market. De Piles developed a rating scheme to rank artists based on several criteria. The majority of his higher ranked artists are still traded today and throughout time their artworks achieved better returns than artworks by his lower ranked artists. Nevertheless, expertise as the source of market success and its effect on the art dealer's acquisition strategies and overall market success still remain a puzzle. Up until now, the effect of a firm's expertise and reputation on industry evolution, bidding strategies and, eventually, firm survival has not been researched. Therefore, this study is also motivated by the lack of empirical evidence in this field.

Our empirical analysis is conducted in three parts. First, we investigate patterns and drivers for the market entry of dealers which led to their institutionalization in the nineteenth century. We expect entrants to be heterogeneous in their characteristics which will influence their bidding behavior and industry structure as a whole. We then analyze the effect of the dealers' relative size on acquisition strategies at auctions. In particular, we are interested in knowing whether dealers with more market power display a different bidding strategy than smaller dealers with less market power. We use the dealer's past market share to proxy her individual level of market power and, thus, expertise and reputation.¹ Based on their past market shares, we distinguish between large and small dealers and analyze their effect on the hammer price beyond what is predicted by artwork characteristics. Our expectation is that larger dealers will, on average, acquire artworks at higher prices than smaller dealers as they have a better expertise and reputation that results in easier access to clientele and a superior ability to promote artists in the market. Consequently, they can extract higher rents from the future resale of the artworks. Lastly, we investigate how firm size affects survival in the market. We expect larger dealers to survive longer than smaller dealers as the latter fail to generate sufficient profits.

Our results show that the entry into the market coincides primarily with the intensity of the current trading activity of dealers and is deterred by increased competition. With respect to the

¹We relate to market power in the sense of the Herfindahl Index where high market shares result in higher market concentration which in turn leads to larger market power of some players.

acquisition strategies of different types of dealers, the results further provide very clear evidence that larger dealers pay, on average, 21% more for an artwork than smaller dealers. This pattern holds for the whole distribution of prices and is especially pronounced in the upper part of the distribution. Moreover, we find that larger dealers are about 7.5% percent more likely to survive the market than smaller dealers. This supports the conjecture that art dealers benefit from a larger market shares that allows them to accumulated reputation and expertise resulting in more market power. This enables them to extract higher rents which ultimately explains market survival.

The paper is organized as follows. In section 2, we describe the evolution of the art market and the drivers that led to the proliferation of the modern art dealer as its integral component. The employed data set is presented in section 3. Section 4 is dedicated to the empirical analysis and details the methodology and results. We finish with some concluding remarks and implications for the art market as well as other fields in section 5.

2 Institutional Background

2.1 The Evolution of the Art Market

By 1700, with the economic decline of the Netherlands, London became the wealthiest and largest city in Europe. The Reformation caused a redistribution of wealth which led to the emergence of a rich upper class (Bayer, 2015, p.16). Aristocrats built large mansions and used art as decoration, which was directly commissioned from artists. These artworks rarely circulated to other buyers and tended to remain in family estates. Therefore, the supply of artworks for trade was very low during the 17th century. When many aristocrats fell into financial distress around the mid-19th century, posthumous estates came up for sale and had to be liquidated quickly. In addition, the Settled Lands act of 1882 allowed tax free disposal of property which also included artworks and antiques (Cooper, 1977, p.19). At the same time, conflicts on the continent, especially the French Revolution, led to the dispersion of many prominent art collections (e.g. the Orléans collection) which ended up for sale in London (The National Gallery, 2016). These events increased the availability of artworks in the market and constituted the main source of supply at auctions. The supplied artworks were mainly Old Masters or contemporary works from foreign, especially Dutch or Flemish, artists. Collecting art gained in popularity among the upper classes, manifested in high prices. However, many of the circulating

artworks were forgeries or cheap copies. Local artists enjoyed a very bad standing in the market due to foreign competition and little support of native artists by the national government (Bayer, 2015, p.17).

The establishment of the Christie's auction house in 1766 (which became the largest auctioneer of fine art) revolutionized the art trade. Auction sales were not only spectacular events for bourgeois society, but also constituted a process of innovation in the art trade. Direct contact between the producer of art and the consumer was not necessary anymore to purchase an artwork (Bayer, 2015, p.25). Auctions offered a public exchange platform and helped to establish a market price for artworks. Early on, auction houses already had policies and regulations in place to protect themselves from fraud and ensure timely payment by sellers and buyers. By the 19th century, laws were enforced which explicitly prohibited price manipulation tactics to protect the consumer (Bayer, 2015, p.74ff). This safe regulatory environment enhanced market liquidity and efficiency and led to higher trade volumes. Christie's enjoyed a monopoly position among auction houses as it managed to build-up an exceptional reputation in the art world. The founder, James Christie, was known to be a very charismatic businessman. He liaised with dealers and offered financial assistance to sellers. As a result, many important collections (consisting of both Old Masters and contemporary art) were disposed of through the auction house and it was the primary source of supply for professional art dealers. Similar to a clearinghouse of today, the auction house became an irreplaceable institution in the art market as a supplier of artworks and a provider of liquidity to the art market (Stourton and Sebag-Montefiore, 2012).

The Industrial Revolution further increased the economic prosperity of the United Kingdom (UK) and elevated a larger share of the population into the upper and middle classes. In the 18th and 19th centuries, the UK was free of wars and other disruptive events which could adversely affect the economy. Further, the UK's rate of urbanization and literacy were among the highest in Europe in the 19th century. Additionally, the early establishment of the Bank of England (in 1694) provided the country with a highly sophisticated financial infrastructure for that time, offering various financial products (Bayer, 2015, p.16ff). This spurred consumerism among the British population and enabled the art market to flourish.

By the middle of the 19th century, contemporary artists eventually managed to establish them-

selves in the art market at the expense of Old Masters and foreign living artists. This was thanks to institutions (such as the Royal Academy) which enabled the exhibition of art and made it accessible to a wider public. However, the breakthrough of contemporary art was achieved through art dealers. They not only took over marketing activities but also materialized these efforts by generating sales. Due to the popularity of British contemporary artists, the supply of artworks grew almost exponentially (Bayer, 2015, p.24ff). Artists, such as William Hunt, William Frith, and Benjamin West became mass producers of art. To increase market competitiveness, most artists became specialized in a certain signature subject or style (e.g. Hunt's *Bird Nest*). To reach a larger target audience, artists started to produce works with different levels of quality. While copies or prints were affordable for a larger mass of buyers, so-called sensation paintings were in a price range that could be paid only by the wealthiest section of the population (Bayer, 2015, p.110ff). Other important market transformations were a departure from historical painting as a theme as well the tendency to produce artworks of smaller sizes due to a diminishing return to scale (Bayer, 2015, p.68). Artworks started to become commodities and were created to please consumers. As a result, the total amount of buyers at auction increased, which further improved liquidity and efficiency in the market.

In summary, the art market in the UK was able to evolve due to uninterrupted and continuous economic growth, a mature financial infrastructure, and the emergence of auction houses. The large demand for art generated the need for specialization and a division of labor between the artistic production process and support functions such as marketing and sales. This created business opportunities for middlemen who would dominate and further revolutionize the trade in the 19th century making London the central global marketplace for art.

Having provided an overview of the 18th- and 19th century London art market, we will now take a deeper look at the role and industry structure of art dealership.

2.2 The History of Art Dealers

The professional art trader emerged in the late 17th century in the Netherlands and matured during the 19th century in the UK to become what is known as an art dealer today (Bayer, 2015). The dealer is part of the socio-economic and institutional network of the art world and is responsible for the establishment of the value of artworks. As described in the section above, her professionalization occurred throughout the process of the commoditization of art as a good in the early 19th century

due to the need for a division of labor. Artists realized that they could not effectively perform production as well as marketing and sales. Thus, the exploding demand for contemporary local art in the middle of the 19th century was thanks to middlemen who acted on this business opportunity.

When the supply of artworks was still scarce and there was little demand for local art in the 16th- and 17th century, dealers had to travel to Continental Europe to acquire paintings in a so-called *Grand Tour*. They would then sell these artworks through auctions or through a network of private buyers (Bayer, 2015). Due to the relatively high financial and operational risks, dealers initially acted as agents and mainly bought artworks on behalf of their clients or organized auction sales where they would sell their inventory. As the supply of artworks increased through the liquidation of aristocratic estates, conflicts in Continental Europe, and the rise of local living artists, business risks decreased.² As a result, art dealers started to become more daring and bought artworks for their own stock which were sold on their own premises. Auctions ceased to be used as the main sales channel and were increasingly used to fill up inventory and perform liquidity sales of artworks that could not be sold to private clients (Bayer, 2015, p.106ff). A mature financial infrastructure in London greatly supported this development as it facilitated access to capital. The growing reputation and influence of certain art dealers granted them taste-making abilities and enabled a faster turnover of inventory. It caused the dealer-controlled and consumer-oriented London art trade to become the most important international art market before the First World War (Stourton and Sebag-Montefiore, 2012).

Art dealers catered to both the middle and upper classes of society. Art was often seen as a speculative venture and no degree or professional society certificate was needed to become an art dealer, lowering the barriers to entry. It was lucrative, even for the rich, to sell parts of their valuable collections (Stourton and Sebag-Montefiore, 2012, p.14). However, building up expertise and a reputation as a trustworthy dealer who resolved uncertainty about the quality of art was crucial as collectors often relied on the dealers' judgment about the future potential of an emerging artist. With respect to Old Masters, the dealer's reputation played an important role in certifying the authenticity of an artwork. Often, Old Masters appeared for sale to the open public for the first time as they were previously commissioned and owned by aristocrats. Thus, in our analysis, we do not make a difference between dealer acquisitions of Old Masters such as Rubens or Rembrandt

²Conflicts in Continental Europe during that time included, among others, the French Revolutionary Wars (1792-1802) and the Napoleonic Wars (1803-1815).

and contemporary artists like Turner.³ From today's perspective, one could argue that a dealer distinguishes herself by her ability to promote new, upcoming artists in the primary market as opposed to selling established artists. However, in the 19th century, Old Masters were not established artists and did not have a market price yet. It was, hence, the dealer's responsibility to certify the provenance and quality of the artworks since many forgeries were circulating (Arora and Vermeulen, 2013). Dealing with Old Masters was not without risk and sometimes even more cumbersome than selling the work of contemporary local artists over which dealers could exert more control. A steady supply of Old Masters was difficult to maintain. Often, Old Masters had to be imported, which required a mature logistical infrastructure, a good support network abroad and a lot of expertise to distinguish forgeries from originals. To make a profit on these artworks, large premiums had to be charged from the client. For this reason, dealers jointly engaged in the public devaluation of Old Masters and started to collaborate with contemporary native artists. This resulted in a market downturn for Old Masters and large price increases for artworks by contemporary British artists in the late 19th century (Bayer, 2015, p.81ff). Despite being associated with certain movements or styles, most dealers were not highly specialized. They employed risk mitigation techniques such as the trading of portfolios of already established artists which helped them to introduce new emerging artists to the market. Also, dealers acted as matching agents in order to sell to each other's clients (Bayer, 2015, p.90ff).

In building a reputation, the dealer's network of artists, collectors, auction houses, the media and other dealers played a decisive role. The network provided the dealer with privileged information about the quality of the artworks, sources of supply, access to wealthy clients, and good publicity. In the 19th century, art dealers eventually took over the role of art academies in dictating what constituted good art and greatly influenced buyer preferences. They further took over the role of patronage from the aristocracy and started to support emerging artists. As a consequence, art dealers also had a say in the productive process of artists, advising them on popular themes and narratives which would lead to commercial success. By boosting the artist's popularity, they simultaneously also improved their own reputation in the market. At the same time, artists were dependent on dealer representation for commercial success. Dealers provided artists with trademark styles and made sure that output was sufficiently large to satisfy demand. The art dealer, Arthur Tooth, for

³The share of Old Masters in the data set is 26.5%. For robustness, we repeated all regression using a sample consisting of contemporary artists at that time only. We observed similar results.

instance, brought 403 new paintings into the market within two years. He also represented artists like James Smith who was known for his waterfall paintings [p.100ff](Bayer, 2015). Thus, although intangible in nature, a reputable and skilled dealer was indeed able to add value to the works of artists.

The end of the 19th century was a century of avant-garde dealers (e.g. Grosvenor and Leicester) who greatly influenced taste. This period produced the most successful and well-known dealers to date. These dealers were entrepreneurs who were entirely committed to the artists they represented (Stourton and Sebag-Montefiore, 2012, p.274). They were also responsible for the departure of the historical painting in favor of landscape paintings (Bayer, 2015, p.105). For instance, the establishment of the Impressionist movement was thanks to influential dealers such as the French dealer Durand-Ruel. He created a market for the painters of this movement who were previously not well received. Durand-Ruel was active as a dealer between 1891 and 1922, with galleries in Paris, London, Brussels and New York, where he represented artists like Edgar Degas, Pierre-Auguste Renoir, Alfred Sisley and Paul Cézanne (Durand-Ruel Galleries, 2015). Practices which were employed by him and other successful dealers to push artists in the market included the set-up of gallery networks with branches in several locations, regular individual exhibitions with free entry, partnerships with providers of capital, frequent press releases, and protection of market prices for the artists they represented.⁴ In their function as market makers, art dealers were also said to perform price stabilizing acquisitions at auctions to maintain a liquid market for the artists they were trading. After all, auctions were public events and could also have been used by dealers as a marketing device to send a signal to the market in order to affect the public's perception of certain artists. (Bayer, 2015, p.108). Some dealers also offered inducements to agents, consultants, or experts who advised well-known collectors with the goal to make them promote certain artists in the public. The late-19th century dealer, William Buchanan, and the 20th century dealer, Lord Duveen, who cooperated with the art expert, Bernard Brenson, were known for these practices (Stourton and Sebag-Montefiore, 2012, p.159). In general, one could categorize art dealers in the 19th century as middlemen, gatekeepers of quality and taste-makers, who were largely responsible for the cross-border proliferation of the London art market.

⁴As noted by (Bayer, 2015, p.116), especially for new artists, there is anecdotal evidence of price manipulation where dealers intentionally bid up prices during the auction. As auctions were and still are the only platform where art prices are public, they enable the dealer to send a positive signal to the market about the value of an artist which would allow her to charge higher prices in later sales.

The preceding section gave an overview of how the art market developed throughout the 19th century. The Christie’s auction house as well as art dealers constituted the key elements that led to the commercialization of art. This development continued after the first- and second world war throughout the 20th century until today. The following section will provide a detailed description the data set employed in this study.

3 Data

The source of our unique historical data set is the auction transactions recorded by Graves (1918). Algernon Graves was a British art dealer and a historian who was responsible for initiating the practice of provenance research. He was widely known for the documentation of artwork sales held in Britain during the 18th and 19th centuries (American Art News, 1922). In three volumes, Graves documents art auctions that took place in London-based auction houses. We retrieved these three volumes from the Victoria and Albert Museum Library in London. The data set includes 37,677 sales transactions for fine art in 57 London-based auction houses from 1741 to 1913. Historical records indicate that the data set is a representative sample of auction sales over this period (Bayer, 2015).⁵ Its unique feature is the availability of the original sellers’ and buyers’ identities in the transactions. There are 3,678 unique sellers and 3,668 distinct buyers in the sample.

The data, moreover, provides information on the name of the artist and her living status, the name of the artwork and year of origin, the medium used as well as the school or movement the artwork can be attributed to. There are 1,801 different artists and, with respect to the medium, we differentiate between paintings, drawings, engravings, copies, and sculptures. We categorize the artworks into Old Masters from the continent, Old Masters from the Low Countries, and British and Continental contemporary art. To provide an even more granular segmentation, we also differentiate based on artistic genre or artwork subject. In total, we arrive at nine different genres (Animal, Genre, History, Landscape, Marine, Mythologize, Portrait, Religion and Still Life). In addition, transaction data are available, such as the name of the auction house where the sale took place, whether the transaction was part of a collection sale, the date of sale and, lastly, the nominal sales price in Pounds, Shillings and Pence. All prices are converted into British Pounds. Note that price

⁵The Christie’s auction house, which is included in the data, captures 92% of the market share by number of acquisitions and 96% by value of acquisitions.

estimates which were formed by the auction houses were not published in auction catalogs before 1973 and are, therefore, not available in the data at hand. Further, an index based on the hedonics of the artwork (i.e. the aforementioned attributes of the sale) is created in order to deflate sales prices with 1850 as the base year.⁶ In creating the hedonic index, we follow the methodology of Anderson (1974); Chanel (1995); Frey and Pommerehne (1989) where the price is regressed on the set of the idiosyncratic characteristics of the artwork in addition to time (year) dummies.⁷ An overview of the employed artwork characteristics can be found in Table A2 of the appendix. We only have sufficient data to deflate prices as of 1828. Therefore, all analyzes that involve values dominated in real British Pounds are conducted using data after this year.

All transactions are based on the English auction in which the buyer with the highest bid receives the item. Only the final hammer prices are observed. This implies that, for every auction, the winner and the final bid are known. As we are interested in the behavior of professional art buyers, our selected sample consists of 17,454 transactions conditioned on art dealer identified as the buyer, leaving us with 27 distinct auction houses, 1,187 different artists, and 2,251 sellers. However, it is important to note that the Christie's auction house captures 97% of the market by number and by value of acquisitions. Besides the first and last names of the buyers, the original data does not provide any other biographical information. Therefore, we used museum archives to identify art dealers among our buyers.⁸ With this search, we were able to classify 138 distinct buyers as dealers who, in total, account for 43% of all transactions. Buy-ins are excluded from the analysis.⁹

For the price analysis, we restrict the time period to the years 1850 to 1913 which leaves us with 130 dealers in total. The period between 1800 and 1850 is used to build a history of initial market shares which is used to classify bidders into large and small dealers. The rationale behind

⁶The values of the index are the exponents of the time dummy coefficients which are then indexed to a selected base year (in our case 1850) which is set equal to 1. A hedonic index is particularly useful for the data at hand as, in contrast to the repeat sales index, it makes efficient use of the data. While for a repeat sales index at least two transactions of each artwork are needed, every transaction can be used in the hedonic index. It should be noted that hedonic indexes for art auctions are prone to a selection bias as not every artwork has the same chance to be traded at auction. Artworks of lower quality or those that have declined in value are less likely to be offered for sale. Similarly, very high-end works (such as Old Masters) are also less likely to be put up for auction as they are often in museums.

⁷The hedonic index can be provided upon request.

⁸The historical nature of the data set limited how much information could be extracted on the identities and biographies of the individual buyers. For instance, we cannot distinguish between full-time and part-time dealers. Moreover, we cannot always clearly distinguish between businesses that discontinue and mergers or partnerships. In cases in which dealerships were held by families over generations, we do not distinguish between different family members who managed the business in different ownership periods.

⁹In auctions, a buy-in takes place when an artwork was not sold as it fails to meet the seller's reserve price. In our data set, buy-ins represent only 5.6% of all transactions.

this choice is that, according to historical records, this was the time when the auction market in the UK reached a high level of maturity with a stable supply of Old Masters as well as rising interest in contemporary art (Stourton and Sebag-Montefiore, 2012). More importantly, at that time, art dealers started to act as principals, buying for their own stock. Previous to this, they acted as agents on behalf of major wealthy buyers which could affect acquisition strategies in a different way due to a more passive role played by dealers. It is worth mentioning that we conducted research on instances of collusion between art dealers throughout the sample period as it could impact the interpretation of our results. However, we could not find any anecdotal evidence of such cases in historical records. There is discussion of ring activity (Cooper, 1977, p.88) in the 1920's but not during the period before. This decade lies outside of our sample period. Even though we cannot entirely exclude the existence of single cases of collusion, the long time span and large size of our dataset renders the chance that these cases might have a strong impact on our results unlikely.

In the second part of the analysis, where the survival rates of different dealer types are investigated, we employ the sample starting in 1828 as we are interested in the full life-cycle of the dealers. We consolidate acquisitions per dealer on a yearly basis.

The following section will provide descriptive statistics on the the growing art market and illustrate how the art dealer industry developed within this market based on evidence in our dataset.

3.1 Descriptive Statistics

3.1.1 The Art Market

We start our analysis by looking at the overall development of the art market during the period 1800 to 1913. Figures 1(a) and 1(b) show the size of the market over the investigated period in terms of number and value of transactions. Both figures clearly show the dramatic increase in artwork sales after 1870. While there were, on average, 181 sale transactions per year before 1870, the volume increased to an average of 685 transactions per year from 1870 until 1913. Even more dramatic is the jump in the value of the artworks sold. The total art market value amounted to an average of £22,365 until 1870 and exploded afterward to an average annual size of £170,641. Furthermore, the art market also increased its weight in the GDP of the UK economy over the same period as shown in Figure 1(c). The share of the total art market as a portion of real GDP doubled from

an average of 0.006% before 1870 to 0.012% after 1870.¹⁰ As a result, not only has the size of the art market quadrupled in terms of number of sale transactions, but art prices also increased eightfold. The phenomenal growth of the art market around 1870 was due to the proliferation of and resulting growth in demand for contemporary local artists. This exploding demand was satisfied with an increase in the amount of professional artists and their production output as well as product diversification into new themes and styles. The success of local living artists can be attributed to dealers who heavily promoted these artists so as to become less reliant on sales from Old Masters which was a more risky business due to limited supply of these works and the existence of many forgeries (Bayer, 2015, p.113ff).

To identify the players in this growing art market, we plot the number of different buyer types in Figure 2(a). We differentiate between commercial and non-commercial buyers. While commercial buyers are represented by dealers, the group of non-commercial buyers includes aristocrats, the bourgeoisie, artists, and civil servants. We can see that the number of non-commercial buyers more than doubled between 1800 and 1913, from an average of 47 buyers per year until 1850 to an average of 118 in the years between 1850 and 1913. Even though dealers represent a smaller buyer group in absolute terms, they quadrupled from an average of eight dealers per year before 1850 to an average of 33 from 1850 until the beginning of the 20th century. The number of entrants per year is presented in Figure 2(b). Despite fluctuations in the number of yearly entries, the number of new players increased dramatically after 1850, from up to two new entrants to a maximum of eight new dealers per year. This can be interpreted as a sign of increased profit opportunities in the market. Thus, the dealer industry expanded dramatically over time.

Investigating the acquisition activity of the different buyer groups, the emerging dominance of dealers as the main buyers in auctions becomes apparent. Figure 2(c) shows the market share captured by dealers versus other buyers by number of acquired artworks. Figure 2(d) depicts the market share of both groups by the value of their acquisitions after 1800. Before 1850, art dealers captured an average market share of 17% when market share is calculated by the number of acquisitions (Figure 2(c)) and 19% when market share is calculated by the value of acquisitions (Figure 2(d)). In both figures, we can observe that the difference between the two buyer groups becomes smaller and the share of the two buyer groups eventually equalizes close to the year 1880. When market

¹⁰In 2015, the UK art market accounted for 0.5% of the national GDP. The data on the GDP was extracted from the Bank of England and the UK Office for National Statistics.

shares are calculated based on number of acquisitions (Figure 2(c)), the average market share of art dealers reaches 57% between 1850 and 1913. The gap between dealers and other buyers widens even further at the beginning of the 20th century. In terms of value of the artworks (Figure 2(d)), dealer acquisitions attain an average share of 66% between 1880 and 1913. This amounts to average acquisitions of £140,000 by dealers per year. While, in peak years, about 33 dealers bought up to 600 artworks valued at £150,000, the 118 remaining buyers bought up to 380 artworks for a maximum total amount of £100,000. Thus, art dealers did not only buy more artworks than other buyers, their acquisitions were individually also more expensive. Overall, this graphical analysis illustrates that, even though art dealers were a smaller buyer group, they grew faster (especially around 1850) and clearly overshot other buyers after 1880.

Overall, the art market as we know it today emerged in the 18th century and experienced significant growth in the 19th century due to the proliferation of contemporary local artists. During this period, professional art dealers rapidly became the dominant buyers in auctions. The subsequent section will zoom into the market structure of the dealer market.

3.1.2 Art Dealers

The most important and successful art dealers emerged in the early 19th century. The vast majority of them were family businesses with a background as artists, print- and frame-makers or passionate collectors. Despite some changes in ownership, they remained in business over generations. Agnew and Sons was among the most influential art dealerships in London. It was also the biggest buyer in our data set. The gallery opened in 1860 in Mayfair in London and had already been operating as a print publisher in Manchester since 1817. In 2013, the gallery was taken over, after six generations, by Lord Anthony Crichton-Stuart, a former head of Christie's Old Master paintings department (Agnew's Gallery, 2014). The second biggest player in our data set, Paul Colnaghi, is still active as a dealer in the market for Old Masters. Located in Mayfair, it is now one of the oldest galleries in the world (Harrison, 2011). The dealership of the Vokins family, which constitutes the third-largest dealer in the data set, became active at the end of the 18th century and remained in the market until the beginning of the 20th century. It was originally a carving, gilding, and frame-making business and enjoyed a very high reputation. Figure 3 shows the market shares for these top three dealers by the number of acquisitions over the whole sample period within the population of art dealers.

Agnew clearly dominates the market with a share between 30% and 60% over the whole period after 1860 and an overall average market share of 40%. The dealer lost market share in times when art market sales increased and a large number of new players entered the market. Agnew is followed by Colnaghi and Vokins who both had an average market share of about 10% over the whole sample period. Consequently, the top three players in the market consistently captured a market share between 40% and 70% among all dealers. When looking at the full market of buyers, which includes dealers as well as all other purchasers (Figure 4), the market shares of the top three dealers dilute but remain nevertheless sufficiently high to constitute a large market share. While Agnew still has a market share between 10% and 40%, with an average share of 20%, Colnaghi and Vokins each overall maintain a market share of 5%. Table 1 lists the top 25 dealers, with the numbers and values of their acquisitions. Here, the leap of Agnew, in terms of value, over the other dealers becomes even more evident. From a total market value of about £4.8 million, £2.0 million can be attributed to Agnew, which amounts to a share of 43%. Each of the next ten largest players by market value reach only a tenth of this amount. Further, the top 10 dealers own more than 70% of the market in terms of number and value of acquisitions. This observation highlights how persistent the market positions of the top players were and how difficult it was to challenge these as an entrant.

We note that the study is based on the art dealership industry in London. Therefore, we cannot exclude the possibility that some dealers were also active in other markets. Paris, for instance, was also a significant trading location for art and it might well be the case that certain dealers had clients there and, consequently, exported to these markets. However, London was the most important art market in the 19th century and the beginning of the 20th century (Bayer, 2015). We, therefore, assume that dealers who had a strong competitive position in the UK art market were also successful in other markets.

The type of acquisitions in terms of artistic school made by the largest dealers is depicted in Table 2. First, we can see that the spread of the acquisitions across the four different schools is approximately the same for all of the top 10 dealers. Modern British is by far the most popular category. Except for two dealers (Colnaghi and Lesser), who focus more on Old Masters, the purchases of all dealers consist of more than 50% of Modern British artists. The Modern British school is followed by Continental Modern art, which accounts for 14% of overall acquisitions. Old Master paintings from the Low Countries as well as from the Continent are the least acquired categories with a share

of less than 10% each.¹¹ Another interesting finding in the table is that most of the top 10 dealers purchase a higher share of Modern British artists than other buyers. This fact points to a particular interest in this category by the largest dealers who probably were involved in the promotion of these artists and, thus, had a stake in their success. An overview of the top five artists purchased by the 10 largest dealers is provided in the appendix in Table A1. We also broke down acquisitions of the top 10 dealers by artistic genre (Table 3). Without exception, all of them concentrated their purchases in Landscape, Genre, and Portrait artworks. Landscape and Genre paintings were contemporary subjects which were the focus of most dealers. For instance, almost half of Angnew's, Vokin's and Permain's acquisitions consisted of Landscape paintings. Another commercial reason why it was important to acquire popular contemporary artworks was that it allowed to secure the copyrights on the prints of these artworks (Cooper, 1977, p.19). All other genres (Animal, History, Marine, Mythology, Religion, and Still Life) can in most cases be attributed to Old Master themes and were significantly less popular. There were some exception as some dealers seemed to secure some niche markets for themselves by acquiring larger than average shares of less popular genres. For instance, 11% of the dealer Tooth's acquisitions consisted of Animal paintings; the dealer Wertheimer concentrated 9% of his purchases in History paintings, while the dealer Lesser focused 12% of his purchases in Religion artworks. Overall, this break-down confirms, on the one hand, the large interest in contemporary local artists and, on the other hand, the low degree of specialization or diversification among the largest dealers in our data set.

In this section, we have illustrated the structure of the dealer industry throughout in the 19th century. The market initially consisted of a handful of dealers who dominated the market and captured a large market share in addition to a larger mass of dealers who were less influential with a significantly lower market share. There seem to be significant differences between art dealers and their attributes which determine success and survival in the market. In the following empirical analysis, we will focus in a multivariate setting on the life cycle of art dealers throughout the evolution of the art market.

¹¹The Low Countries include the Netherlands, Belgium and Luxemburg.

4 Empirical Analysis

4.1 Entry

What motivates dealers to enter into the art market? In particular, we aim to identify the factors that drove the evolution of the art dealership industry resulting in such a heterogeneous group of dealers. In the spirit of Rosenthal and Strange (2003) and Berry and Reiss (2007), we assume that firms will enter the market as far as their expected profits are non-negative. Hence, we empirically estimate the expected number of entrants per year using a count model controlling for competition and other market conditions. We assume that the number of entrants will have a Poisson distribution. Note that a standard Poisson model assumes equality between the mean and variance of the dependent variable, conditional on explanatory variables. If the assumption is violated, the maximum likelihood estimator will lead to inconsistent results. Hence, we employ a Poisson pseudo-maximum likelihood (PPML) estimator which is particularly efficient and robust. For PPML estimation, the data does not have to follow a Poisson distribution to produce consistent estimates. The only condition required for consistency is the correct specification of the conditional mean of the independent variable (see Silva and Tenreyro (2010); Wooldridge (1999)). In this setting, our dependent variable is the number of dealers entering in a given year and its conditional mean is given by:

$$E[y_t|A_t, K_t, X_t] = \exp(A'_t\alpha + K'_t\beta + X'_t\gamma). \quad (1)$$

To explain the number of entrants in the market, we include trading activity as an independent variable (represented by A). We use both, the number and the value of artworks bought by dealers in a given year t . Note that information on upcoming auctions is known well in advance. Our expectation is that, with higher trading activity, new players will be incentivized to enter the market.¹² The descriptive statistics in Table 4 show that the average annual number of artworks bought by dealers during this time period is between five and 603 with an average of 205 artworks. The mean of the dealer acquisitions reaches a value of £58,658. Additionally, we include the number of existing dealers to control for market competition as an explanatory variable (denoted by K).

As the overall national economy may have an effect on entry, we include a set of market charac-

¹²We do not lag the number of artworks as it is known to the dealers ex-ante how many objects are sold in the market. Hence, they can incorporate this information when making the decision about whether to participate in the market or not.

teristics (denoted by X) such as population, per capita income and the bond yield.¹³ These variables control for similar characteristics of the market and, thus, we include them separately in the regressions. Our expectation is that a growing population and more disposable income will have a positive effect on the demand for artworks and will create space for more players in the market. Further, we include the lagged annual bond yield as an explanatory variable to proxy opportunity costs. When interest rates are high, potential entrants may divert their excess financial capacity to bonds rather than art. As presented in Table 4, the average bond yield is around three percent. The population is about 12 million in 1828 and grows to 33.9 million by the end of the period. The real per capita income more than doubles during the time period from £2,870 to £6,530 per year.

As the art market matured, dealers started to act as principals instead of agents, buying for their own stock after 1850. Thus, we include a dummy for the years after 1850. We expect the coefficient of the after-1850 variable to have a positive effect on entry. For the analysis, we use the time period between 1830 and 1913 as data on per capita income was available only for the years after 1829.

The entry results are presented in Table 5. These findings show that the increase in the number of entrants is mainly driven by higher trading activity. The number and the value of artworks bought by dealers have both a positive and statistically significant effect on entry. Another important factor explaining entry is the current level of competition. As expected, the number of incumbents, a proxy for market competition, has a deterring effect on entry. The coefficient is highly significant in all regression specifications. However, none of the economic conditions show significant effects on dealer entry. Moreover, contrary to expectation, the post-1850 period does not seem to have any significant effect on entry. Additionally, to have a complete picture of the full period from 1800 until 1913, we run a separate regression including only the variables for which we have complete data (column 7). The results are qualitatively consistent with the findings in columns 1 to 6, namely that trading activity is positively correlated with entry, while competition discourages it. As entrants may need more time to adjust to increasing trading activity, we have repeated the regressions using lagged values of the number and value of artworks bought by dealers. The results can be found in the appendix in Table A3 (columns 1 to 6). Even though the coefficients slightly lose their magnitude, the qualitative results remain the same.

¹³The data on the per capita income and population was not part of the original data set and was extracted from the Bank of England and the UK Office for National Statistics.

Overall, we can infer that entry was driven by the increasing trading activity and was curbed as competition increased. This finding hints at the competitive dynamics of the art dealership industry. New, less informed dealers might already anticipate that they cannot compete against better informed dealers and decide to stay out of the market. In the subsequent part of the empirical analysis, we will investigate differences in the bidding strategies of large and small dealers.

4.2 Bidding Strategies

As previously described, in this study, our key interest is expertise and reputation and how bidding strategies and survival rates differ based on firm size. We consider two types of art dealers, which are denoted small and large dealers. The distinction between small and large dealers is made based on the previous year's accumulated market shares of the individual dealers. While large dealers have a market share of 10% or more, small dealers are rest of the population. We use the number and value of acquisitions per dealer by year to construct the variable.

We expect large dealers to pay higher prices than small dealers, on average, as the former have a better capacity to promote artists and dispose over a larger clientele and can, therefore, extract higher rents from their acquisitions. A first look at the summary statistics (Table 6) lends support to our hypothesis. Table 6 shows the level of prices paid and number of artworks acquired for different dealer types along different quantiles of the price distribution over the sample period 1850 to 1913. While Panel A presents summary statistics for large and small dealers defined by number of acquisitions, Panel B shows summary statistics for both groups when market shares are calculated based on the value of acquisitions. Independent of how market shares are defined, on average, large dealers seem to pay higher prices in every quantile of the price distribution. The difference becomes more pronounced for higher priced artworks. This makes intuitive sense as small dealers might have fewer funds, which restricts them when competing with large dealers for lower priced items.

Figures 5 and 6 present the corresponding unconditional densities for different distributions of the prices for large and small dealers. Figure 5 depicts the density function when market shares are defined by the number of acquisitions and Figure 6 shows the respective graph when market shares are defined by the value of acquisitions. In both representations, the price distribution of large dealers is shifted to the right. The differences in prices paid by both dealer types are especially

pronounced in higher price segments. The clear representation in these density functions confirms our findings in Table 6 and means that the distribution of winning bids of large dealers stochastically dominates the distribution of winning bids of small bidders. As a result, both the table and its graphical representations outline the same pattern, namely that large dealers appear to bid more aggressively than small dealers over the whole distribution of prices. Furthermore, Figures A1 and A2 show the development of average real prices paid for artworks by large and small dealers over time. We see an increase trend in averages prices for both dealer types. Nevertheless, in almost every year, large dealers appear to pay higher average prices than small dealers. This time trend perspective confirms our conjecture that large dealers have a higher value distribution than weak dealers.

We expected large bidders to exert a different influence on auction prices for artworks than small bidders. In particular, we expect that large bidders will bid more aggressively than small bidders. Large dealers are able to accumulate market power as a result of their experience, reputation and financial resources, which enabled them to create more value by promoting artists better than small dealers. Consequently, large dealers are able to extract higher rents from their acquisitions. Accordingly, large dealers had a higher value distribution than weak dealers. Our summary statistics reveal that large dealers pay higher prices for artworks across the whole distribution of winning bids. Given that artworks are very heterogeneous, it may, therefore, be that large dealers simply acquire more valuable artworks than small dealers. Hence, we continue with further testing the robustness of our results conditioned on the idiosyncratic characteristics of the artwork in a multivariate setting.

To estimate the influence of the dealer type on price, we regress the price of an artwork on dealer types; we include a dummy variable that equals one for large dealers and zero otherwise. Note that the bidder status, large or small, is not permanent and varies across time in our sample. As the dealer's reputation and expertise set might not only be reflected in the level of her market share, captured by the large dealer dummy, we are able to also control for other dealer characteristics in a direct way. We expect that a higher availability of funds will enable the dealer to afford more expensive artworks. Hence, we control for dealers' financial resources. The variable capacity is defined as the maximum total amount spent in a year before the current acquisition period. Further, to have a proxy for the dealer's experience, apart from her market share, the number of years of experience in the market up to the current transaction is controlled for. All three dealer characteristics are highly

correlated with one other and are, therefore, included in separate regression specifications.¹⁴

Furthermore, we are controlling for other factors related to the competitive landscape. First, we control for auction characteristics. These include the number of bidders and the lot sequence within a single auction sale. A single auction sale involves all transactions that were sold during one day in the same auction house with artworks commissioned by the same seller. As mentioned before, we cannot directly observe the number of bidders that were present at a sale. Therefore, we proxy them with the number of lots that were up for sale during a single auction event. In cases where the number of bidders was smaller than three, the value was replaced by number of lots sold during that day independent of the identity of the seller. As observed by Li and Zheng (2009), a higher number of competing bidders drive up the price. We also control for the lot sequence of an artwork. The timing when an item is sold can influence its price. Empirical studies provide evidence for both directions with respect to the expected effect of the lot sequence. While Ashenfelter (1989); Ginsburgh (1998); Ginsburgh and van Ours (2007) show that earlier lots fetch higher prices than later lots, Chanel et al. (1996); Deltas and Kosmopoulou (2004); Pesando and Shum (1996) illustrate that later lots yield higher prices at auction. Second, we control for rival characteristics. The attributes of rivals a dealer is faced with at auction, can affect her bidding behavior which in turn will influence prices. In particular, the presence of wealthier bidders or bidders with a lot of market power can drive up prices. We control for the rival's maximum capacity as well as the rival's maximum market share in terms of volume and value. The rival's maximum capacity equals the capacity of the bidder who displays the highest capacity among all bidders present in one auction sale. Similarly, a rival's maximum share equals the market share of the competing bidder who accumulated the largest market share among all rivals present in one auction event. All variables are lagged by one period to exclude the current sale.

Additionally, to control for the quality of the artwork, we include its observable characteristics. We follow the literature on hedonic pricing which assumes that it is possible to correctly estimate the price of every characteristic and that their sum equals the final sales price of the artwork. The size of an artwork significantly contributes to its price. However, this variable is not always recorded in the data, particularly for objects such as sculptures. To avoid loss of statistical power due to a reduced sample size and simultaneously remain conservative, we estimate every regression, both including as

¹⁴The correlation between the large dealer dummy, the capacity variable and the experience variables ranges from 48% to 77%.

well as excluding the artwork size. Our basic regression model has the following specification,

$$\ln P_{ijt} = D'_{jt}\beta + M'_{jt}\eta + X'_{it}\theta + \tau_t + \epsilon_{ijt}, \quad (2)$$

where $\ln P$ indicates the log of the real price of an artwork, i , bought by dealer j in a given year t . All dealer characteristics are captured in D , while rival characteristics are subsumed under M . X denotes the artwork's and auction characteristics. τ_t represents the time fixed-effects. Lastly, ϵ_{ijt} denotes the error term.

Table 7 reports the descriptive statistics for large and small dealers for the time period under investigation: 1850 to 1913. While panel A shows descriptive statistics by dealer types when dealers market share is calculated using the number of acquisitions, panel B reports the same information when dealers market shares are based on the value of acquisitions. We can see that large dealers are responsible for 6,967 sales out of 16,360 total dealer transactions. This is about 43% of the dealers' market.¹⁵ However, the total value of these large dealers' transactions accounts for 40% of the dealers' market share. A comparison of the past market shares, which were used to define large/small dealers, shows that our threshold of 10% offers a very clear-cut distinction. While large dealers reach, on average, between 24.1% and 31.3%, small dealers have a mean past market share of between 3.4% and 4.0%. From a total market value of about £4.8 million, small dealers obtain a share amounting to a sum between £163,200 and £192,000. It is important to note that the large dealer dummy is a dynamic variable and, hence, the large or small status is not permanent for a given bidder. Hence, the number of distinct small and large dealers and, consequently, the amount of transactions by these two dealer types changes from year to year. While Agnew, for instance, dominates the market most of the time, the positions of the other key players are less stable. When market share is defined by the number of transactions, there are, on average, five large dealers and 41 small dealers per year. Similarly, when market share is defined by the value of completed transactions, we have a mean of four large dealers and 42 small dealers per year (see appendix Table A4). The capacity of large dealers reaches, on average, almost ten times the capacity of small dealers (£11,370 and £96,363). This outlines the financial constraints of small dealers. Also, with respect to experience, large dealers have, on average, approximately twice as many years of experience (44

¹⁵Out of the 16,581 observations available for the years 1850 to 1913, we lose 221 observations due to missing values for the variables artist age and artist living status.

versus 24 years) as small dealers. From the descriptive statistics, we can infer that large and small dealers differ in their characteristics which will have an influence on their respective market power stemming from accumulated expertise and reputation. Furthermore, there are on average 28 rival bidders present at auction with a mean capacity of £1,126. The average market share of rivals is 23% in terms of volume and 25% in terms of value.

In Table 8 we present the regression results for the influence of dealer type on price. Columns 1 and 2 show the effect of large dealers on price when market shares are calculated based on number of acquisitions. Columns 3 and 4 present the results when market shares are based on value of acquisitions. In all four regression specifications, the large dealer dummy coefficient is positive and statistically significant. The interpretation of this result is that when the buyer is a large dealer, the expected estimated price is approximately 21% higher than if the buyer were a small dealer. The magnitude of the coefficient is similar when we use the value instead of the number of acquisitions to calculate market shares (21.2% and 23.2 %). Another way to interpret this result is that a large dealer estimates the additional value he can create in his role as a taste-maker at about 21% higher than what a small dealer could create in value given the characteristics of the artwork. As a result, expertise plays a substantial role in price. When size is added as an additional explanatory variable, the magnitude of the large dealer coefficient declines by two percent. However, it is still very important with an impact of about 1%. Experience, which is defined as the number of years in business, also has a statistically important effect on the expected price of the artwork. The coefficient indicates that an additional year of experience increases the expected price by about 10% (columns 5 and 6). In columns 7 and 8, we use capacity as the main explanatory variable. The coefficient on capacity is positive and statistically significant. It shows that dealers with high financial resources pay, on average, about 8.5% more. Moreover, the competitive landscape has important effect on price. Every additional bidder increases the price by 4% to 6%. In particular the presence of wealthy rivals puts upward pressure on price as can be seen by the positive and statistically significant coefficient on rival's past maximum capacity. Lastly, it appears that lots which are sold later within the auction sale fetch higher prices. This could be explained by the fact that dealers don't want to leave the auction sale empty-handed and thus increase their bids towards the end.

All results are robust for the inclusion of size as a control variable. As mentioned above, we examine bidding strategies after the year 1850 as this was the time when dealers started acting as

principals, buying artworks for their own inventory. To ensure robustness, we repeat these regressions while extending the sample period from 1828 to 1913. The regression results can be found in the appendix in Table A5. The results, especially with respect to the large dealer dummy, become even stronger. The coefficient of the large dealer dummy increases in magnitude, lending further support to our hypothesis that larger dealers pay, on average, higher prices for their acquisitions given the quality of the artwork.

So far, the results strongly support our conjecture that larger dealers pay higher prices at auction, which can be explained by their superior ability to promote artists in the market and access clients more easily. The large dealer dummy, our proxy for the dealer's overall expertise and reputation, financial capacity, and years of market experience, all confirm that larger dealers, on average, pay more for an artwork given its quality.

To see if these results also hold over the entire distribution, we estimate the above model using the quantile regression approach proposed by Koenker and Bassett Jr (1978). Panel A in Table 9 presents the results when large dealers are defined based on number of acquisitions. Panel B shows the results when the market share is calculated based on value of acquisitions. In both specifications, results indeed confirm that, at the more expensive end of the distribution, small bidders are less able to compete with large bidders. In the lowest quantile of the price distribution, large dealers pay, on average, between 14% and 19% more than small dealers (depending on how market share is defined). Interestingly, the difference in prices paid by the two dealer types is lowest in the 25th quantile of the price distribution (10% and 15%). This may indicate that, even if a dealer is smaller, she may be more competitive in the lower-mid-quality range than for the lowest quality artworks. From the 50th percentile onward, the difference becomes even more pronounced, peaking in the 90th percentile where large dealers pay about 35% more than small dealers given the characteristics of the artwork. Generally, the difference between the two dealer types with respect to their influence on price is slightly larger when the value of transactions is used to construct market shares. However, coefficients in Panels A and B get very close to each other in the upper part of the distribution of the price.

Note that, in all regressions, we have not used a full set of dealer fixed effects. The reason for this decision is that there is not enough variation within individual dealers with respect to the dealer type. As such, the dealer type is sticky, meaning that a dealer who is considered large does not often

switch her status to that of a small dealer.¹⁶ As a robustness check, we repeat the regression models controlling for the top 10 dealers versus other dealers. These results are presented in Table A6. The findings are consistent with large dealers paying higher prices than weak dealers. For example, we see that Agnew bids on average 41% more than other dealers.

In summary, the results in this section provide strong statistical support to the conjecture that large dealers pay higher prices in auctions than small dealers given the characteristics of the artwork. This is especially the case for higher priced artworks. Moreover, dealers of larger size do not seem to simply recognize and buy artworks of better quality. Instead, they appear to have accumulated attributes such as expertise, reputation and financial resources which enable them to do a better job of promoting artists in the market and, thereafter, when reselling, can charge higher prices. Thus, large dealers appear to act as taste-makers who can make the market. The higher prices paid at acquisition indirectly reflect expertise and reputation, which then feeds back into the market as an intangible value for which a premium can be charged on resale. In the next section, we aim to underpin this hypothesis even further by analyzing the survival rates of large and small dealers.

4.3 Exit Patterns

We are also interested in learning whether the large dealers' strategy of acquiring artworks at higher prices is sustainable. If large dealers indeed pay higher prices, as they possess have a better reputation and expertise which enables them to promote artists in the market more effectively and extract higher profits from their acquisitions, we expect them to survive longer than small dealers. In this case, smaller dealers, who don't manage to scale up to a certain firm size, should leave the market as they fail to generate sufficient profits to sustain the dealership. However, if large dealers consistently overpay and cannot recover the amount spent on the acquisition of artworks, we should observe them exiting the market with a higher probability than small dealers.

To investigate which dealer type has a relatively higher chance of survival in the market, a simple probit model is employed. The binary dependent variable, *exit*, takes the value of one if the dealer exits the market in a given year and zero otherwise. We consider market inactivity of a dealer as an exit if there were no purchase or sale transactions for three consecutive years. We allow for a

¹⁶The average variation of the dealer type change per dealer is 0.7 when market share is defined by number of acquisitions and 0.6 when market share is defined by value of acquisitions. Out of 130 dealers, there are 86 dealers (100 when market share is calculated by value of acquisitions) who have never changed dealer type at all over the whole sample period.

break of three years before we define dealer inactivity (buyer or selling) as an exit. This allows for the possibility that dealers remain active elsewhere and may replenish supply either through private acquisitions or in other public sales outside of London. A period of three years was selected based on the distribution of the years of market absence among dealers in the sample.¹⁷ In the case of an exit, we still cannot exclude the possibility that the dealer is still active as an art dealer in a different market or auction house. Nevertheless, as the London auction market was considered the most important art market at the time, we interpret an exit as a sign of market failure. Dealers are considered re-entrants when they exit the market and make a first acquisition upon their return. Therefore, re-entrants are considered as entrants with past experience.¹⁸ Our definition of firms with past experience is similar to Dunne et al. (2005), where they examine the exit patterns of firms with past experience in the manufacturing industry. Entry status is not permanent and all dealers are considered incumbents after the initial year of entry or re-entry. While most of the dealers entered after 1850, many dealers exited and re-entered the market several times. We identify re-entrants using a dummy variable that takes the value of one if a dealer was active in the market before and zero otherwise. If a dealer was active in the market in the past, it should help her to survive in the market due to more accumulated information. Hence, she should have a lower likelihood of exit. Furthermore, we control for market conditions and year effects. Similar to the entry analysis, we expect that favorable market conditions (i.e., more trading activity, higher artwork prices, a prospering population and low opportunity costs) should increase survival probability. Due to the fact that all market condition variables exhibit a high correlation with each other, we include them separately in different regression specifications. Note that, as we are interested in the full life-cycle of the dealers, we use only firms that entered or re-entered from 1828 to 1910. We do not use entrants or re-entrants after 1910 and this gives us an opportunity to track dealers for at least three years since they last participated in the market. This ensures that they are not active again within at least three years. We use a simple probit model to analyze exit and the empirical specification has the following form:

$$Pr(Exit = 1|Z) = \Phi(Z'_{jt}\lambda), \quad (3)$$

¹⁷In our sample, 98% of all dealers were not active in the market as buyers or sellers for a maximum of three years.

¹⁸In order to define exit and re-entry, we count the number of inactive years per dealer. We define years of inactivity as years in which neither sale nor purchase transactions were completed by the dealers. However, only purchase transactions are considered to define entry.

where the independent variables Z can be classified into three main groups D , E , and M . D denotes the dealer j 's type at exit, E represents whether dealer j is a firm with past market experience, and M includes proxies for the market conditions. Φ is the cumulative normal distribution.

Table 10 shows the descriptive statistics for the main explanatory variables for large and small dealers used in our exit analysis. While Panel A presents the descriptive statistics when market share is defined by number of acquisitions, Panel B shows the values when market share is determined using the value of acquisitions. The most important insight that can be inferred from Table 10 is that the probability of exit is much higher for small dealers (12%) than for large dealers (4%). As before, and subject to our definition, large dealers have a much larger market share (19% to 23%) than small dealers (one percent). There are also more dealers with past experience among the large dealers (87%) than among small dealers (69%). Furthermore, the financial resources of large dealers exceed small dealers' funds fivefold.

The results of the probit regression are reported in Tables 11 and 12. Table 11 reports the regression coefficients when market share is defined by number of acquisitions and Table 12 shows the results when market shares are determined using value of acquisitions. For all regression coefficients, we report the marginal effects. The results indicate that, independent of the inclusion of market condition variables, both tables show consistent effects for the large dealer dummy. The probability of exiting the market is between 6.7% and 8.2% lower when a dealer is defined as large rather than small. As expected, previous market experience alleviates the probability of exit. A dealer with past experience is between 7.6% and 7.8% less likely to exit the market than a dealer who has no previous experience. Both results are statistically significant. The coefficients of the market condition variables have the expected signs and are all statistically significant. For instance, higher average prices for artworks decrease the probability of exit as a booming market provides more profits. Higher bond yields, on the other hand, increase the probability of exit by about 8% which reflects the opportunity cost of investing in other financial assets. Since the results might only be driven by the amount of financial resources a dealer has access to, we repeated the estimation using capacity as the main explanatory variable instead of the large dealer dummy. The results can be found in the appendix in Table A7. While the coefficient of the capacity variable is statistically significant and negative, it is smaller in magnitude (minus five percent). Consequently, although financial funds are an important source for accumulating market share for dealers, it cannot solely explain them. As a result, the

dealer's expertise and reputation remain important attributes for an effective promotion of artists in the market and the establishment of large client base.

Overall, the results in this part of the analysis show that the large dealers' strategy of paying higher prices indeed reflects their better reputation and higher expertise. This can be explained by their superior ability to promote an artist in the market and eventually extract higher rents on future re-sales. Large dealers are able to create a higher intangible value by guaranteeing the quality of the artworks they purchase. Clients seem to be willing to pay for this information production in the form of higher premiums. Furthermore, our findings provide evidence that dealers are more likely to fail to compete in the market unless they manage to build up sufficient financial capacity and experience to become a large dealer. This highlights the importance of size and market power for maintaining a competitive position.

5 Concluding Remarks

This is the first study to empirically put a value on expertise and reputation within the course of the evolution of a new industry characterized by uncertainty and heterogeneity. Having access to a unique data set, which covers the period of the formation of the contemporary art market and the emergence of the modern-day art dealer in the United Kingdom, gives us the opportunity to use the art market as a case study. Due to the heterogeneous nature of art as a good and the resulting importance of experts to add value, the art market provides a good example to study the value addition created by these intermediaries. We use the evolution of the art dealership industry to show how dealer expertise and reputation, as a result of accumulated firm size, affects market dynamics that govern entry, exit and growth.

We show that sales of artworks at auction exponentially increased over the market evolutionary period from 1800 to 1913. At the same time, the number of art dealers multiplied four-fold within the period 1850 to 1913. During this time, dealers became the dominant buyers at auction. This development marked their professionalization and the establishment of art dealership as an industry. Dealer entry was primarily motivated by an increased trading activity and was curbed by a higher level of competition. We further provide insights on the strategic acquisition behavior of dealers who differ in their firm size and, thus, expertise and reputation. In particular, our evidence suggests

that dealers with a higher market share have a positive effect on the auction price beyond what is predicted by the characteristics of an artwork. These large dealers tend to pay about 21% more than small dealers. This effect is valid for the whole distribution of prices. We further show that large dealers are about 7.5% more likely to survive in the market than small dealers. Our results are robust for market shares specified as the number or value of total acquisitions.

Our results support the conjecture that auctions provide an advantage to large bidders with more expertise and better reputation for heterogeneous objects whose value is uncertain. We provide support for the findings in the area of financial intermediation, namely that firms with more expertise and higher capability to resolve information asymmetries perform better in the market as among others presented by Ertugrul and Krishnan (2011); Golubov et al. (2012); Song et al. (2013). In addition, we contribute to the field of industry evolution research by demonstrating firm-level dynamics in an industry characterized by heterogeneity. Although providing comparable evidence as to other markets, the most revealing finding in this analysis is that we can put a value on the expertise as well as explain how firm size helps sustain performance in a market evolutionary setting.

Our findings can be widely applied to auctions, specifically for heterogeneous goods. Another prominent area of application is the real estate market. In the acquisition of real estate, price uncertainty is a central concern. These include the future development of the neighborhood in which the object is located, the construction quality of the building, as well as the outlook of the real estate market as a whole. Other examples of industries where expertise and reputation information is crucial and can yield substantial advantages due to its opaque nature is venture capital, merger and acquisition advisory, and the security underwriting industry. More generally, the results can further be applied to any other industry where entry, exit and growth are subject to information asymmetries between firms.

Our paper provides a useful empirical study that observes an industry characterized by significant uncertainties concerning the value of a good. Insight into historical information of dealers helps us to quantify expertise and reputation and explain how firm size affects dealers' bidding behavior and their subsequent survival in the market over its evolution. Our results provide a crucial step in understanding how experts evolve and influence market prices.

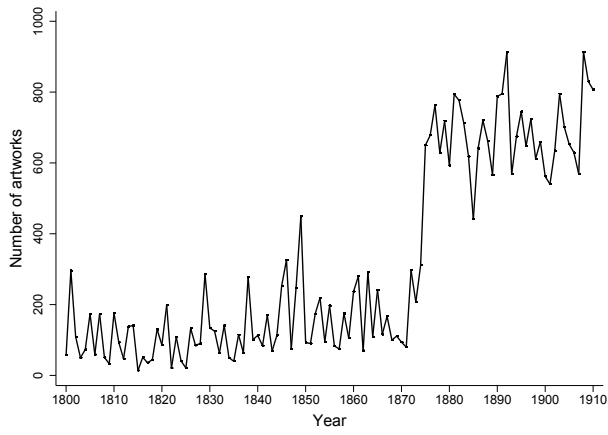
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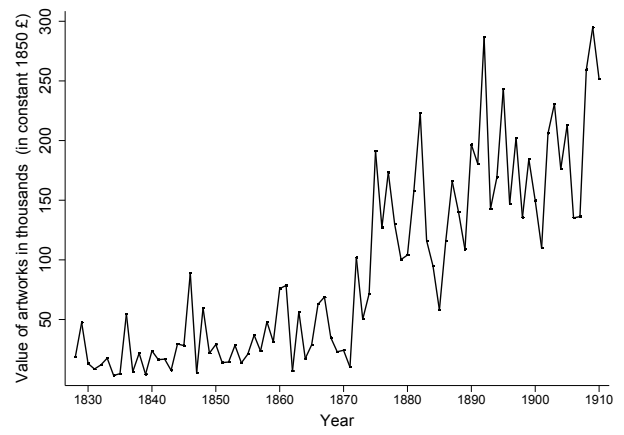
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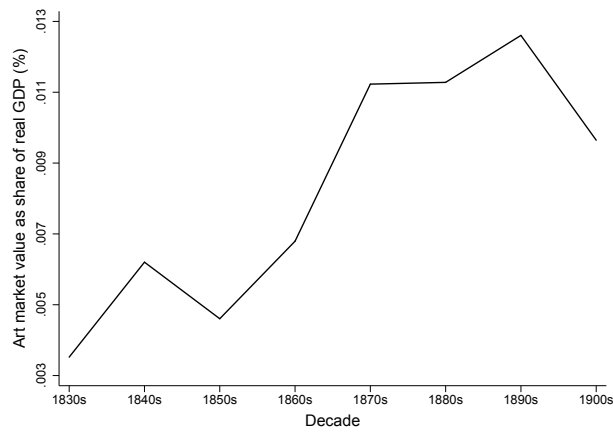
Figures



(a) Size of market (by number)

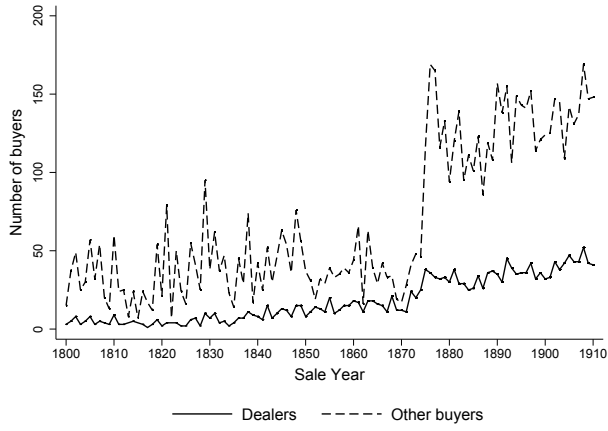


(b) Size of market (by value)

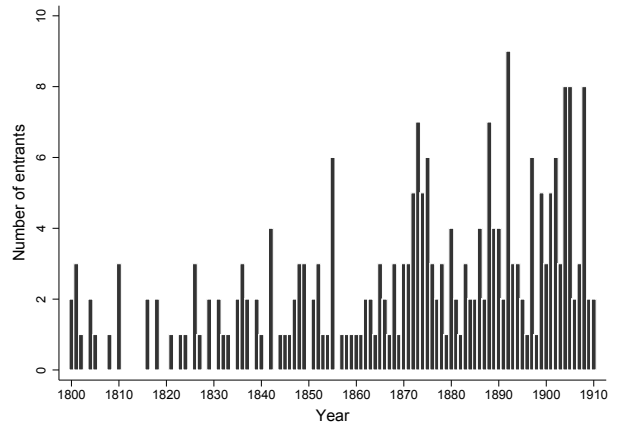


(c) The art market as a share of GDP

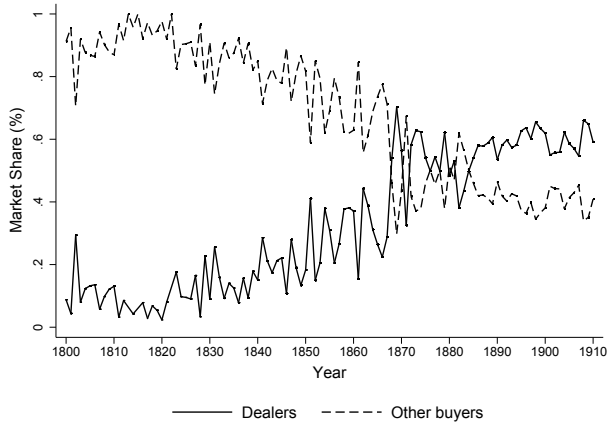
Figure 1: Art Market Evolution (1800-1913)



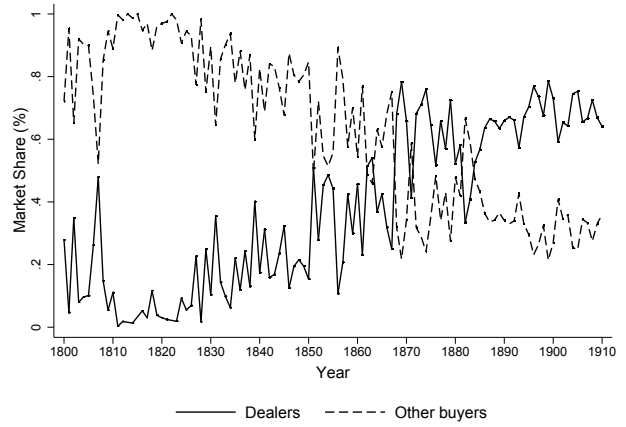
(a) Number of buyers in the market



(b) Number of entrants in the market



(c) Proportion of market captured by buyers (by number)



(d) Proportion of market captured by buyers (by value)

Figure 2: Art Market Evolution - Buyers (1800-1913)

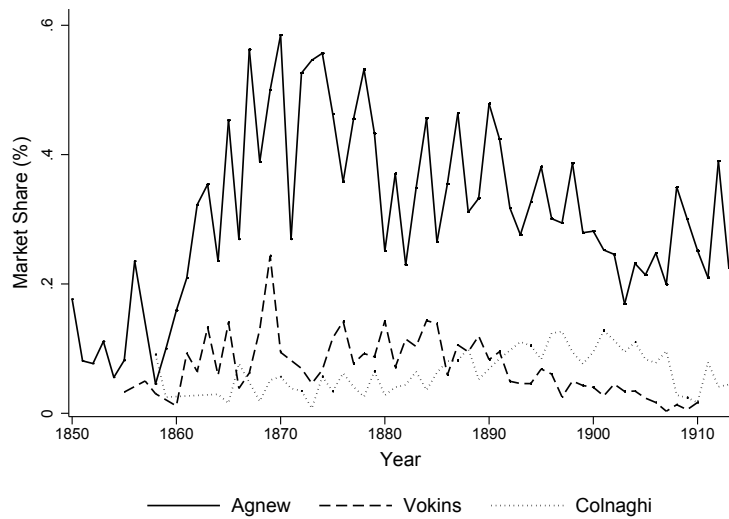


Figure 3: Market Shares 1850-1913 - Top 3 (dealer market)

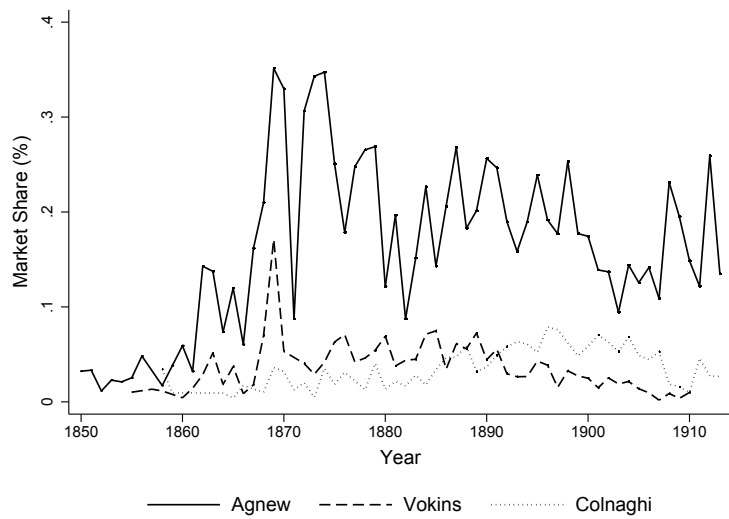


Figure 4: Market Shares 1850-1913 - Top 3 (whole market)

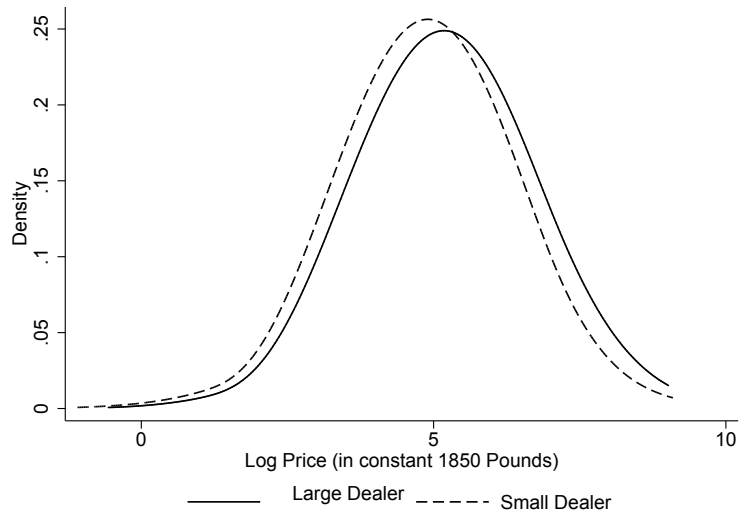


Figure 5: Large and Small Dealers (by number of acquisitions)



Figure 6: Large and Small Dealers (by value of acquisitions)

Tables

Table 1: Top 25 dealers with number and value of acquisitions

| Rank | Dealer | Number of Acquisitions | Value of Acquisitions (in constant 1850 £) |
|--------|-------------------|------------------------|---|
| 1 | Agnew | 5,469 | 2,048,069.00 |
| 2 | Colnaghi | 1,126 | 343,614.60 |
| 3 | Vokins | 999 | 213,989.70 |
| 4 | Tooth | 906 | 221,443.80 |
| 5 | Wallis | 823 | 213,925.50 |
| 6 | McLean | 754 | 127,714.60 |
| 7 | Gooden & Fox | 609 | 150,744.30 |
| 8 | Permain | 399 | 59,701.42 |
| 9 | Wertheimer | 322 | 225,116.60 |
| 10 | Lesser | 304 | 54,234.73 |
| 11 | Sampson | 277 | 39,956.71 |
| 12 | Smith | 262 | 49,071.33 |
| 13 | White | 232 | 46,380.61 |
| 14 | Leggatt | 208 | 21,783.16 |
| 15 | Shepherd | 200 | 22,163.04 |
| 16 | Graves | 197 | 37,295.82 |
| 17 | Polak | 170 | 15,524.76 |
| 18 | Lawrie | 144 | 68,065.40 |
| 19 | Dowdeswell | 136 | 39,376.35 |
| 20 | Sedelmeyer | 128 | 40,439.52 |
| 21 | Davis | 128 | 76,061.21 |
| 22 | Gambart | 115 | 31,009.02 |
| 23 | Pilgram & Lefevre | 114 | 31,560.53 |
| 24 | Grindley | 113 | 12,582.82 |
| 25 | Obach | 102 | 31,209.49 |
| 26-138 | Others | 2,344 | 569,018.93 |

Table 2: Top 10 dealers with share of acquisitions by school (in %)

| Rank | Dealer | Modern British | Modern Continental | Old Master Continental | Old Master Low Countries |
|--------|--------------|----------------|--------------------|------------------------|--------------------------|
| 1 | Agnew | 83.5 | 9.3 | 2.2 | 4.6 |
| 2 | Colnaghi | 45.1 | 14.3 | 9.6 | 29.0 |
| 3 | Vokins | 88.0 | 9.3 | 1.3 | 1.1 |
| 4 | Tooth | 69.6 | 27.0 | 0.6 | 2.7 |
| 5 | Wallis | 61.5 | 31.4 | 1.4 | 5.2 |
| 6 | McLean | 81.9 | 14.4 | 0.8 | 2.4 |
| 7 | Gooden & Fox | 76.1 | 13.8 | 3.1 | 5.9 |
| 8 | Permain | 90.8 | 5.5 | 1.0 | 2.3 |
| 9 | Wertheimer | 52.6 | 21.4 | 3.4 | 21.7 |
| 10 | Lesser | 28.6 | 14.8 | 12.8 | 43.4 |
| 11-138 | Others | 64.6 | 16.0 | 4.8 | 14.2 |
| Total | | 71.5 | 14.2 | 3.6 | 9.9 |

Percentages do not sum up to 100 as artworks which could not be attributed to a school (others) were excluded.

Table 3: Top 10 dealers with share of acquisitions by genre (in %)

| Rank | Dealer | Animal | Genre | History | Landscape | Marine | Mythology | Portrait | Religion | Still life |
|--------|--------------|--------|-------|---------|-----------|--------|-----------|----------|----------|------------|
| 1 | Agnew | 6.0 | 17.7 | 5.2 | 41.1 | 3.1 | 3.3 | 14.9 | 4.3 | 2.0 |
| 2 | Colnaghi | 4.5 | 14.7 | 8.7 | 26.2 | 2.2 | 1.5 | 29.5 | 8.9 | 1.7 |
| 3 | Vokins | 6.2 | 18.5 | 5.8 | 41.3 | 3.3 | 3.6 | 10.5 | 3.7 | 4.6 |
| 4 | Tooth | 10.9 | 23.4 | 4.6 | 34.1 | 3.1 | 3.2 | 12.6 | 2.6 | 2.2 |
| 5 | Wallis | 5.8 | 25.5 | 5.9 | 32.7 | 2.4 | 1.1 | 17.0 | 4.3 | 1.3 |
| 6 | McLean | 5.7 | 20.9 | 6.6 | 38.9 | 2.1 | 2.9 | 13.5 | 3.6 | 2.3 |
| 7 | Gooden & Fox | 5.6 | 18.7 | 5.1 | 38.1 | 2.1 | 3.8 | 17.8 | 3.1 | 2.5 |
| 8 | Permain | 6.5 | 15.0 | 4.3 | 45.1 | 3.0 | 3.8 | 11.3 | 3.8 | 3.3 |
| 9 | Wertheimer | 2.8 | 17.7 | 9.3 | 11.5 | 0.9 | 1.9 | 46.4 | 3.4 | 1.9 |
| 10 | Lesser | 5.6 | 19.1 | 4.0 | 24.0 | 1.0 | 1.3 | 28.0 | 11.5 | 1.0 |
| 11-138 | Others | 7.9 | 17.9 | 9.1 | 27.1 | 2.4 | 3.7 | 21.3 | 6.1 | 2.1 |
| Total | | 6.7 | 18.4 | 6.8 | 33.9 | 2.6 | 3.2 | 18.4 | 5.1 | 2.2 |

Percentages do not sum up to 100 as artworks which could not be attributed to a school (others) were excluded.

Table 4: Summary statistics for market characteristics between 1830-1913

| Variables | Summary statistics | |
|---|--------------------|----------|
| | Mean | Sd |
| Average number of artworks bought by dealers per year | 205.3 | 181.4 |
| Average value of artworks bought by dealers per year | 58,657.9 | 58,685.0 |
| Annual bond yield (in %) | 3.0 | 0.4 |
| Population (in mn) | 2.20 | 0.68 |
| Real per capita income (in £) | 43.2 | 11.6 |

Only the dealer sample is considered for the analysis. All prices are in constant £1850.

Table 5: Entry results

| Variables | Number of entrants | | | | | | |
|--|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Number of artworks bought by dealers (log) | 0.767*** (0.131) | 0.712*** (0.110) | 0.668*** (0.105) | | | | 0.641*** (0.125) |
| Value of artworks bought by dealers (log) | | | | 0.465*** (0.096) | 0.445*** (0.078) | 0.383*** (0.074) | |
| Number of incumbents | -0.048*** (0.010) | -0.049*** (0.010) | -0.051*** (0.012) | -0.022*** (0.008) | -0.024*** (0.007) | -0.026*** (0.009) | -0.061*** (0.011) |
| Lagged population (log) | -0.688 (0.490) | | | -0.683 (0.544) | | | 1.023** (0.464) |
| Lagged real per capita income in £ (log) | | -0.414 (0.349) | | | -0.578 (0.358) | | |
| Lagged annual bond yield | | | 0.026 (0.219) | | | 0.065 (0.224) | |
| After 1850 | 0.221 (0.191) | 0.102 (0.173) | 0.116 (0.177) | 0.024 (0.233) | -0.100 (0.228) | -0.044 (0.222) | 0.215 (0.280) |
| Observations | 83 | 83 | 83 | 83 | 83 | 83 | 113 |
| Pseudo log-likelihood | -144.3 | -143.8 | -145.7 | -146.9 | -146.8 | -147.8 | -190.3 |

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
All prices are in constant £1850.

Table 6: Prices paid by dealers types between 1850-1913

| Panel A: Dealer type defined by number of acquisitions | | | | |
|--|---------------|---------------|---------------|---------------|
| Quantiles | Large dealers | | Small dealers | |
| | N | Average price | N | Average price |
| q10 | 705 | 56.74 | 953 | 50.21 |
| q25 | 1,056 | 89.19 | 1,442 | 76.88 |
| q50 | 1,758 | 163.60 | 2,369 | 124.48 |
| q75 | 1,764 | 348.85 | 2,389 | 239.22 |
| q90 | 1,056 | 771.05 | 1,431 | 480.88 |
| Panel B: Dealer type defined by defined by value of acquisitions | | | | |
| Quantiles | Large dealers | | Small dealers | |
| | N | Average price | N | Average price |
| q10 | 657 | 60.00 | 997 | 47.84 |
| q25 | 985 | 91.66 | 1,499 | 76.63 |
| q50 | 1,641 | 167.37 | 2,515 | 124.23 |
| q75 | 1,643 | 354.65 | 2,501 | 241.70 |
| q90 | 985 | 784.73 | 1,500 | 487.02 |

All prices are in constant £1850.

Table 7: Summary statistics for large and small dealers between 1850-1913

| Panel A: Dealer type defined by number of acquisitions | | | | | | |
|--|---------------|---------|--------|---------------|--------|-------|
| Variables | Large dealers | | | Small dealers | | |
| | N* | Mean | Sd | N* | Mean | Sd |
| Past market share | 6,967 | 0.241 | 0.071 | 9,393 | 0.040 | 0.028 |
| Capacity | 6,967 | 96,363 | 52,091 | 9,393 | 11,370 | 9,085 |
| Experience | 6,967 | 43.7 | 14.9 | 9,393 | 24.2 | 14.8 |
| Panel B: Dealer type defined by value of acquisitions | | | | | | |
| Variables | Large dealers | | | Small dealers | | |
| | N* | Mean | Sd | N* | Mean | Sd |
| Past market share | 6,503 | 0.313 | 0.108 | 9,857 | 0.034 | 0.026 |
| Capacity | 6,503 | 101,913 | 49,356 | 9,857 | 11,709 | 9,303 |
| Experience | 6,503 | 44.0 | 14.9 | 9,857 | 24.9 | 15.1 |
| Panel C: Control variables | | | | | | |
| Variables | | | | Mean | Sd | |
| Number of bidders | | | | 28.215 | 24.989 | |
| Lot sequence | | | | 17.864 | 17.682 | |
| Rival's past maximum capacity (in £) | | | | 1,126 | 4,911 | |
| Rival's past maximum share by volume | | | | 0.232 | 0.214 | |
| Rival's past maximum share by value | | | | 0.254 | 0.249 | |

All prices are in constant £1850.

*Values correspond to number of art works bought.

Table 8: Influence of dealer type on price

| Variables | Log of price | | | | | | | |
|--|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Large dealers (<i>Top 10% by number</i>) | 0.212*** (0.066) | 0.189*** (0.068) | | | | | | |
| Large dealers (<i>Top 10% by value</i>) | | | 0.232*** (0.063) | 0.203*** (0.068) | | | | |
| Experience (log) | | | | | 0.099** (0.043) | 0.092* (0.047) | | |
| Dealer capacity (log) | | | | | | | 0.085*** (0.013) | 0.084*** (0.014) |
| Number of bidders (log) | 0.039* (0.020) | 0.057*** (0.021) | 0.039* (0.021) | 0.058*** (0.021) | 0.040** (0.019) | 0.056*** (0.021) | 0.036* (0.019) | 0.054*** (0.020) |
| Log of lot sequence (log) | 0.153*** (0.030) | 0.058*** (0.017) | 0.153*** (0.030) | 0.059*** (0.017) | 0.153*** (0.030) | 0.058*** (0.017) | 0.151*** (0.031) | 0.056*** (0.018) |
| Rival's past maximum capacity (log) | 0.013** (0.006) | 0.027* (0.014) | 0.013** (0.006) | 0.027** (0.013) | 0.013** (0.006) | 0.027* (0.014) | 0.016** (0.007) | 0.031** (0.014) |
| Rival's past maximum share (log) (<i>By volume</i>) | | | -0.004 (0.056) | 0.078 (0.060) | -0.258 (0.159) | -0.139 (0.132) | -0.042 (0.056) | 0.035 (0.062) |
| Rival's past maximum share (log) (<i>By value</i>) | 0.048 (0.061) | 0.101** (0.051) | | | 0.309* (0.156) | 0.262** (0.124) | | |
| Size (log) | | 0.405*** (0.038) | | 0.405*** (0.038) | | 0.405*** (0.038) | | 0.406*** (0.037) |
| Year effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Season effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Auction house effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Artist effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Seller effects | Yes | Yes | Yes | Yes | No | No | Yes | Yes |
| Observations | 16,360 | 5,842 | 16,360 | 5,842 | 16,360 | 5,842 | 16,360 | 5,842 |
| R ² | 0.515 | 0.577 | 0.515 | 0.577 | 0.512 | 0.575 | 0.519 | 0.582 |

Standard errors clustered by dealers in parentheses. *** p<0.01, ** p<0.05, * p<0.1
All prices are in constant £1850.

Table 9: Quantile regression results

| Panel A: Dealer type defined by number of acquisitions | | | | | |
|---|---------------------|---------------------|---------------------|---------------------|---------------------|
| Variables | Log of price | | | | |
| | q10 | q25 | q50 | q75 | q90 |
| Large dealer (<i>Top 10% by number</i>) | 0.135*** (0.032) | 0.104*** (0.019) | 0.192*** (0.016) | 0.275*** (0.026) | 0.336*** (0.049) |
| Number of bidders (log) | 0.159*** (0.017) | 0.083*** (0.007) | 0.064*** (0.010) | 0.057*** (0.011) | 0.059*** (0.021) |
| Log of lot sequence (log) | 0.074*** (0.014) | 0.085*** (0.007) | 0.144*** (0.007) | 0.223*** (0.007) | 0.275*** (0.017) |
| Rival's past maximum capacity (log) | 0.099*** (0.008) | 0.049*** (0.006) | 0.028*** (0.004) | 0.010** (0.005) | -0.005 (0.006) |
| Rival's past maximum share (log) (<i>By value</i>) | 0.168*** (0.064) | 0.085*** (0.031) | 0.042 (0.026) | 0.029 (0.051) | 0.092 (0.069) |
| Other characteristics | Yes | Yes | Yes | Yes | Yes |
| Observations | 16,360 | 16,360 | 16,360 | 16,360 | 16,360 |

| Panel B: Dealer type defined by value of acquisitions | | | | | |
|--|---------------------|---------------------|---------------------|---------------------|---------------------|
| Variables | Log of price | | | | |
| | q10 | q25 | q50 | q75 | q90 |
| Large dealer (<i>Top 10% by number</i>) | 0.187*** (0.023) | 0.148*** (0.014) | 0.214*** (0.018) | 0.286*** (0.026) | 0.364*** (0.047) |
| Number of bidders (log) | 0.155*** (0.027) | 0.083*** (0.015) | 0.060*** (0.014) | 0.057*** (0.019) | 0.054* (0.031) |
| Log of lot sequence (log) | 0.074*** (0.012) | 0.085*** (0.006) | 0.145*** (0.006) | 0.224*** (0.010) | 0.275*** (0.009) |
| Rival's past maximum capacity (log) | 0.098*** (0.010) | 0.049*** (0.005) | 0.026*** (0.003) | 0.010* (0.006) | -0.008 (0.009) |
| Rival's past maximum share (log) (<i>By volume</i>) | 0.085 (0.058) | 0.003 (0.032) | -0.009 (0.035) | -0.017 (0.051) | -0.062 (0.072) |
| Other characteristics | Yes | Yes | Yes | Yes | Yes |
| Observations | 16,360 | 16,360 | 16,360 | 16,360 | 16,360 |

Bootstrapped standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

All prices are in constant £1850.

Table 10: Summary statistics for large and small dealers between 1850-1913

| Panel A: Dealer type defined by number of acquisitions | | | | |
|--|---------------|----------|---------------|---------|
| Variables | Large dealers | | Small dealers | |
| | Mean | Sd | Mean | Sd |
| Probability of exit* | 0.040 | 0.197 | 0.116 | 0.320 |
| Past market share | 0.190 | 0.071 4 | 0.014 | 0.022 |
| Dealers with past experience | 0.874 | 0.333 2 | 0.687 | 0.464 |
| Capacity | 18,068.9 | 37,075.4 | 3,779.9 | 5,402.4 |

| Panel B: Dealer type defined by value of acquisitions | | | | |
|---|---------------|----------|---------------|---------|
| Variables | Large dealers | | Small dealers | |
| | Mean | Sd | Mean | Sd |
| Probability of exit* | 0.028 | 0.165 | 0.116 | 0.320 |
| Past market share | 0.234 | 0.112 | 0.014 | 0.023 |
| Dealers with past experience | 0.846 | 0.362 | 0.695 | 0.461 |
| Capacity | 20,723.1 | 40,309.2 | 3,839.7 | 5,528.1 |

All prices are in constant £1850.

*Multiple entries and exits by dealers are possible during the sample period.

Table 11: Exit probabilities - Dealer type defined by number of acquisitions

| Variables | Exit | | | | |
|--|----------------------|----------------------|----------------------|----------------------|----------------------|
| | (1) | (2) | (3) | (4) | (5) |
| Large dealer (<i>top 10% by number</i>) | -0.067*** (0.012) | -0.067*** (0.012) | -0.067*** (0.012) | -0.067*** (0.012) | -0.068*** (0.012) |
| Dealer with past experience | -0.076*** (0.013) | -0.077*** (0.013) | -0.076*** (0.013) | -0.076*** (0.013) | -0.076*** (0.013) |
| Value of artworks bought by dealers (log) | -0.011** (0.005) | | | | |
| Number of artworks bought by dealers (log) | | -0.012** (0.006) | | | |
| Average price per art work (log) | | | -0.045*** (0.016) | | |
| Real per capita income in £ (log) | | | | -0.055** (0.027) | |
| Annual bond yield | | | | | 0.078*** (0.027) |
| Year effects | Yes | Yes | Yes | Yes | Yes |
| Observations | 3,098 | 3,098 | 3,098 | 3,098 | 3,098 |
| Wald χ^2 | 113.1 | 112.6 | 113.2 | 112.8 | 116.6 |

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

All prices are in constant £1850. The regression coefficients are transformed into marginal effects.

Table 12: Exit probabilities - Dealer type defined by value of acquisitions

| Variables | Exit | | | | |
|---|----------------------|----------------------|----------------------|----------------------|----------------------|
| | (1) | (2) | (3) | (4) | (5) |
| Large dealer (<i>top 10% by value in £</i>) | -0.082*** (0.010) | -0.082*** (0.011) | -0.082*** (0.010) | -0.082*** (0.011) | -0.082*** (0.010) |
| Dealer with past experience | -0.077*** (0.013) | -0.078*** (0.013) | -0.077*** (0.013) | -0.078*** (0.013) | -0.077*** (0.013) |
| Value of artworks bought by dealers (log) | -0.011** (0.005) | | | | |
| Number of artworks bought by dealers (log) | | -0.013** (0.006) | | | |
| Average price per artwork (log) | | | -0.046*** (0.016) | | |
| Real per capita income in £ (log) | | | | -0.056** (0.027) | |
| Annual bond yield | | | | | 0.077*** (0.027) |
| Year effects | Yes | Yes | Yes | Yes | Yes |
| Observations | 3,098 | 3,098 | 3,098 | 3,098 | 3,098 |
| Wald χ^2 | 119.4 | 118.7 | 119.6 | 118.6 | 122.2 |

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

All prices are in constant £1850. The regression coefficients are transformed into marginal effects.

Appendix

Table A1: Top 10 dealers with most popular acquisitions by artist

| Rank | Dealer | Top 5 artists acquired | Number of acquisitions |
|--------|--------------|-----------------------------|------------------------|
| 1 | Agnew | William Turner | 543 (9.9%) |
| | | David Cox | 227 (4.1%) |
| | | Edwin Henry Landseer | 121 (2.2%) |
| | | John Linnell | 121 (2.2%) |
| | | Copley Fielding | 118 (2.2%) |
| 2 | Colnaghi | Joshua Reynolds | 52 (4.5%) |
| | | Thomas Gainsborough | 51 (4.1%) |
| | | George Romney | 41 (3.6%) |
| | | Francesco Guardi | 33 (2.9%) |
| | | Jacob van Ruisdael | 27 (2.4%) |
| 3 | Vokins | William Turner | 90 (8.9%) |
| | | William Holman Hunt | 46 (4.6%) |
| | | Copley Fielding | 41 (4.1%) |
| | | Myles Birket Foster | 34 (3.4%) |
| | | Peter De Wint | 30 (3.0%) |
| 4 | Tooth | Myles Birket Foster | 29 (3.2%) |
| | | John Linnell | 28 (3.1%) |
| | | Benjamin Williams Leader | 27 (3.0%) |
| | | Joshua Reynolds | 22 (2.4%) |
| | | Eugène Joseph Verboeckhoven | 20 (2.2%) |
| 5 | Wallis | William Turner | 43 (5.2%) |
| | | Joshua Reynolds | 29 (3.5%) |
| | | Henry Raeburn | 26 (3.1%) |
| | | John Linnell | 24 (2.9%) |
| | | Jacob Maris | 24 (2.9%) |
| 6 | McLean | William Turner | 43 (5.7%) |
| | | John Linnell | 29 (3.4%) |
| | | William James Mueller | 25 (3.3%) |
| | | Joshua Reynolds | 22 (2.9%) |
| | | Thomas Sidney Cooper | 19 (2.5%) |
| 7 | Gooden & Fox | William Turner | 27 (4.4%) |
| | | Lawrence Alma-Tadema | 14 (2.3%) |
| | | Joshua Reynolds | 14 (2.3%) |
| | | George Frederic Watts | 12 (2.0%) |
| | | Thomas Sidney Cooper | 11 (1.8%) |
| 8 | Permain | David Cox | 19 (4.8%) |
| | | William Turner | 19 (4.8%) |
| | | Thomas Sidney Cooper | 17 (4.3%) |
| | | Myles Birket Foster | 16 (4.0%) |
| | | Copley Fielding | 13 (3.3%) |
| 9 | Wertheimer | Henry Raeburn | 18 (5.6%) |
| | | Charles Marion Russell | 18 (5.6%) |
| | | George Romney | 16 (5.0%) |
| | | Thomas Gainsborough | 13 (4.0%) |
| | | Joshua Reynolds | 13 (4.0%) |
| 10 | Lesser | Joshua Reynolds | 23 (7.6%) |
| | | Jacob van Ruisdael | 17 (5.6%) |
| | | Rembrandt van Rijn | 14 (4.6%) |
| | | David Teniers | 11 (3.6%) |
| | | Peter Paul Rubens | 8 (2.6%) |
| 11-138 | Others | Joshua Reynolds | 385 (6.5%) |
| | | Thomas Gainsborough | 235 (4.0%) |
| | | William Turner | 180 (3.1%) |
| | | Edwin Henry Landseer | 112 (1.9%) |
| | | Thomas Sidney Cooper | 111 (1.9%) |
| Total | | William Turner | 981 (5.7%) |
| | | Joshua Reynolds | 671 (3.9%) |
| | | Thomas Gainsborough | 468 (2.7%) |
| | | David Cox | 339 (2.0%) |
| | | Edwin Henry Landseer | 316 (1.8%) |

Table A2: Overview of artwork characteristics

| Variable | Definition/ unit |
|--|---|
| <i>Personal characteristics of the artist</i> | |
| Name | First and last name of the artist |
| Living status | Dummy indicating if artist was dead or alive at the date of sale |
| School | Indicates whether artwork was modern British, modern Continental, Old Master Continental or Old Master Low Countries |
| Age | Difference between birth year and date of sale |
| <i>Physical characteristics of the artwork</i> | |
| Size | Height times width in inches |
| Medium | Dummy indicating if artwork was a painting, sculpture, engraving, drawing or a copy |
| <i>Transaction characteristics</i> | |
| Sales price | Nominal sales price in Pounds, Sterling and Dimes |
| Sales date | Day, month, year when the transaction took place |
| Auction house name | Name of auction house that held the sale |
| Collection sale | Dummy indicating if artwork was part of a sale where an entire collection was sold (mostly the case for posthumous sales) |
| Seller name | First and last name of the seller |
| Buyer name | First and last name of the buyer |
| Lot sequence | A rank number indicating how late an artwork was up for bidding in a sequence of sales within one auction |
| Number of bidders | Proxied by the number of lots sold within one auction sale |
| <i>Rival characteristics</i> | |
| Rival's past maximum capacity | Highest financial capacity among all winners (excluding the winner of the current transaction) within a one auction sale |
| Rival's past maximum share by volume | Highest market share in terms of volume among all winners (excluding the winner of the current transaction) within a one auction sale |
| Rival's past maximum share by value | Highest market share in terms of value among all winners (excluding the winner of the current transaction) within a one auction sale |

Table A3: Entry results with alternative specifications

| Variables | Number of entrants | | | | | |
|---|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Lagged number of artworks bought by dealers (log) | 0.351** (0.176) | 0.424*** (0.150) | 0.408*** (0.130) | | | |
| Lagged value of artworks bought by dealers (log) | | | | 0.203* (0.123) | 0.266** (0.109) | 0.255*** (0.093) |
| Number of incumbents | -0.034** (0.014) | -0.032** (0.014) | -0.033** (0.015) | -0.023** (0.011) | -0.020** (0.010) | -0.020* (0.011) |
| Lagged population (log) | 0.368 (0.636) | | | 0.432 (0.633) | | |
| Lagged real per capita income in £ (log) | | -0.115 (0.392) | | | -0.100 (0.404) | |
| Lagged annual bond yield | | | 0.002 (0.232) | | | -0.005 (0.239) |
| After 1850 | 0.163 (0.249) | 0.215 (0.232) | 0.218 (0.235) | 0.086 (0.236) | 0.127 (0.245) | 0.136 (0.241) |
| Observations | 83 | 83 | 83 | 83 | 83 | 83 |
| Pseudo log-likelihood | -150.1 | -151.4 | -154.7 | -150.7 | -152.3 | -155.5 |

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
All prices are in constant £1850.

Table A4: Average number of large and small dealers per year between 1828-1913

| Variables | Summary statistics | |
|--|--------------------|-------|
| | Mean | Sd |
| Large dealer (<i>Top 10% by number</i>) | 4.84 | 1.68 |
| Large dealer (<i>Top 10% by value</i>) | 3.84 | 1.44 |
| Small dealer (<i>Bottom 90% by number</i>) | 41.33 | 13.94 |
| Small dealer (<i>Bottom 90% by value</i>) | 42.33 | 14.30 |

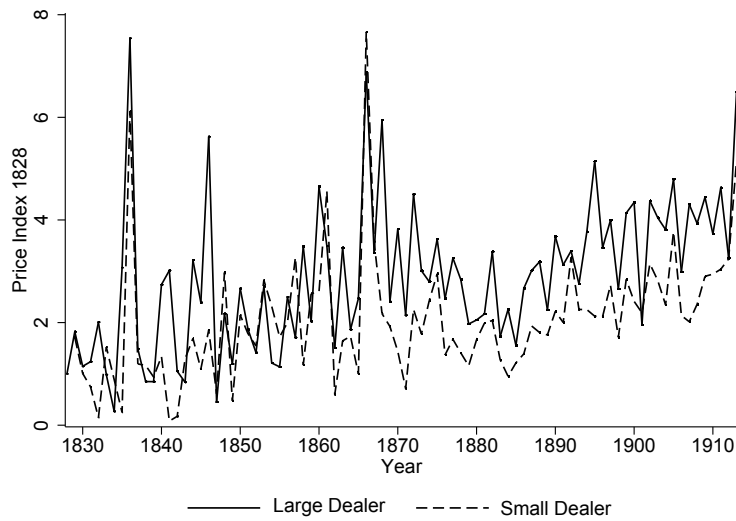


Figure A1: Average prices paid by large and small dealers (by number of acquisitions)

Table A5: Influence of dealer type on price for 1828-1913 sample

| Variables | Log of price | | | | | | | |
|--|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Large dealers (<i>Top 10% by number</i>) | 0.217*** (0.065) | 0.188*** (0.068) | | | | | | |
| Large dealers (<i>Top 10% by value</i>) | | | 0.240*** (0.062) | 0.205*** (0.068) | | | | |
| Experience (log) | | | | | 0.098** (0.044) | 0.091* (0.047) | | |
| Dealer capacity (log) | | | | | | | 0.082*** (0.013) | 0.085*** (0.014) |
| Number of bidders (log) | 0.030* (0.018) | 0.057*** (0.021) | 0.030* (0.018) | 0.058*** (0.021) | 0.033* (0.017) | 0.056*** (0.021) | 0.028 (0.017) | 0.053*** (0.020) |
| Log of lot sequence (log) | 0.162*** (0.027) | 0.058*** (0.017) | 0.161*** (0.027) | 0.058*** (0.017) | 0.163*** (0.027) | 0.058*** (0.017) | 0.160*** (0.027) | 0.056*** (0.018) |
| Rival's past maximum capacity (log) | 0.014** (0.006) | 0.027* (0.014) | 0.014** (0.007) | 0.027** (0.014) | 0.014** (0.007) | 0.027* (0.014) | 0.016** (0.007) | 0.031** (0.014) |
| Rival's past maximum share (log) (<i>By volume</i>) | | | -0.009 (0.057) | 0.078 (0.060) | -0.282* (0.170) | -0.133 (0.132) | -0.038 (0.056) | 0.035 (0.062) |
| Rival's past maximum share (log) (<i>By value</i>) | 0.045 (0.063) | 0.102** (0.051) | | | 0.328* (0.168) | 0.258** (0.125) | | |
| Size (log) | | 0.405*** (0.038) | | 0.405*** (0.038) | | 0.405*** (0.038) | | 0.405*** (0.037) |
| Year effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Season effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Auction house effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Artist effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Seller effects | Yes | Yes | Yes | Yes | No | No | Yes | Yes |
| Observations | 16,874 | 5,856 | 16,874 | 5,856 | 16,874 | 5,856 | 16,874 | 5,856 |
| R ² | 0.537 | 0.578 | 0.537 | 0.578 | 0.534 | 0.575 | 0.540 | 0.584 |

Standard errors clustered by dealers in parentheses. *** p<0.01, ** p<0.05, * p<0.1
All prices are in constant £1850.

Table A6: Influence of dealers on price

| Variables | Log of price | | | | | |
|--------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| | OLS | Quantiles | | | | |
| | | q10 | q25 | q50 | q75 | q90 |
| (1) | (2) | (3) | (4) | (5) | (6) | |
| Agnew | 0.411*** (0.044) | 0.449*** (0.040) | 0.307*** (0.020) | 0.364*** (0.028) | 0.447*** (0.034) | 0.475*** (0.048) |
| Colnaghi | 0.228*** (0.055) | 0.367*** (0.049) | 0.191*** (0.033) | 0.180*** (0.039) | 0.246*** (0.039) | 0.204*** (0.076) |
| Vokins | 0.321*** (0.048) | 0.327*** (0.048) | 0.192*** (0.020) | 0.195*** (0.022) | 0.219*** (0.043) | 0.112* (0.063) |
| Tooth | 0.149*** (0.044) | 0.288*** (0.057) | 0.186*** (0.035) | 0.172*** (0.030) | 0.177*** (0.060) | 0.110* (0.067) |
| Wallis | 0.010 (0.041) | 0.297*** (0.062) | 0.150*** (0.036) | 0.134*** (0.035) | 0.145*** (0.051) | 0.010 (0.056) |
| McLean | -0.001 (0.050) | 0.196*** (0.063) | 0.095** (0.038) | 0.074** (0.036) | 0.044 (0.049) | -0.091* (0.051) |
| Gooden & Fox | 0.061 (0.043) | 0.284*** (0.050) | 0.162*** (0.031) | 0.127** (0.051) | 0.080* (0.045) | -0.084 (0.063) |
| Permain | -0.073* (0.044) | 0.073 (0.050) | 0.002 (0.045) | -0.017 (0.051) | -0.073 (0.078) | -0.232*** |
| Wertheimer | 0.625*** (0.091) | 0.607*** (0.112) | 0.635*** (0.049) | 0.752*** (0.086) | 1.188*** (0.120) | 1.148*** (0.082) |
| Lesser | 0.126** (0.049) | 0.398*** (0.139) | 0.208*** (0.053) | 0.137*** (0.041) | 0.063 (0.065) | -0.086 (0.139) |
| Years | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 16,360 | 16,360 | 16,360 | 16,360 | 16,360 | 16,360 |

All regressions include the standard control variables listed in Table A2.

Standard errors clustered by dealers in parentheses in column (1).

Bootstrapped standard errors in parentheses for columns (2)-(7).

*** p<0.01, ** p<0.05, * p<0.1. All prices are in constant £1850.

Table A7: Exit results with Capacity as proxy for dealer type

| Variables | Exit | | | | |
|--|----------------------|----------------------|----------------------|----------------------|----------------------|
| | (1) | (2) | (3) | (4) | (5) |
| Capacity (log) | -0.026*** (0.003) | -0.026*** (0.003) | -0.025*** (0.002) | -0.026*** (0.003) | -0.025*** (0.003) |
| Dealer with past experience | -0.027** (0.013) | -0.027** (0.013) | -0.027** (0.013) | -0.027** (0.013) | -0.027** (0.013) |
| Value of artworks bought by dealers (log) | 0.006 (0.005) | | | | |
| Number of artworks bought by dealers (log) | | 0.010 (0.006) | | | |
| Average price per art work | | | -0.005 (0.016) | | |
| Real per capita income in £ (log) | | | | 0.041 (0.028) | |
| Annual bond yield | | | | | -0.003 (0.027) |
| Year effects | Yes | Yes | Yes | Yes | Yes |
| Observations | 3,098 | 3,098 | 3,098 | 3,098 | 3,098 |
| Wald χ^2 | 232.6 | 233.5 | 230.4 | 233.2 | 229.9 |

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

All prices are in constant £1850. The regression coefficients are transformed into marginal effects.

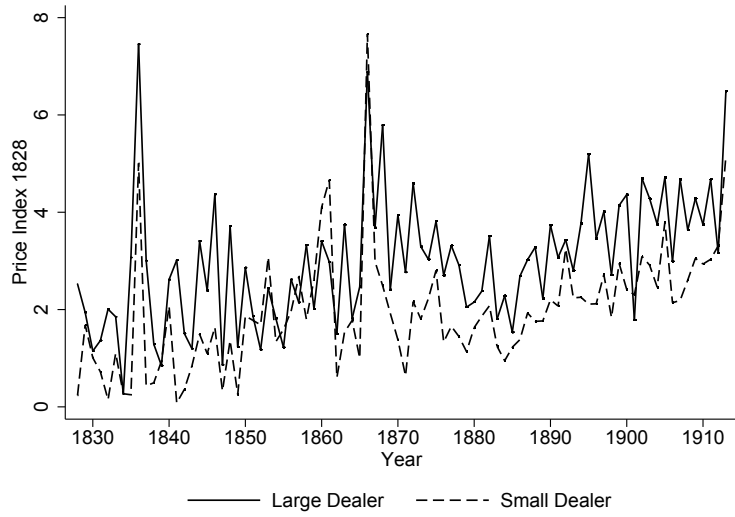


Figure A2: Average prices paid by large and small dealers (by value of acquisitions)