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Market Evolution, Bidding Strategies, and Survival of Art Dealers ^{*}

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Abstract

We show the value of expertise during the evolution of a market characterized by asymmetric information. Using a unique historical data set, we show how market dynamics encourage entrants. Our results provide evidence that better informed dealers pay about 24% more for an artwork of the same quality than less informed dealers. Additionally, our results indicate that informed dealers are more likely to survive in the market. Our evidence supports the conjecture that, in common value auctions, when information asymmetries are present, dealers with better information benefit. These results have important implications for maintaining and sustaining competitive advantage.

KEYWORDS: Auctions, Bidding, Art Dealers, Market Evolution, Common Value

JEL CODES: C57, D44, Z11, D47

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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 acquisition of superior information. 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 identify two different groups of dealers emerging; one with better information than the other. We show that dealers with a better information set, bid more aggressively. We further show that dealers with superior information survive longer. Our empirical findings support the theoretical claim made by (Milgrom and Weber, 1982) that bidders with superior information benefit at auction for objects with high common value components.

Gains from superior information can be large. Experts accumulate unique industry knowledge and reputation 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. Therefore, costs of information retrieval will be lower for experts. 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 are magnified. Thus, in markets such as real estate and commodities, asymmetric information is more prevalent than in others and, therefore, there is more opportunity to extract rents.

The art market offers us an excellent setting with which to examine the nature of these asymmetries and the role they play in the bidding strategies of dealers in these markets. 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. 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, conditioned on an accurate information set. However, the accumulation of information requires time and depends on expertise as well as 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 in which large information asymmetries prevail. We demonstrate the importance of expertise and reputation in such settings. We show that it is crucial to accumulate accurate information in order to survive in the market.

There has been a large number of studies on the importance of intermediaries for information production, 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). Furthermore, based on the theoretical predictions for auctions with asymmetric information derived by Milgrom and Weber (1982), Hendricks and Porter (1988) empirically show that in the case of federal offshore oil and gas drainage lease auctions, bidders with more accurate information yield higher profits from their acquisitions despite submitting higher bids. Thus, while there is empirical evidence that firms can benefit from more accurate information, these studies do not consider the impact of better information on the overall industry structure and the evolutionary path of an emerging market. Our analysis extends this literature by demonstrating how differences in information sets influence the evolution of a market. Additionally, we show how asymmetric information 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 successful 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.

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). Expertise as the source of market success and its effect on the art dealer's acquisition strategies and overall market success, therefore, still remain a puzzle. Up until now, the effect of a firm's expertise and accuracy of information 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 four parts. First, we investigate patterns and drivers for the market entry of dealers which led to their institutionalization in the 19th 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 accuracy of information on acquisition strategies at auctions. In particular, we are interested in knowing whether dealers with more accurate information display a different bidding strategy than less informed dealers. We use the dealer's market share to proxy her individual level of information asymmetry and, thus, expertise. Based on their market shares, we distinguish between strong and weak dealers and analyze their effect on the hammer price beyond what is predicted by artwork characteristics. Our expectation is that better informed dealers will, on average, acquire artworks at higher prices than less informed dealers as they have a better information set that results in 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 information asymmetries affect survival in the market. We expect better informed (strong) dealers to survive longer than uninformed (weak) 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 acquisition strategies of different types of dealers, the results further provide very clear evidence that better informed dealers pay, on average, 24% more for an artwork than less informed 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 informed art dealers are about eight percent more likely to survive the market than less informed dealers. This supports the conjecture that art dealers benefit from information asymmetries in the market that enable them to extract higher rents on future

re-sales 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. In section 4, we outline our conceptual framework which demonstrates how we relate the accuracy of information to differences in bidding strategies. 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. 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 two events increased the availability of artworks in the market and constituted the main source of supply at auctions. These 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, 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 themselves 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.

In this study, we use art auction transactions documented by the art historian Algernon Graves. The data were collected from the Albert and Victoria Museum in London and provides a good overview of the competitive landscape of professional art dealers as well as other buyers in the UK over the 19th and 20th centuries. Before presenting the data in greater detail, we will introduce a part of it in this first section of our analysis to show how the art dealer industry developed within the growing 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 1870.¹ 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

¹In 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.

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 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 became the dominant buyers in auctions. 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 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

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

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.

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 [p.90ff](Bayer, 2015).

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 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.

The most important and successful art dealers thus 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

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.

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.

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.⁵ 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

⁵The Low Countries include the Netherlands, Belgium and Luxemburg.

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. 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 illustrated the rapid evolution of the dealer industry. By the end of the 19th century, art dealers became the dominant force in the art market and were responsible for its overall development. We have also illustrated the structure of the dealer industry of that time. 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. This section alludes to success in the form of ex-post market share. It is important to give an overview of these market players but, in order to understand the dynamics at play in the art market, we first present our conceptual framework that sets out our expectations with respect to how these asymmetries reflect on a dealer's acquisition strategies in auctions and their likelihood of remaining in the market.

3 Conceptual Framework

As described in the section above, art dealers are intermediaries between artists and collectors and they synchronize demand and supply. They are professional traders who acquire artworks with the aim to resell them at a future point in time for a profit. Hence, it is fair to assume that a dealer does not derive any personal utility from holding his inventory of artworks but acquires it merely for its resale value. We further assume that the expected future resale price of the artwork is estimated at the time of the purchase. Under conditions of perfect information, the expected resale price will be the same for all bidders. However, if information asymmetries are present, the value estimates of the different dealers will vary depending on the level of their private information. Therefore, we consider artworks as objects with high common value components. In common value auctions, all bidders have estimates regarding the value of objects and their value estimates are correlated. However, the signals the bidders receive about the value of the artwork differ based on their ability to promote artists, their expertise, or reputation. In their seminal paper, Milgrom and Weber (1982) show that bidders with more precise information can extract positive rents. They further stress that

the privacy of the information is more crucial than its accuracy. These findings are at the heart of why the market evolves as it does, wherein only dealers with the most accurate and proprietary information set survive.

In the previous section on the history of art dealers, we observed a market structure consisting of a few very large dealers who drive the market and a large amount of small dealers with low market shares. We denote these two types of dealers as strong and weak dealers. Such a market structure is the result of differences in the entrants' attributes which facilitate or make it more difficult for a dealer to effectively promote an artist. The better the dealer's capacity to promote an artist, the higher will be the price she can charge from collectors on a future resale of an art work. This ability is not equally distributed among the dealers and will vary with the dealer's information set, which depends on her characteristics. Differences in these characteristics make it relatively easier or costlier to promote an artist in the market and, hence, constitute information asymmetries across dealers. Thus, dealers who possess additional information are more accurate in predicting the future value of an artwork compared to dealers who lack this information. While information on the size, artist, and provenance of an art work are public information, which can be accessed at almost no cost, other types of information, such as the authenticity of art works and the future capacity or demand for an artist, are not freely accessible and are often acquired from private information sources.

How costly is it for a dealer to extract this information? This is a function of the above mentioned attributes. For instance, close ties to important collectors who exert influence on other buyers give art dealers information on future trends in the market. Good relationships with artists help dealers influence themes or subjects of future projects. Reputation creates trust which makes the client acquisition process easier and enables the dealer to extract rents from buyers and sellers through higher commissions. Additionally, contacts with selected curators give dealers a greater chance to exhibit the artist's work and expose them to larger audiences. All of these elements can provide the dealer with an information advantage through better industry expertise over other dealers. As a result, a dealer's capacity to push and promote an artist in the market improves relative to other dealers. Thus, the dealer creates value through expertise in the form of reduced information asymmetries. This value added is intangible in nature but feeds back into the resale price as collectors are willing to pay a premium for alleviating uncertainty. Consequently, the dealer can extract higher profits from the artworks she sells on to collectors. Crucially, therefore, better informed dealers are

able to pay higher prices for the artworks they acquire, which should be reflected in their bidding strategy at auction.⁶ This is the conjecture that we test empirically.

To evaluate the relative accuracy of a dealer’s information set, we distinguish between strong and weak dealers based on the accumulated market shares in the year preceding a transaction. We define strong dealers as professional art traders who have a market share of at least 10%, while weak dealers are composed of art traders who are below this threshold.⁷ The number as well as the value of completed transactions per year is used to calculate market shares. Note that the latter value can easily be driven up by dealers who are rather inactive and unknown to the market but have bought some very expensive artworks. We use both of these measures to identify weak and strong bidders. We assume that dealers who have attained a large market share will have accumulated the necessary attributes to promote artists in the market effectively. As mentioned above, these attributes include reputation, expertise, a dense network and financial capacity. To account for these characteristics also in a direct way, we additionally control for the dealer’s experience in years and financial capacity separately. Our expectation is that art dealers who have a large market share and, thus, an information advantage (strong dealers) over their peers (weak bidders), would engage in more aggressive bidding as they can extract higher profits from their acquisitions. This means that, on average, we should observe higher prices paid by strong dealers than weak dealers.

However, it may also be the case that strong dealers do not have an information advantage and suffer from the winner’s curse by constantly overbidding due to hubris, or their social status that comes from being a strong or large dealer. They are not able to promote artists better and extract higher profits. Instead, they merely form overly optimistic estimates about the value of the artworks. If this conjecture is true, we should observe that strong bidders are more likely to exit the market than weak bidders who bid less aggressively. However, if weak dealers are more likely to exit the market, we can infer that the information set of strong bidders is indeed superior. This enables

⁶It is possible that a dealer might be willing to pay a higher price for an artwork if it represents a missing part that would complete a collection. However, from historical records and the analysis in the section above, we provide evidence that art dealers were not specialized but diversified in their acquisitions (at least in this evolutionary period). This is apparent from Table A1 which shows the most popular acquisitions among dealers by artist. The top-selling artists, William Turner, Joshua Reynolds, and Thomas Gainsborough can be found in the top five purchases of almost all large dealers. Moreover, we observe that, in the case of large estate collection sales, acquisitions are widely spread among several buyers. Therefore, while it might be the case that art dealers aimed at completing the collections of their respective clients, we exclude the possibility that dealers followed this practice for their own inventories on a large scale.

⁷A threshold of 10% best identifies the leading dealers at the time based on historical records. Our results, however, are also robust market share thresholds of 5% and 1%.

them to extract higher rents while weak dealers fail to make sufficient profits to remain in business. We, therefore, expect strong dealers to be more likely to survive in the market if they truly have an information advantage.⁸

Hendricks and Porter (1988) find, in their seminal work on first-price sealed bid drainage lease auctions, that bidders with an information advantage win most of the profitable oil and gas drainage tracts, while uninformed bidders earn about zero profits on the tracts they acquire. In particular, uninformed bidders earn positive profits when informed bidders participate and negative profits when no informed bidders are present in the auction. Bidders in these auctions have uncertainty about the amount of oil in the tract, its quality, the ease of recovery and/or the future market price. The participation of informed bidders, therefore, predicted the profitability of a tract. In their analysis, informed buyers are defined as bidders who already own a neighboring tract and could, thus, infer private information about the auctioned tract from it.

In our study, we focus on the asymmetric information created during market evolution. We, thus, extend the literature by our findings that, even during the infancy of market evolution, dealers are able to strategically exploit information asymmetries. We show that strong dealers are more likely to survive in the market than are weak dealers. As in Hendricks and Porter (1988), we provide empirical evidence for Milgrom and Weber (1982)'s theory that, in auctions, bidders with an information advantage can extract higher profits even during market evolution.⁹

4 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 19th and 20th 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 37,732 sales transactions for fine art in 57 London-based auction houses from 1756 to 1913. Historical records

⁸De Silva et al. (2009b) note that entrants bid more like incumbents and survive longer after information release.

⁹Also see De Silva et al. (2008) for information release and aggressive bidding.

indicate that the data set is a representative sample of auction sales over this period (Bayer, 2015).¹⁰ 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. 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 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.¹¹ 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.¹² 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,

¹⁰The 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.

¹¹The 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.

¹²The hedonic index can be provided upon request.

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.¹³ 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.¹⁴

For the price analysis, we restrict the time period to the years 1850 to 1913. The period between 1800 and 1850 is used to build a history of initial market shares which is used to classify bidders into strong and weak dealers. The rationale behind 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.

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.

As previously described, in this study, our key interest is expertise and how bidding strategies and survival rates differ between informed and less informed dealers. These two types of dealers are denoted as strong (informed) and weak (uninformed) dealers. The distinction is made based on the previous year's accumulated market shares of the individual dealers. While strong dealers have a market share of 10% or more, weak dealers are in the bottom 90% of the market (market share of less than 10%). We use the number and value of acquisitions per dealer by year to construct the variable. Table 3 reports the descriptive statistics for strong and weak 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

¹³The 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.

¹⁴In 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.

information when dealers market shares are based on the value of acquisitions. We can see that strong 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 strong dealers' transactions accounts for 40% of the dealers' market share. A comparison of the past market shares, which were used to define strong/weak dealers, shows that our threshold of 10% offers a very clear-cut distinction. While strong dealers reach, on average, between 24.1% and 31.3%, weak dealers have a mean past market share of between 3.4% and 4.0%. From a total market value of about £4.8 million, weak dealers obtain a share amounting to a sum between £163,200 and £192,000. It is important to note that the strong dealer dummy is a dynamic variable and, hence, the strong or weak status is not permanent for a given bidder. Hence, the number of distinct weak and strong 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 strong dealers and 41 weak dealers per year. Similarly, when market share is defined by the value of completed transactions, we have a mean of four strong dealers and 42 weak dealers per year (see appendix Table A3).

To control for other factors that might be related to the accuracy of a dealer's information, two other dealer characteristics are employed in the analysis, which are presented in Table 3. First, the variable capacity is defined as the maximum total amount spent in a year before the current acquisition period. The capacity of strong dealers reaches, on average, almost ten times the capacity of weak dealers (£11,370 and £96,363). This outlines the financial constraints of weak dealers. Second, the variable experience is the total number of years a dealer is active in the market up to the current transaction. Also, with respect to experience, strong dealers have, on average, approximately twice as many years of experience (44 versus 24 years) as weak dealers. From the descriptive statistics, we can infer that strong and weak dealers differ in their characteristics which will have an influence on their respective information sets.

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

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.

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 first conjecture we investigate, with respect to differences between strong and weak dealers, concerns their respective bidding strategies. We expect strong dealers to pay higher prices than weak dealers, on average, as the former have a better capacity to promote artists and can, therefore, extract higher rents from their acquisitions. A first look at the summary statistics (Table 4) lends support to our hypothesis. Table 4 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 strong and weak 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, strong 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 weak dealers might have fewer funds, which restricts them when competing with strong dealers for lower priced items.

Figures 5 and 6 present the corresponding unconditional densities for different distributions of the prices for strong and weak 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 strong 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 4 and means that the distribution of winning bids of strong dealers stochastically dominates the distribution of winning bids of weak bidders. As a result, both the table and its graphical representations outline the same pattern, namely that informed dealers appear to bid more aggressively than uninformed dealers over the whole distribution of prices. Furthermore, Figures A1 and A2 show the development of average real prices paid for artworks by strong and weak dealers over time. We see an increase trend in averages prices for both dealer types. Nevertheless, in almost every year, strong dealers appear to pay higher average prices than weak dealers. This time trend

perspective confirms our conjecture that strong dealers have a higher value distribution than weak dealers.

So far, the results of the univariate analysis back our conjecture that strong, more informed dealers seem to bid more aggressively on average than weak, less informed dealers. Now, we will extend our analysis into a multivariate setting.

5 Empirical Analysis

5.1 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.¹⁶ The descriptive statistics in Table 5 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 characteristics (denoted by X) such as population, per capita income and the bond yield.¹⁷ 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 5, 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 6. 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,

¹⁶We 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.

¹⁷The 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.

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 A4 (columns 1 to 6). Even though the coefficients slightly lose their magnitude, the qualitative results remain the same.

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 strong and weak dealers.

5.2 Bidding Strategies

Based on our conceptual framework, we expected informed (strong) bidders to exert a different influence on auction prices for artworks than less informed (weak) bidders. In particular, we expect that strong bidders will bid more aggressively than weak bidders. We argued that strong dealers are able to accumulate accurate information as a result of their experience, reputation and financial resources, which enabled them to create more value by promoting artists better than weak dealers. Consequently, strong dealers are able to extract higher rents from their acquisitions. Accordingly, strong dealers had a higher value distribution than weak dealers. Our summary statistics reveal that strong dealers pay higher prices for artworks across the whole distribution of winning bids. Given that artworks are very heterogeneous, it may, therefore, be that strong dealers simply acquire artworks of better quality (in particular, certain artists) than weak dealers. Hence, in this part of the analysis, we further test the robustness of our results conditioned on the idiosyncratic characteristics of the artwork.

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 strong dealers and zero otherwise. Note that the bidder status, strong or weak, is not permanent and varies across time in our sample. 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. As the accuracy of a dealer’s information set might not only be reflected in the level of her market share, captured by the strong 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. 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.¹⁸

The size of an artwork is an additional characteristic which 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 well as excluding the artwork size. Further, while we cannot observe the number of actual or potential bidders in these auctions, it is worth noting that De Silva et al. (2009a) have shown that the number of potential bidders or expected number of bidders has no effect on auction prices with common value components. Our basic regression model has the following specification,

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

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 . X denotes the artwork’s characteristics and τ_t represents the time fixed-effects. Lastly, ϵ_{ijt} denotes the error term.

In Table 7 we present the regression results for the influence of dealer type on price. Columns 1 and 2 show the effect of strong 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 strong dealer dummy coefficient is positive and statistically significant. The interpretation of this result is that when the buyer is a strong dealer, the expected estimated price is approximately 24% higher than if the buyer were a weak dealer. The

¹⁸The correlation between the strong dealer dummy, the capacity variable and the experience variables ranges from 48% to 77%.

magnitude of the coefficient is similar when we use the value instead of the number of acquisitions to calculate market shares (24.6% and 23.2%). Another way to interpret this result is that a strong dealer estimates the additional value he can create in his role as a taste-maker at about 24% higher than what a weak 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 strong dealer coefficient declines by three percent. However, it is still very important with an impact of about 21%. 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 11% (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.

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 strong dealer dummy, become even stronger. The coefficient of the strong dealer dummy increases in magnitude, lending further support to our hypothesis that informed dealers pay, on average, higher prices for their acquisitions given the quality of the artwork.

So far, the results strongly support our conjecture that strong dealers pay higher prices at auction, which can be explained by their superior set of information. The strong dealer dummy, our proxy for the dealer's overall information advantage, financial capacity, and years of market experience, all confirm that better informed 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 8 presents the results when strong 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, weak bidders are less able to compete with strong bidders. In the lowest quantile of the price distribution, strong dealers pay, on

average, between 16% and 21% more than weak 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 (14% and 17%). This may indicate that, even if a dealer is less informed, 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 strong dealers pay about 45% more than weak 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 strong does not often switch her status to that of a weak dealer.¹⁹ 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 strong dealers paying higher prices than weak dealers. For example, we see that Agnew bids on average 40% more than other dealers.

In summary, the results in this section provide strong statistical support to the conjecture that strong dealers pay higher prices in auctions than weak dealers given the characteristics of the artwork. This is especially the case for higher priced artworks. Moreover, dealers with more information and expertise do not seem to simply recognize and buy artworks of better quality. Instead, they appear to have attributes such as experience, 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, strong dealers appear to act as taste-makers who can make the market. The higher prices paid at acquisition indirectly reflect asymmetric information, 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 strong and weak dealers.

¹⁹The 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.

5.3 Exit Patterns

We are also interested in learning whether the strong dealers' strategy of acquiring artworks at higher prices is sustainable. If strong dealers indeed pay higher prices, as they possess more accurate information 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 weak dealers. In this case, weak or uninformed dealers should leave the market as they fail to generate sufficient profits to sustain the dealership. However, if strong 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 weak 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 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.²⁰ 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.²¹ 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

²⁰In our sample, 98% of all dealers were not active in the market as buyers or sellers for a maximum of three years.

²¹In 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.

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:

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

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 9 shows the descriptive statistics for the main explanatory variables for strong and weak 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 9 is that the probability of exit is much higher for weak dealers (12%) than for strong dealers (4%). As before, and subject to our definition, strong dealers have a much larger market share (16% to 18%) than weak dealers (one percent). Interestingly, there are more dealers with past experience among the weak dealers (62%) than among strong dealers. However, this is in line with our expectation that strong dealers are less likely to exit. The activity of weak dealers fluctuates more. They enter and exit the market more often than strong dealers do. In line with previous findings, the financial resources of strong dealers exceed weak dealers' funds threefold. Also, the average number and value of transactions is much higher for strong than for weak dealers.

The results of the probit regression are reported in Tables 10 and 11. Table 10 reports the regression coefficients when market share is defined by number of acquisitions and Table 11 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 strong dealer dummy. The probability of exiting the market is between 8.1% and 8.4% lower when a dealer is defined as strong rather than weak. As expected, previous market experience alleviates the probability of exit. A dealer with past experience is between 7.0% and 7.5% 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. However, only the average artwork price and the annual bond yield are statistically significant. 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 10% 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 strong 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 three percent). Consequently, although financial funds are an important source of the information asymmetries between 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.

Overall, the results in this part of the analysis show that the strong dealers' strategy of paying higher prices indeed reflects their information advantage 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. Strong dealers are able to create a higher intangible value by providing information on 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 develop into a strong dealer. This highlights the importance of maintaining a competitive position in the market.

6 Concluding Remarks

This is the first study to empirically put a value on expertise within the course of the evolution of a new industry characterized by large information asymmetries. 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, as a result of an information advantage, 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 the accuracy of their information and, thus, expertise. In particular, our evidence suggests that strong dealers have a positive effect on the auction price beyond what is predicted by the characteristics of an artwork. These strong dealers tend to pay about 24% more than weak dealers. This effect is valid for the whole distribution of prices. We further show that strong dealers are 8% more likely to survive in the market than weak dealers. Our results are robust for market shares specified as the number or value of total acquisitions.

Our results support the conjecture put forward by Milgrom and Weber (1982), who state that auctions provide an advantage to bidders with better information for objects with high common value components. The findings are further in line with the evidence provided by Hendricks and Porter (1988), who show that, in federal oil and gas drainage lease auctions, firms who have operations adjacent to the auctioned tract pay, on average, more and extract higher rents from the acquired tracts than uninformed bidders. While Hendricks and Porter (1988) show that informed bidders yield higher returns from the acquired tracts to demonstrate superior information of strong bidders, we find evidence that strong bidders survive longer in the market. Our results are also in line with the findings of De Silva et al. (2008), who study bidding behavior in highway procurement auctions

surrounding the release of public information. They find that bidders bid more aggressively with additional information release. Further, 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 information asymmetries. 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 and reputation of experts as well as explain how this information advantage helps sustain performance in a market evolutionary setting.

Our findings can be widely applied to auctions, specifically for common value goods. Another prominent area of application is the real estate market. In the acquisition of real estate, information asymmetries are a central concern. There are large uncertainties about, for instance, 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 private 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 information asymmetries. Insight into historical information of dealers helps us to quantify expertise and explain how accurate information 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.

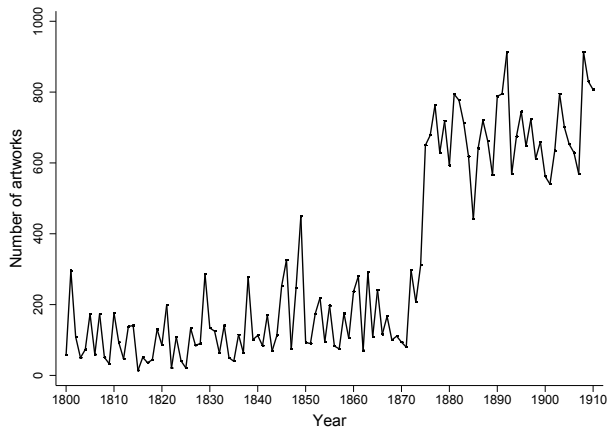
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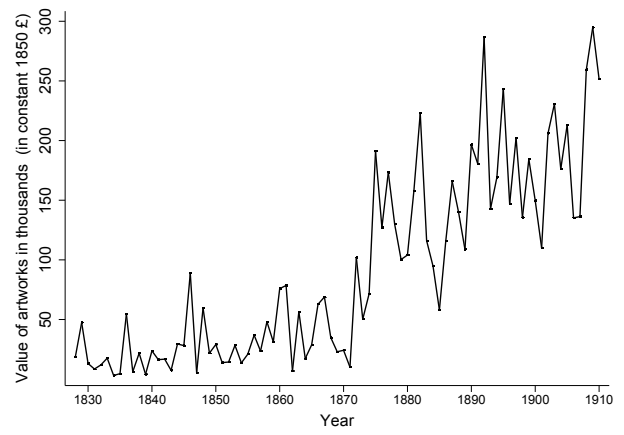
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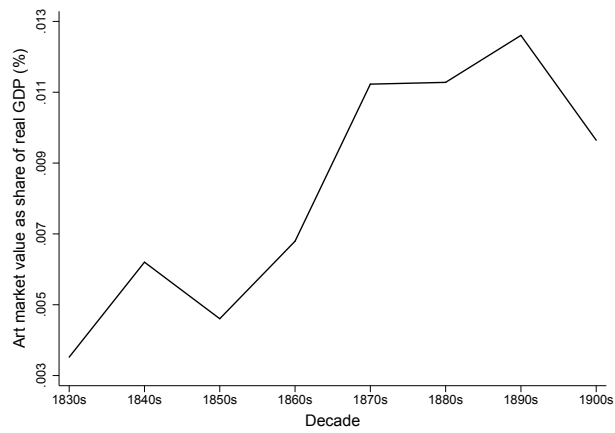
Figures



(a) Size of market (by number)

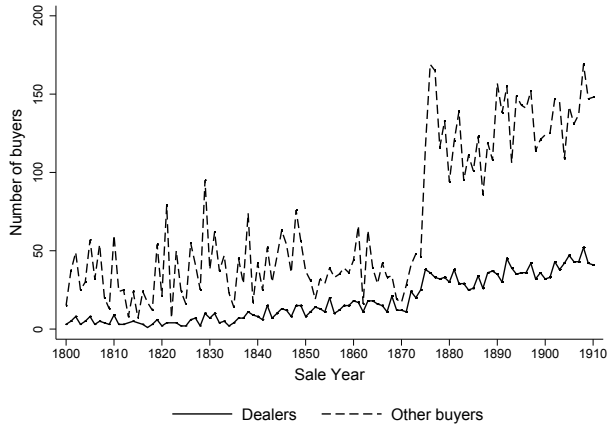


(b) Size of market (by value)

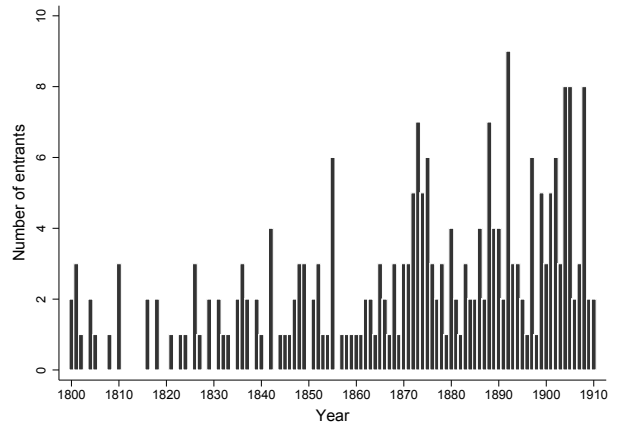


(c) The art market as a share of GDP

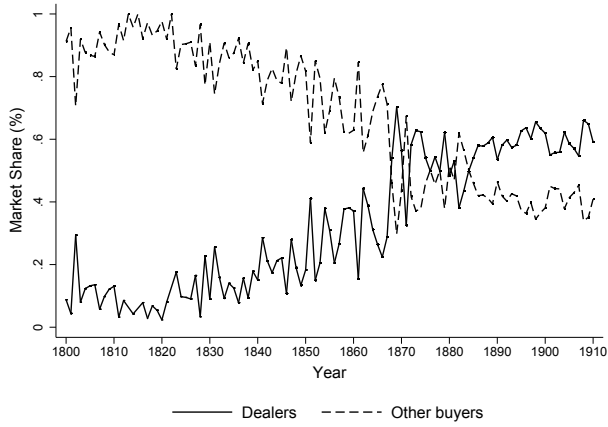
Figure 1: Art Market Evolution (1800-1913)



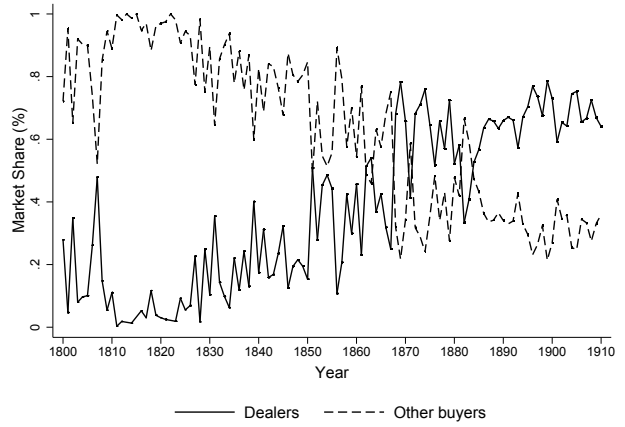
(a) Number of buyers in the market



(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)

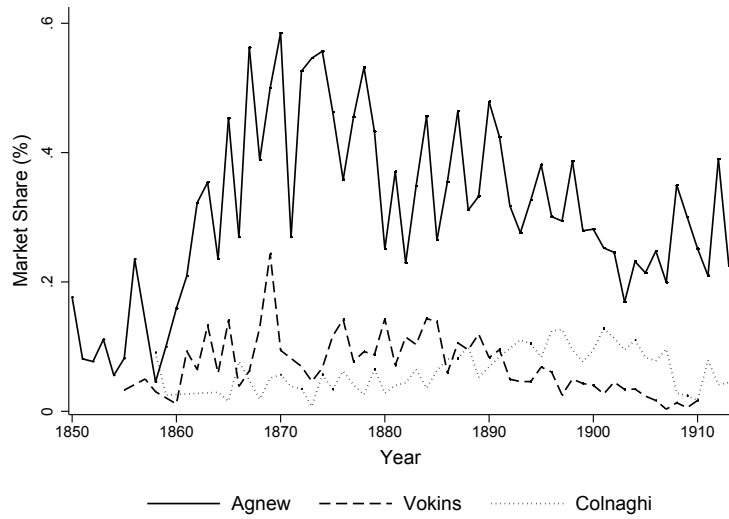


Figure 3: Market Shares 1850-1913 - Top 3 (dealer market)

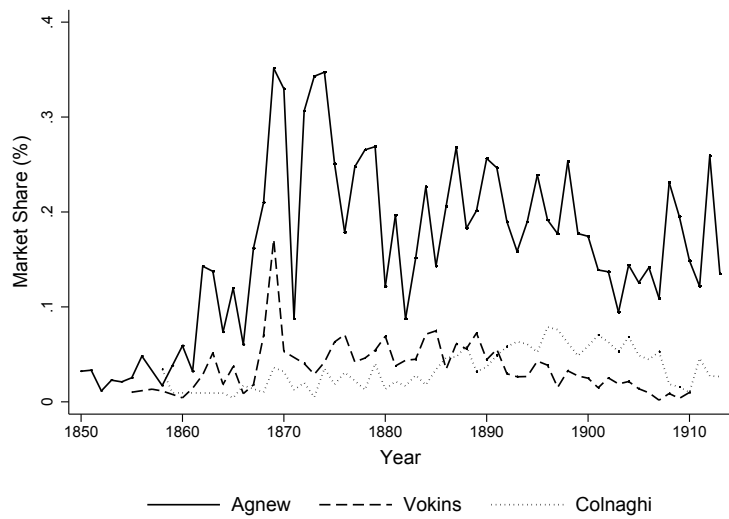


Figure 4: Market Shares 1850-1913 - Top 3 (whole market)

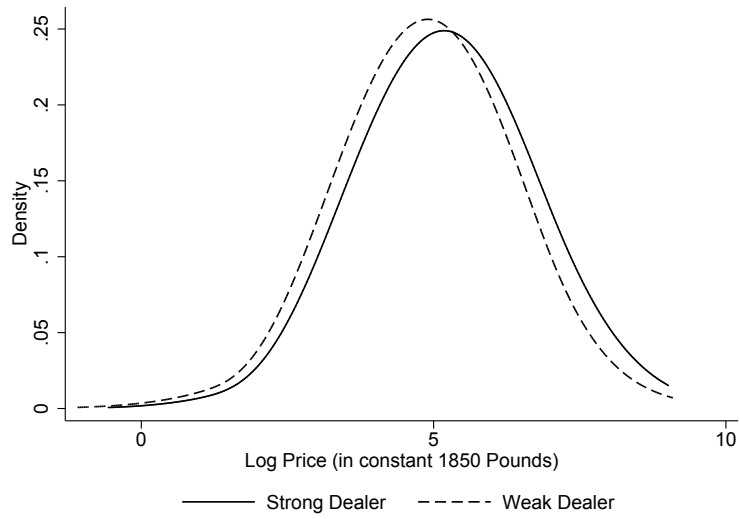


Figure 5: Strong and Weak Dealers (by number of acquisitions)



Figure 6: Strong and Weak 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

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: Summary statistics for strong and weak dealers between 1850-1913

Panel A: Dealer type defined by number of acquisitions						
Variables	Strong dealers			Weak 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	Strong dealers			Weak 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

All prices are in constant £1850.

*Values correspond to number of art works bought.

Table 4: Prices paid by dealers types between 1850-1913

Panel A: Dealer type defined by number of acquisitions				
Quantiles	Strong dealers		Weak 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	Strong dealers		Weak 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 5: 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 6: 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 7: Influence of dealer type on price

Variables	Log of price							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Strong dealers (<i>Top 10% by number</i>)	0.232*** (0.063)	0.207*** (0.068)						
Strong dealers (<i>Top 10% by value</i>)			0.246*** (0.061)	0.215*** (0.067)				
Experience (log)					0.115** (0.046)	0.105** (0.050)		
Capacity (log)							0.084*** (0.013)	0.086*** (0.014)
Size (log)		0.410*** (0.039)		0.410*** (0.039)		0.410*** (0.038)		0.412*** (0.038)
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	0.501	0.573	0.502	0.573	0.499	0.570	0.505	0.579

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

Table 8: Quantile regression results

Panel A: Dealer type defined by number of acquisitions					
Variables	Log of price				
	q10	q25	q50	q75	q90
Strong dealer (<i>Top 10% by number</i>)	0.158*** (0.022)	0.141*** (0.015)	0.224*** (0.017)	0.339*** (0.024)	0.428*** (0.031)
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
Strong dealer (<i>Top 10% by number</i>)	0.211*** (0.029)	0.169*** (0.014)	0.244*** (0.020)	0.350*** (0.028)	0.453*** (0.034)
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 9: Summary statistics for strong and weak dealers between 1850-1913

Panel A: Dealer type defined by number of acquisitions				
Variables	Strong dealers		Weak dealers	
	Mean	Sd	Mean	Sd
Probability of exit*	0.042	0.203	0.116	0.321
Past market share	0.158	0.054	0.014	0.022
Dealers with past experience	0.465	0.502	0.624	0.485
Capacity	17,620	36,883	5,274	6,774
Average price per artwork	247	331	231	314
Number of artworks bought by dealer	17.0	38.7	6.3	9.0
Value of artworks bought by dealer	9,115.5	23,493.3	2,337.7	4,279.2
Panel B: Dealer type defined by value of acquisitions				
Variables	Strong dealers		Weak dealers	
	Mean	Sd	Mean	Sd
Probability of exit*	0.040	0.197	0.116	0.321
Past market share	0.180	0.092	0.010	0.018
Dealers with past experience	0.427	0.498	0.625	0.484
Capacity	20,404.3	40,363.1	5,311.7	6,888.3
Average price per art work	262	345	228	312
Number of artworks bought by dealer	19.7	42.4	6.3	9.1
Value of artworks bought by dealer	10,692.6	25,773.7	2,348.1	4,356.5

All prices are in constant £1850.
*Multiple entries and exits by dealers are possible during the sample period.

Table 10: Exit probabilities - Dealer type defined by number of acquisitions

Variables	Exit				
	(1)	(2)	(3)	(4)	(5)
Strong dealer (<i>top 10% by number</i>)	-0.081*** (0.017)	-0.081*** (0.017)	-0.080*** (0.017)	-0.081*** (0.017)	-0.081*** (0.016)
Dealer with past experience	-0.072*** (0.015)	-0.074*** (0.015)	-0.071*** (0.015)	-0.075*** (0.015)	-0.070*** (0.015)
Value of artworks bought by dealers (log)	-0.010 (0.007)				
Number of artworks bought by dealers (log)		-0.009 (0.009)			
Average price per art work (log)			-0.055** (0.025)		
Real per capita income in £ (log)				-0.027 (0.040)	
Annual bond yield					0.102*** (0.039)
Year effects	Yes	Yes	Yes	Yes	Yes
Observations	1,981	1,981	1,981	1,981	1,981
Wald χ^2	77.0	77.1	78.2	77.4	82.1

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 11: Exit probabilities - Dealer type defined by value of acquisitions

Variables	Exit				
	(1)	(2)	(3)	(4)	(5)
Strong dealer (<i>top 10% by value in £</i>)	-0.084*** (0.015)	-0.084*** (0.016)	-0.084*** (0.015)	-0.084*** (0.016)	-0.084*** (0.015)
Dealer with past experience	-0.072*** (0.015)	-0.074*** (0.015)	-0.072*** (0.015)	-0.075*** (0.015)	-0.071*** (0.015)
Value of artworks bought by dealers (log)	-0.011 (0.008)				
Number of artworks bought by dealers (log)		-0.010 (0.009)			
Average price per artwork (log)			-0.060** (0.025)		
Real per capita income in £ (log)				-0.031 (0.040)	
Annual bond yield					0.105*** (0.039)
Year effects	Yes	Yes	Yes	Yes	Yes
Observations	1,981	1,981	1,981	1,981	1,981
Wald χ^2	77.5	77.7	78.6	78.0	82.8

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

Table A3: Average number of weak and strong dealers per year between 1828-1913

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

Table A4: 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 A5: Influence of dealer type on price for 1828-1913 sample

Variables	Log of price							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Strong dealers (<i>Top 10% by number</i>)	0.237*** (0.062)	0.206*** (0.068)						
Strong dealers (<i>Top 10% by value</i>)			0.254*** (0.060)	0.216*** (0.066)				
Experience (log)					0.113** (0.047)	0.105** (0.050)		
Capacity (log)							0.081*** (0.014)	0.084*** (0.015)
Size (log)		0.410*** (0.039)		0.410*** (0.038)		0.410*** (0.038)		0.411*** (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	0.523	0.574	0.524	0.574	0.520	0.571	0.527	0.580

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	0.417*** (0.043)	0.521*** (0.034)	0.324*** (0.020)	0.407*** (0.021)	0.513*** (0.028)	0.607*** (0.046)
Colnaghi	0.232*** (0.056)	0.419*** (0.048)	0.193*** (0.034)	0.215*** (0.047)	0.265*** (0.043)	0.244*** (0.092)
Vokins	0.317*** (0.048)	0.418*** (0.040)	0.169*** (0.024)	0.201*** (0.041)	0.197*** (0.044)	0.161** (0.071)
Tooth	0.157*** (0.047)	0.308*** (0.049)	0.200*** (0.022)	0.178*** (0.029)	0.171*** (0.052)	0.173** (0.073)
Wallis	0.019 (0.042)	0.311*** (0.069)	0.158*** (0.028)	0.194*** (0.027)	0.171*** (0.039)	0.109** (0.053)
McLean	0.006 (0.052)	0.288*** (0.082)	0.089** (0.036)	0.090* (0.048)	0.105* (0.062)	-0.084 (0.059)
Gooden & Fox	0.076* (0.045)	0.396*** (0.043)	0.164*** (0.042)	0.160*** (0.056)	0.065 (0.072)	-0.042 (0.116)
Permain	-0.061 (0.045)	0.076 (0.123)	0.026 (0.046)	-0.027 (0.043)	-0.078 (0.074)	-0.169* (0.092)
Wertheimer	0.668*** (0.094)	0.708*** (0.103)	0.637*** (0.083)	0.780*** (0.084)	1.233*** (0.145)	1.278*** (0.121)
Lesser	0.107** (0.051)	0.482*** (0.151)	0.196*** (0.049)	0.156** (0.069)	0.038 (0.085)	-0.159** (0.068)
Other characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16,360	16,360	16,360	16,360	16,360	16,360

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)	-0.029*** (0.003)	-0.030*** (0.003)	-0.027*** (0.003)	-0.030*** (0.003)	-0.027*** (0.003)
Dealer with past experience	-0.012 (0.015)	-0.013 (0.015)	-0.008 (0.015)	-0.013 (0.015)	-0.008 (0.015)
Value of artworks bought by dealers (log)	0.016** (0.008)				
Number of artworks bought by dealers (log)		0.026*** (0.010)			
Average price per art work			-0.001 (0.024)		
Real per capita income in £ (log)				0.114*** (0.040)	
Annual bond yield					-0.009 (0.038)
Year effects	Yes	Yes	Yes	Yes	Yes
Observations	1,981	1,981	1,981	1,981	1,981
Wald χ^2	175.0	177.0	171.4	178.5	170.7

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.

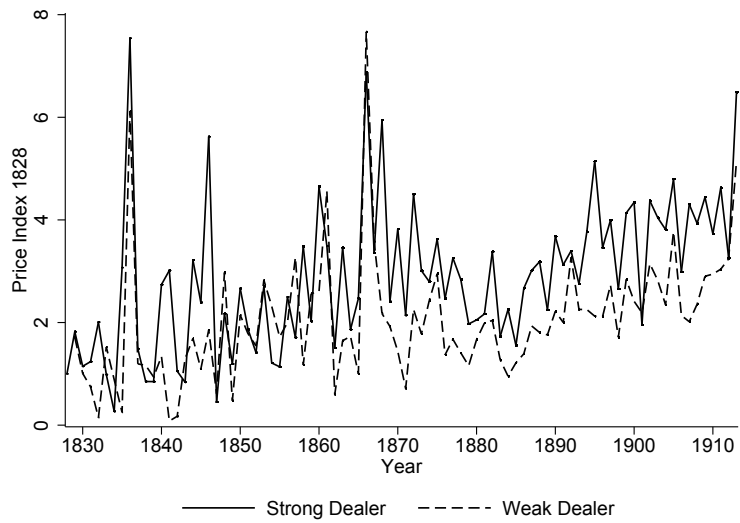


Figure A1: Average prices paid by strong and weak dealers (by number of acquisitions)

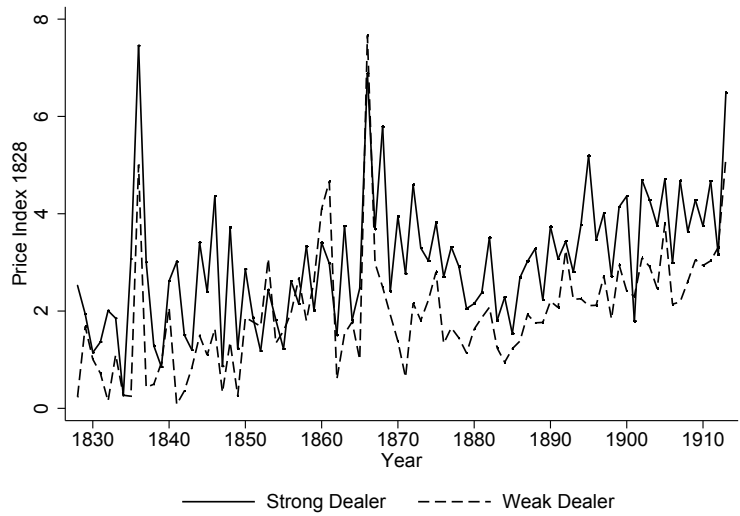


Figure A2: Average prices paid by strong and weak dealers (by value of acquisitions)