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Bai, Jennie; Guo, Jia; Mandel, Benjamin

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Going global: Markups and product quality in the Chinese art market

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Jennie Bai
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Abstract

We analyze two reasons for export prices to be different across markets—namely, quality differentiation and variable markups—and attempt to parse their relative importance and some of their underlying drivers. To overcome the substantial measurement issues in this task, we consider a particular industry as a special case: Chinese fine art. The simplicity of the supply side of art vis-á-vis marginal cost and the wealth of data on its quality characteristics make it possible to separately identify the markup and quality components of international relative prices for Chinese artworks. Through this lens, we trace the process of growth and internationalization of Chinese art since the year 2000. We find strong support for quality sorting into international markets at both the level of artist and artwork, as well as substantial markup differences across destinations. Using a structural model of endogenous quality choice by Feenstra and Romalis (2012), we argue that much of the international quality premium is driven by per unit distribution costs (whether physical or informational) rather than destination-specific preferences for quality.

Keywords: international prices, quality differentiation, art auction

1. Introduction

It is well-documented in the international trade and international macro literatures that exporters set very different price levels for similar products across destination countries. This observation has generated intense interest in the drivers of those price differences, with the idea that this knowledge will abet our understanding of export success (in the case of international trade) and the international transmission of shocks (in the case of international macro). In this paper, we will focus on two reasons for export prices to be different across markets, namely quality differentiation and variable markups, and attempt to parse their relative importance and some of their underlying drivers.

We build on recent empirical work highlighting the role of quality differentiation in explaining export price patterns. A representative paper in that line of inquiry is Manova and Zhang (2012), which documents the firm-level pricing behavior of Chinese goods exporters. They find that firms that set higher prices in a given destination have higher export revenues, suggesting that product quality is a dominant determinant of export sales (rather than relatively low quality-adjusted prices). They also find that for a given firm, prices vary across destinations in a manner which suggests sending different quality levels to different markets. In a separate body of research, the role of a firm's markup over its marginal cost of production has been emphasized as a means for firms to tailor prices to specific markets. Often the size of the markup is thought of as a function of destination characteristics such as market size and the level of competition, among other factors. One prominent example of this type of variable markup in the context of a monopolistically competitive industry is Melitz and Ottaviano (2008).

The problem we address is that, even at the frontier of data availability (i.e., a census of firm- and product-level prices and sales volume by export destination), it is difficult to make unqualified statements about the importance of either product quality or markups in explaining international trade patterns. The first issue is the challenge measuring these components of price. The basic

identification problem is that only two pieces of data are typically observed, export prices and quantities, which are each influenced by a multitude of factors including the export's quality level, marginal cost and markup. This quandary has led researchers to try to estimate a subset of these factors from the available trade data,[1] however doing so risks ignoring the influence of the omitted factors on those being measured. The other issue is that, even with a clean measure of product quality in hand, the underlying determinants of quality choice are also unidentified. An exporter may choose to ship higher quality varieties to a given destination due to demand factors such as the importing consumers' preferences for quality, or supply factors such as the costs of producing or shipping. Our objective is therefore to take preliminary steps to separately identify quality and markups across markets and to investigate the determinants of quality sorting.

To fix ideas, we shall consider a particular industry as a special case: the international market for Chinese fine art sold at auction, and we will analyze the price of Chinese art sold outside of China versus that sold inside mainland China. This industry is well-suited to our purposes for a few reasons. First, quality characteristics of each artwork, such as physical traits, measures of authenticity, proxies for provenance, and characteristics of the auction transaction, are observed. This allows us to measure and control for the different quality characteristics of each artwork and to compare prices across markets on an apples-to-apples basis. Second, isolating the markup component of price is greatly abetted by the fact that the relationship between marginal cost and price for artworks can be summarized by observable data. The auction market for fine art is largely a secondary market, and therefore the concept of the marginal cost of an artwork has to do, if anything, with an artwork's former sale price.[2] We attempt to control for that in our empirical

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[1]An indicative example of this practice is the measurement of trade quality, where unit value prices are often used as a proxy, ignoring the influence of productivity and markups. Several authors have suggested alternative measures that use information on inputs or quantities, in addition to prices, to better identify product quality. For example, Brambilla, Lederman, and Porto (2012) utilize the concentration of skilled and unskilled workers within a firm. Hallak and Schott (2011), Khandelwal (2010), and Gervais (2012) use the trade balance, import market share and export quantity, respectively, conditional on price and other controls as a measure of quality. In spite of these advances, though, the influence of variable markups on prices is rarely explicitly taken into account.

[2]An alternative, more familiar, definition of marginal cost is as a production cost, variation in which we do not believe has an appreciable influence on art auction prices. On one hand, the artists of many works sold at auctions are no longer alive, which distorts the relationship between supply factors and output prices. On the other, for contem-

work and, as such, what is being captured in our measures of price differences across markets comes close to being a pure measure of markup differences.

Third, in addition to observing quality and markups, Chinese art is also an industry that has recently undergone a transition from autarky to exporting. Auction-quality artworks produced by Chinese artists were until lately only sold at auction houses in mainland China. Beginning in the late 1990s and early 2000s, however, the share of Chinese artworks sold at auction houses outside of mainland China began to rise steadily, going from 2.7 percent of the number of sales in the early 2000 to a peak of 9.2 percent in 2007. And fourth, the relatively well defined limits of the Chinese art market gives rise to a very manageable scale for empirical analysis, making it at least plausible to gather information about *all* auction sales since 2000 to say something about the market as a whole. That is precisely what we do; we have assembled an almost comprehensive census of auction transaction prices for Chinese artworks over this period sold anywhere in the world, and including a detailed list of artwork and transaction characteristics. All in all, the dataset includes information on over 1 million artworks put up for auction.

With this long list of sales data, we uncover a rich set of facts describing the international pricing of Chinese art, beginning with the unconditional international price premium and telescoping into quality adjusted estimates and estimates conditional on certain characteristics of the artwork and auction transaction. The results can be summarized as follows: (i) internationally sold artworks and the domestic artworks of internationally selling artists have much higher average prices than those of artists selling only domestically; (ii) for internationally selling artists, international works have a higher price than their domestic works; (iii) most of (i) and (ii) is explained by quality differences between internationally sold artworks and those sold domestically; (iv) after controlling for quality differences, internationally sold artworks still have a significantly higher price than

porary and classical artists alike, the market structure is such that marginal cost plays a relatively small role in price setting because of the high degree of differentiation among artworks. Our identifying assumption is that the elasticity of prices to production cost is zero, which is a clear difference between art and other industries (where marginal cost is an important determinant of price).

domestic artworks; and (v) the international price premium is most pronounced for auctions taking place in the United States and United Kingdom, for contemporary art, and for artists with the highest number of international sales.

The fact that international sales have higher price and higher quality than domestic sales (i.e., results (i), (ii) and (iii)) is closely related to the literature on quality sorting in international trade. Perhaps the closest antecedent among those papers is Crozet, Head, and Mayer (2012), in which the quality of French wine is observed to be higher for firms exporting to more destinations, at higher prices, and for firms selling larger quantities in each destination; these correlations support trade models in which firms sort into export markets according to their output quality as opposed to their productivity. Our work also provides a measure of export quality and supports the finding of quality sorting, but differs in several ways.

First, prices are higher for exports because higher quality outputs have higher markups, not higher marginal costs, which differs from the common practice of modeling output quality as a function of input cost.[3] Specifying that higher output quality requires higher cost inputs is an intuitive and reasonable assumption, but it is also done for convenience. That is because extending models with constant elasticity preferences, such as Melitz (2003), to have quality differentiation runs into the constraint of constant markups across firms; the only way to introduce price heterogeneity due to quality is through the marginal cost component of price. Our results demonstrate an important interaction between markups and quality that is not present in most models of international trade.

Second, the quality sorting results are supportive of the Alchian-Allen (1964) effect, or the idea that exporters "ship the good apples out." Alchian and Allen's conjecture was that any specific cost applied to an export, such as a flat per unit transport cost or tariff, will shift demand

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[3]For instance, Kugler and Verhoogen (2012) model endogenous improvement in the quality of labor, capital and output, given firm productivity, and find a correlation between plant size and both output and input prices. Other papers relating output quality to explicit costs include: Baldwin and Harrigan (2011), Johnson (2012), Bastos and Silva (2010), Crozet, Head and Mayer (2012), Fernandes and Paunov (2009), Hallak and Sivadasan (2011), Mandel (2009), Iacovone and Javorcik (2008), Verhoogen (2008) and Sutton (2007).

towards higher-priced, higher-quality varieties by lowering their relative price. Previous studies supporting this mechanism for quality sorting include Hummels and Skiba (2004), who find that export costs, taken literally as transportation costs, behave much more like specific costs than ad valorem costs in their relationship with destination-specific export prices. Lugovskyy and Skiba (2010) also find a significant portion of transport costs to be specific. On its face, the quality sorting of Chinese art is consistent with Alchian-Allen, though it probably does not reflect the cost structure of physical transportation. It could be that there are other specific costs to exporting fine art, such as those associated with establishing an artist's brand or acquiring information, which explain the quality premium on international sales. As alluded to above, quality sorting may also be driven by demand-side factors such as differential preferences for quality across markets. These forces have been emphasized by Hallak (2006), Feenstra and Romalis (2012) and Lugovskyy and Skiba (2010), where the preference for quality is modeled as an increasing function of importer income. To see which effect (i.e., specific costs a la Alchian-Allen or preferences for quality) is more prominent in our data, we will adapt the formulation of Feenstra and Romalis (2012) and derive a structural interpretation of our international quality premium. We find that the quality premium for Chinese art largely reflects specific costs.

Third, albeit for only one specific industry, we provide a quantification of the relative contributions of quality and markups to export prices. Recent studies, such as Manova and Zhang (2012), Bastos and Silva (2010), Brambilla, Lederman, and Porto (2012) and Kneller and Yu (2008), each find that average export prices of a given product vary systematically across destinations, in some instances even within the same exporting firm. The fact that prices are a function of destination characteristics such as income suggests that exporters are able to price discriminate by adjusting their quality and/or markups. Building on those results, we show that quality dominates (non-quality-related) markups in the determination of the international price premium for Chinese art (result (iii)). We also demonstrate that the *quality-adjusted* markup differences across markets are still large in absolute terms (result (iv)). It is noteworthy that this last result highlights the

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importance of variable markups and their influence on the distribution of export prices; in standard heterogeneous firms trade models, the firms with the lowest quality-adjusted price, due to high productivity, are the ones that export. Here, once marginal cost and quality are held constant, exporters still have relatively higher prices due to markups.

Fourth, thinking about Chinese artists as firms, we show that these facts are robust to single- and multi-product producers: export prices are higher both because higher quality artists select into exporting and because exporting artists export their higher quality artworks. In terms of the relative contributions of quality and markups, quality is the dominant factor in both the artist-level and within-artist international price premium. This is consistent with the predictions of the multi-product firm model of quality heterogeneity in Bastos and Silva (2010).

Finally, we use the depth of the dataset to try to further analyze quality and markup discrimination across markets. It turns out that the price and quality premia are quite sensitive to the region where the auction is located, the medium and period of the artwork, and the degree of internationalization of the artist (result (v)). These findings are related to the modeling of international trade prices with variable markups. In a model with linear demand, Melitz and Ottaviano (2008) show that exporter markups and average productivity are an endogenous function of market size and the degree of trade integration, with larger and more integrated countries characterized by higher average productivity and lower average markups. This is the opposite of our result that larger art markets (i.e., US and UK) and highly internationalized artists have relatively high markups, even controlling for quality. These results support our earlier argument that there are other forces above and beyond productivity differences that can drive large wedges in international prices. These forces might include specific costs such as informational barriers or non-homotheticities in the demand for quality.

The paper proceeds as follows. The next section provides an overview of the evolution of the Chinese fine art market over the past decade and details the dataset. Section 3 describes our

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empirical specification and results, including a structural interpretation of quality sorting. Section 4 concludes.

2. The Market for Chinese Art

2.1. Data

Our point of departure is a highly detailed list of the auction sales of Chinese artists sold anywhere in the world since 2000. We obtain these data from www.artron.net, one of the largest online databases covering auctions of Chinese artworks and antiques. Our dataset contains catalogue information from 6,978 individual auctions that took place in 424 auction houses in China (including Hong Kong, Macau and Taiwan) between May 1994 to September 2011, totaling 1,994,178 individual lots and over RMB 200 billion in sales turnover. In addition, the dataset includes another 165 auctions selling works of Chinese art and antiques held at 16 auction houses outside of greater China, totaling 39,830 individual lots and over RMB 11 billion in sales turnover.

The dataset provides information on each auction, including the name of the auction house, the time of auction, the ordering of items within an auction, the low and high estimated prices for each item, whether the item was sold, and how much it was sold for. In addition, the dataset also provides information on the characteristics of each artwork, including the title, the classification of the artwork (calligraphy, paintings, jewelry, furniture, etc.), its size and medium, the artist, the time period in which the work was produced, and any proof of the authenticity of the work provided by the seller.

In previous studies of art auctions, researchers have identified most of the aforementioned observable characteristics as important factors in determining art prices. In terms of the characteristics of the artworks, for example, the literature has found that art prices correlate positively

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with 1) the size of the work (to a certain extent), 2) the presence of the artist's signature or some other signs of authenticity, 3) the prestige of the work's provenance, and 4) the rarity in terms of its medium, style or subject matter. Furthermore, oil paintings often auction for higher prices than other media such as watercolor, presumably because of its superior durability.

In terms of the characteristics of the artist, the literature finds that the price of artworks correlate positively with 1) the historical significance of the artist, 2) the participation of the artist in major exhibitions, 3) the prestige of the gallery that represents the artist, 4) the popularity of the subject matter that the artist specializes in at the time of auction, and 5) whether the artwork was produced during the best period of the artist's career. The nationality of the artist and the artistic style that the artist identifies with are also important drivers of price.

Lastly, the features of the auction itself, including the prestige of the auction house, the location of the sale, the time of the sale, the ordering of the lots, etc., are important determinants of sales prices as well. Some studies, such as Ashenfelter and Graddy (2003) and Mei and Moses (2002), have found that the estimated price range provided by auction houses have an anchoring effect on the buyers and hence a positive influence on hammer prices.

In this paper, we focus on the works of art in the following classifications: calligraphy, classical-style paintings, and oil paintings. These segments together account for 1,234,338 individual lots, and over RMB 134 billion in sales, 63.7% of the total sales turnover recorded in the dataset. Among the 1,234,338 lots, the database does not report sales price for 540,948 lots, which is an indication that those items went up for auction but were not sold. These observations are removed from our sample for our baseline specification. In addition, another 10,206 lots are removed because they do not have information on the artist of the work. Finally, in the resulting 683,184 lots, we focus on the 679,317 lots that were auctioned on or after January 1, 2000, due to the relative sparsity of coverage prior to 2000; there are only 644 lots sold per year on average in our sample pre-2000, compared with an average of 56,610 lots per year afterwards. In addition, the average number of

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auction houses that the database covers is only 3 in the years prior to 2000, compared with 77 auction houses afterwards.

2.2. Market Overview - Volume

The past decade has witnessed a boom in the market for Chinese art, which has mirrored the boom in China's overall economy. Sales revenue from domestic auctions, defined as sales in mainland China, went from RMB 96.7 million in 2000 to RMB 32.1 billion in 2010, a compound annual growth rate of 79 percent. At 2013 values of the renminbi of 6.2 per dollar, sales grew from $15.6 million to $5.2 billion over the same period. As we will show, this increase was driven by both quantities and prices of Chinese art sold at auction. On the quantity side, the number of works sold at domestic auctions houses increased from 2,218 in 2000 to 48,480 in 2010, a compound annual growth rate of 49 percent. The initial low level and blistering subsequent growth of Chinese art sales indicate that the 2000s represented the birth of this market as a major auction category. More broadly, China's domestic market for all types of art underwent dramatic growth over this period. According to Artprice's 2011 annual "Art Market Trends" report, Beijing represented 27% of global auction revenues for the year and finished ahead of New York and London as the leading marketplace for art in terms of revenue.

We will pay special attention to the international aspect of this market expansion. Figure 1 (drawn from the more detailed data in Table 1) shows the growth of domestic and international sales over the period 2000 through mid-2011, where international sales are defined as those outside of mainland China.[4] Values for both series were low and flat through 2003, when they each began to accelerate. Domestic sales shot up to almost RMB 10 billion by 2005 and accelerated dramatically again in 2008-11. Note that we only observe sales through mid-2011; with data through the rest of

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[4]We treat Hong Kong as part of the international market because Hong Kong's free-port status results in low taxes, zero tariffs on art, mild regulatory burden, and banking secrecy, which makes it significantly different from the mainland art market.

the year, 2011 would have been, quite literally, off of the chart. International sales grew steadily through 2007 before being dented by the financial crisis in 2008-9. All in all, international sales went from RMB 83 million in 2000 to RMB 3.5 billion in 2010, a compound annual growth rate of 46 percent.

Table 1 drills down further into the geographic composition of Chinese art sales. The majority of artworks by Chinese artists are auctioned in mainland China, which accounts for over 89% of the total sales turnover and 97% of the number of works sold in our sample. In particular, the largest domestic auction houses are concentrated in Beijing, accounting for over 71% of the total sales and 62% of the total works sold. The largest foreign-operated auction houses, namely Sotheby's and Christie's, auction the majority of their portfolio of Chinese artworks in Hong Kong, which accounts for 9% of overall sales and 2% in terms of the number of works sold.

One can draw distinctions between the nature of domestic and international transactions along several dimensions. First, the type of artist sold internationally tends to be quite different from that which has sold only domestically, as illustrated in Table 2. We note that it is only a relatively small subset of artists, about 14 percent, who are sold internationally, and that those artists account for a disproportionate share of overall sales volume. We define domestic-only artists as those who never had their works auction outside mainland China in our sample, whereas international artists are those with at least one. As show in Panel A of Table 2, there are a total of 41,812 individual artists in our sample, of which 5,881 are international. However, the median number of works sold is much higher for international artists, at 7, relative to domestic-only artists, at 1. Figure 2 shows the cumulative number of domestic-only versus international artists in each year. The majority of Chinese artists never sell outside of mainland China, accounting for 58% to 87% of all artists in a given year. Furthermore, 29% to 43% of the international artists in a given year are those who have auctioned internationally only once. Finally, Table 3 compares the works of international artists sold at auctions in mainland China versus their works sold in international markets. It is evident that the majority of works by international artists are auctioned in mainland China, totaling over

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RMB 101 billion in sales, or 85% of their total turnover.

A second dimension of the international nature of art transactions reflects the composition of auction houses, acting as intermediaries in art transactions, that have sold Chinese art. Panel C of Table 1 illustrates that mainland intermediaries grew very quickly in the 2000s, going from 6 to 128. Moreover, this growth was relatively consistent among Beijing, Shanghai and other locations. These observations are somewhat surprising in light of the fact that revenues are highly concentrated in China's two flagship auction houses, China Guardian and Poly International Auction. In contrast, sales internationally have taken place at a much smaller number of auction houses, concentrated primarily in Hong Kong.

To be sure, Guardian and Poly have been a key role in the rise of the Chinese art market. China Guardian started business in Beijing in 1993 and operates on a private business model similar to Sotheby's and Christie's. It leads the mainland auction houses with $901.8 million, about 8 percent of the world's auction sales revenue in 2011. Poly was founded in 2005 and also saw its share of global auction revenue grow to 8% in 2011. Both auction houses now rank third and fourth in the global auction market, next to Sotheby's and Christie's whose combined global market share has fallen from 73% to 47% in just ten years, according to "Art Market Trends 2011". As a measure of the growth in the Chinese market, even smaller auction houses, such as Beijing Hanhai and Beijing Council, ranked among the top ten auction houses in the world in terms of revenue in 2011.

2.3. Market Overview - Prices

We will now turn our attention to art price differences across markets, which is the main focus of the paper. The top panel of Figure 3 shows the average price level of internationally sold artworks relative to those of artists who have only sold domestically. In addition, since we observe all of the works of all artists, we can define a third category of artwork as the domestic sales of artists who have sold internationally at some point during the sample. The international sales have a price

level substantially higher than domestic sales; the average price of works sold in mainland China is RMB 173,170, compared with an average of RMB 531,667 of works sold in the international markets. The artworks of domestic-only artists have the lowest average price level, while the domestic sales of internationally-sold artists carve an intermediate path in between international and domestic-only. The bottom panel indexes each series to its level in 2000 to gauge the relative growth rates of prices. International sales, in spite of their high levels and almost doubling through 2011, grew the slowest while domestic sales, led by the domestic sales of international artists, grew the fastest. In summary, the unconditional average price of international sales was substantially higher than domestic sales during the 2000s, but domestic sales were catching up.

One additional characterization of art prices in each market is their variance, shown in panel E of Table 1. We note that there is a very high degree of price dispersion in all markets, with the overall standard deviation of prices equivalent to a 184 percent deviation from their geometric mean. At the beginning of the sample, the variance of international sales is below the variance of domestic sales, though this changes over time as increasing price dispersion in Hong Kong pulls the international standard deviation above the domestic one. These trends are germane to the evaluation of art quality in the following sections and are suggestive of evolving quality composition across markets.

Taking a step back from the data, we acknowledge that there are several shortcomings to analyzing art markets using auction prices. First, industry reports suggest that auctions account for less than 50% of the artworks transacted in the market, with the rest taking place in galleries and via dealers. However, since the dealer market is highly segmented and not transparent, it is difficult to obtain comparable data. Also, as Goetzmann (1993) argues, auction data have inherent survivorship bias as only works that do not fall out of fashion or are acquired by museums and major private collectors can appear on the auction market. An analogous selection bias is that auction houses (especially the larger ones) may select only the works of the highest calibre. Second, other factors that we do not observe in our auction dataset may be influencing the price of artworks.

For example, the characteristics of buyers (e.g., motivation, valuation, art historical knowledge, information set) can be significant drivers of prices. Pommerehne and Feld (1997) have argued that public museums often purchase artworks at above-average prices because they tend to target works whose calibre and historical significance are often not in question. As a result, such works have lower risk and require a higher premium. Finally, many external forces are at play. Renneboog and Spaenjers (2012) identify economic growth, disposable income (inequality) and lagged equity returns as important determinants of art prices. The regulatory structure of a market are also important. As pointed out by Plattner (1996), the tax benefits associated with donations to cultural institutionsintheUSmayplayaroleintheselectionofartworksboughtatauction. Wedescribe several other factors in the following section. We describe several 'other factors' in the following section.

2.4. Other Factors

We conclude our description of the market for Chinese art by outlining some other concerns that may drive differences in auction price between mainland and international transactions. First of all, we don't expect physical shipping costs to substantially alter the relative price of international transactions, as anecdotes suggest that most artworks auctioned outside China are not exported from China directly before the sale.[5] Exceptions are primarily modern and contemporary artworks, however for that group of artworks, shipping costs are typically a de minimus share of the final auction price.

Second, the buyer's premium (i.e., the fee charged by the auction house) is not very different in mainland and international auction houses. Take Christie's as an example, where the buyer's premium is 25% for an auction price up to $75,000, 20% for an auction price between $75,000 and

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[5]Artworks dating prior to the 19th century and which are auctioned in the international market had likely been taken out of mainland China before the foundation of the People's Republic of China in 1949.

$1.5 million, and 12% for a price larger than $1.5 million.[6] By way of comparison, at the top two Chinese auction houses, Poly and Guardian, the buyer's premium ranges between 10-25%.[7]

3. Empirical Results

In this section, we document the average price and quality of internationally selling artworks and internationally selling artists (including their domestic sales) relative to those of artists that only sold in mainland China. The framework used is the hedonic regression. The marginal values of each artwork characteristic and transaction characteristic are estimated, including physical characteristics, auction house estimates and proxies for authenticity or provenance, among others. Whether the artwork was sold domestically (i.e., at auction in mainland China) or internationally (i.e., outside of mainland China) enters as an additional characteristic in the hedonic regression, and will be our gauge of the relative markup on international transactions. Further, we will consider two different measures of this international price premium. In the first, we do not control for the influence of all of an artwork's quality characteristics described above; this will be our measure of the unconditional international price premium. In the second, we do control for those characteristics. The difference between the international price premium that does not control for quality and that which does is our estimate of how quality influences international prices (i.e., it is an international quality premium). Finally, we also assess the effect of being an internationally sold artist on the price and quality premia of that artist's domestic sales.

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[6]http://www.christies.com/features/guides/buying-guide/related-information/buyers-premium
[7]Poly's website: http://en.polypm.com.cn/english/pmgz.php. China Guardian's website (in Chinese): http://www.cguardian.com/tabid/68/Default.aspx

3.1. Baseline

In our baseline model, the log price of a given artwork for sale, $\ln p^i_{ct}$, is a function of whether the work is sold internationally, *Intl_Intl*, whether it is the domestic work of an internationally selling artist, *Dom_Intl*, a vector of quality characteristics Z, and a full set of semi-annual fixed effects:

$$\ln p^i_{ct} = \alpha + \beta_0 Intl\_Intl + \beta_1 Dom\_Intl + \sum_{c=1}^{m} \beta_{2,c} \, Z_c + \sum_{t=1}^{n} \beta_{3,t} \, year_t + \varepsilon^i_{ct} \qquad (1)$$

The average difference in price between international and domestic artists is estimated by the coefficients β_0 and β_1: β_0 is the price of internationally sold artworks relative to those of artists only selling domestically, while β_1 is the price of domestically sold artworks of internationally selling artists relative to those of artists only selling domestically. The quality characteristics contained in the vector Z include: the type of artwork, the period it was produced, its size, among others listed in the Appendix A.

An important additional quality characteristic is the pre-sale auction house estimate of the artworks value which is a range composed of a low estimate and a high estimate, and which we include as part of Z. The pre-sale range of estimates captures a wide array of value-determining characteristics which are otherwise difficult to measure, including the significance of the artist and artwork, the value from being sold at a particular auction house and even geographic characteristics. It is also well-documented the low estimate tends to be closely related to the seller's reserve price below which the item fails to sell at auction. We exploit this fact in two ways. First, in our baseline, the low estimate is a control variable which additionally captures variation in prices due to the seller's reserve. To the extent that the seller's reserve price is related to the past sale price of an artwork, the low estimate serves as a control for the artwork's cost basis. Second, since models of international trade featuring imperfect competition stress the role of the firms as price setters, in the following section we will examine the robustness of the results using the low estimate as the dependent variable.

Given the inclusiveness of the pre-auction estimate variable in terms of its informational content, we do not include artist dummy variables in our baseline specification. We will shall introduce those later on as a robustness check to control for unobserved artist characteristics. We note, however, the fact that auction house estimates may reflect the value of being an internationally sold artist, and hence might be collinear with β_0 and β_1. Such a correlation (and the implied inclusive definition of quality) would imply that β_0 and β_1 are conservative estimates of the true underlying international price premium. We do not include fixed effects for auction houses given their collinearity with the geographically defined international dummy variables. And finally, the semi-annual fixed effects control for general trends in the prices of Chinese fine art across all markets.

Our baseline results are shown in Table 4. The first column shows the unconditional price premium commanded by internationally selling artists, that is, *without* controlling on the quality characteristics of each artwork. It is evident that internationally selling artists have much higher prices than domestically selling artists and, further, that this result is driven by both the international and domestic sales of the internationally selling artists. International sales have the rather large price premium of 155 percent while the domestic sales of internationally selling artists have a price premium of 100 percent. It is immediate that prices of international sales are about 50 percent higher than the domestic sales of internationally selling artists.

The second column reports results from a similar regression, though this time the quality controls (including auction house pre-sale estimates) are added to the right-hand side of the equation. We can interpret the price premium for international artworks in this regression as a 'quality-adjusted' premium since it takes into account the composition of works sold in each market. It is evident that the premium for both internationally sold works and the domestic works of internationally selling artists goes down considerably when quality differences are accounted for, as the estimates drop to 28.5 percent and 14.8 percent, respectively. That said, apples-to-apples price differences of almost 30 percent still indicate a substantial amount of international price dispersion.

We take this to mean that the markup charged in the international market is substantially higher than in the domestic market. Moreover, the markup charged for internationally selling artist in the domestic market is larger than for the rest of the domestic market. There could be various reasons for this latter observation, such as some type of anchoring or signaling mechanism orthogonal to measured quality characteristics which drives up the markups of the domestic artworks of international artists.

One can interpret the difference between the unconditional estimates in the first column and the quality-adjusted estimates in the second column as the influence of quality composition on international art prices; this difference is shown in the third column entitled 'international quality premium.' Reading across the first row, the results indicate that internationally selling artworks are 155 percent more expensive than those of domestic artists, with 127 percent of this premium due to the fact that internationally sold artworks have higher-valued quality characteristics. We also observe that most (over 85 percent) of the premium for the domestic works of internationally selling artists is due to quality differences, as implied by the estimates in the second row.

Overall, the results in Table 4 suggest a high degree of quality sorting into export markets: (i) artists with higher quality artworks select into selling internationally, and (ii) the higher quality works of those artists are the ones that sell internationally. The first of these statements is supported by the fact that the international quality premium is positive for both international artworks and domestic works of international artists. The fact that all types of sales of international artists have higher quality implies that, on average, the quality of internationally selling artists is higher than that of domestically selling artists. The second statement is illustrated by the relatively large premium for international works. In summary, a sufficient condition for these two statements to be true is:

International quality premium (intl.) > International quality premium (dom.) > 0

which holds in our baseline in Table 4, as well as in the balance of robustness checks presented in the next section.

The pattern of quality and markup sorting also holds over time during this period, as shown in Figure 4 on an annual basis. However, the magnitude of the quality premium and the quality-adjusted premium have distinct dynamics. The quality premium was very high at the beginning of the period, reaching a peak of 412 percent in 2001, before falling steadily to less than 100 percent in 2007 and ticking up thereafter. In contrast, the quality-adjusted price premium grew steadily through 2007, going from 9 percent to 45 percent before falling back to 13 percent in 2010.

3.2. Robustness

To gauge the robustness of the international price and quality premia in the baseline model, there are several alternate specifications that we explore. First, we return to the notion that auction sales prices may systematically differ from the reserve price of the seller. This could be introducing bias into the measures of the international premium due to the use of auction *transaction* prices in the baseline regression; to the extent that transaction prices deviate from reserve prices either more or less in international transactions than domestic ones, the international premium would reflect that difference in prices. Table 5 shows the resulting estimates of (1) where we have substituted the transaction price on the left-hand side with the low estimate (a proxy for the seller's reserve price). Since the low estimate was previously used as a quality control variable, the specification in Table 5 also adds artist fixed effects for the top 300 artists by physical sales volume into the quality-adjusted international premium specification. The results are broadly in line with our baseline, though the unconditional price premium falls somewhat for both international sales and domestic sales of international artists and the quality-adjusted estimates rise. Importantly, as before, the quality premium indicates both across artist and within artist sorting into international sales.

In Table 6, we address the possibility that there is selection bias in our baseline sample of

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artworks which only included those that consummated a sale at auction (and did not include lots put up for auction that failed to sell). This concern is not a trivial one as roughly one third of our 1.1 million observation sample does not have a transaction price, indicating that these works did not end up being sold. Building on our specification using the low estimate as the dependent variable, we proceed to run the regression over all lots brought up for auction. The estimates shown in Table 6 are minimally different from those in Table 5, indicating that even if there are systematic pricing differences between sold and unsold artworks at auction, they do not manifest themselves across geographic auction locations.

In Table 7, we consider whether the churning of artists in the sample had an appreciable influence on the international premia. Given the rapid growth in the number of domestic artists documented above (see Figure 2) there may be concern that the composition of artists is changing in such a way that amplifies the price differences across markets. For example, if the new domestic entrants are of relatively low price and quality, it would create the appearance of relatively high quality international and incumbent domestic artists. We test this possibility by reverting to auction transaction prices on the left-hand side and holding the composition of artists in the year 2000 constant over subsequent periods. Table 7 shows that doings so, despite dropping roughly half of the sample, has little effect on the international price and quality premia of internationally sold artworks. The domestic-international premia decline somewhat but are qualitatively similar to the baseline.

Next we examine the international price and quality premia in particular destination markets. To do so, we divide the international cohort into two groups: Honk Kong/Macau/Taiwan and US/UK/Other, which roughly divides the world into the broader Asian market and the rest of the world, respectively. Table 8 shows regression estimates for the US/UK/Other group of auction locations. It is immediately apparent that the premia for international works, both unconditional and quality-adjusted, is much larger than for the overall sample. Artworks sold in the US/UK/Other fetched over three times more than works sold in mainland China. Again, the majority of this

difference (i.e., 283 percent of the 331 percent premium) is accounted for by the higher quality of the international sales, and even controlling for quality there is a large price premium of about 50 percent. Interestingly, the domestic sales of international artists have virtually the same price and quality premia as the overall sample, indicating that there is nothing in particular about selling in US/UK/Other that allows internationally selling artists to charge more in mainland China.

Tables 9 and 10 duplicate the analysis for the different subgroups of medium and period, respectively. Among the media, both the international price premium and quality premium are higher for oil paintings than for classical-style paintings and calligraphy, though the quality-adjusted premium is roughly the same for each medium. That is, while quality sorting seems to be stronger for oil paintings, the quality-adjusted markup is about the same for all media. Much the same pattern holds for contemporary versus non-contemporary art, which is in part by construction since contemporary art is less likely to be classical-style or calligraphy.

Finally, Table 11 decomposes the price and quality premia by degree of internationalization, which is proxied by the number of international sales for a given artist. As shown in Figure 2, the number of artists with very few international sales is not trivial; by 2011, over half of the cumulative number of international sales were by artists who only sold a single painting abroad over the period. This distinction turns out to be quite meaningful for the international premia, as the top quartile of artists by number of international sales have substantially higher relative price and quality than the bottom quartile. For the most internationalized artists, the selection of high quality artists into international markets is also the strongest, as evidenced by the relatively close estimates of the quality premium of international versus domestic works of international artists. In other words, the artists with the highest quality works sell more works abroad, but at a similar quality and price level to their domestic sales.

3.3. A Structural Model of Quality Sorting

Having shown evidence for quality and markup differentials inside versus outside of China, in this section we attempt to rationalize the results through the lens of theories that give rise to quality sorting. To uncover the drivers of the quality premium, we shall follow the structural approach of Feenstra and Romalis (2012) and adapt their model of endogenous quality choice. Their framework features specific transport costs and non-homothetic preferences for quality, a structure that allows for the identification of the quality component of average export prices in the trade data. Given that we observe relative trade quality from our empirical estimates, we shall invert their model equations to identify the parameters governing specific costs and preferences for quality.

On the preferences side, demand in a country k is in the form of the following expenditure function:

$$E^k = E(p_1^k/z_1^{\alpha^k}, ..., p_n^k/z_n^{\alpha^k}, U^k)$$

which is defined over n varieties with price p and quality level z. The parameter α amplifies quality's effect on quality-adjusted prices exponentially and indicates the preference for quality of country k consumers. Since E^k is a function of the country's utility, it follows that richer countries with higher consumption levels spend more on all available import varieties. Similarly, countries with higher levels of α tilt their expenditure towards higher quality varieties. In Feenstra and Romalis (2012), this expenditure function is specialized to the following "non-homothetic" CES function:

$$E^k = U^k \left[\int_i (p_i^k/z_i^{\alpha^k})^{(1-\sigma)} di \right]^{\frac{1}{(1-\sigma)}}$$

which scales the constant elasticity aggregator (with elasticity σ) by country k's level of utility.

On the production side, sellers simultaneously choose the level of quality and the landed price

to maximize the following expression for profit given destination demand Q_i^k:[8]

$$\max_{p_i^k, z_i^k} \left\{ p_i^k - \tau_i^k \frac{c_i(z_i^k, w_i, \varphi_i) + T_i^k}{z_i^{\alpha^k}} \right\} \frac{Q_i^k}{tar_i^k}$$

The difference between landed prices and those at the factory gate are transport and tariff costs, which appear in this expression as a specific cost T_i^k, an iceburg cost τ_i^k and an ad-valorem tariff tar_i^k. Profits also reflect the variable cost of a variety, denoted $c_i(z_i^k, w_i, \varphi_i)$, which is a function of quality as well as input prices and productivity. As discussed above, since auctions are largely secondary market transactions, it is difficult to apply the notion of production to them in a literal sense. Therefore we will proceed by implicitly normalizing $w_i/\varphi_i = 1$, which purges the resulting expressions for price and quality of productivity and wages.[9]

The seller's problem gives rise to two first order conditions for export price and quality:

$$p_i^k = T_i^k \left(\frac{1}{1 - \alpha^k \theta} \right) \left(\frac{\sigma}{\sigma - 1} \right) \tag{2}$$

$$z_i^k = \left[T_i^k \left(\frac{\alpha^k \theta}{1 - \alpha^k \theta} \right) \right]^\theta \tag{3}$$

Price is a function of the specific cost, the quality valuation parameter, the elasticity of substitution among varieties and θ, which is a parameter between 0 and 1 necessary to ensure diminishing returns to the production of quality and a corresponding interior solution for quality and prices in the model. From our empirical work above we have estimates of the price and quality of international sales relative to those of domestic sales (i.e., p_i^k/p_i^0 and z_i^k/z_i^0 where 0 denotes a domestic sale). Equations (2) and (3) thus compose a system of two equations in 4 unknowns

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[8]At this point, we depart somewhat from the notation in Feenstra and Romalis (2012). First, we do not adopt firm-level subscripts for two reasons: (i) since our focus will not be on firm-specific (in our empirics, artist-specific) variation in costs, we abstract from firm level heterogeneity in productivity and inputs, and (ii) we have in mind an application where each firm/artist has many varieties on the market, and so the exposition is clearest modeling individual varieties, not firms. Second, for simplicity and ease of interpretation, we do not track the factory gate prices of sellers.

[9]In Feenstra and Romalis (2012), productivity and wages also cancel out of aggregate export prices but for a different reason. See footnote 8 in their paper.

$(T_i^k, \alpha^k, \sigma, \theta)$. Our final identifying assumption is that σ is the same across markets.

Dividing each expression by its value for domestic sales, taking logs and rearranging yields a closed form expression for the relative preference for quality across destinations:

$$\ln\left(\widehat{\frac{\alpha^k}{\alpha^0}}\right) = \ln\left(\frac{p^k}{p^0}\right) - \frac{1}{\theta}\ln\left(\frac{z^k}{z^0}\right) \qquad (4)$$

Interestingly, for values of θ close to 1, a sufficient statistic for the relative preference for quality is the quality-adjusted international price premium (i.e., $\ln\left(p^k/p^0\right) - \ln\left(z^k/z^0\right)$). In other words, countries with a strong preference for quality have higher markups, *above and beyond* those being paid for imports of higher quality. The intuition for this result is that sellers internalize consumers' preference for quality and increase their prices to high-valuation markets by even more than the premium implied by the quality-inclusive price. Due to the non-linearity of the logged first order conditions with respect to α, it is difficult to solve directly for T^k/T^0. That said, Equation (4) already attaches an implicit value to the importance of specific costs; holding σ and θ constant, changes in the price premium over time above those accounted for by the quality-adjusted price are being driven by changes in the relative specific cost.

With this decomposition in mind, we return to our time series estimates of the international price and quality premia in Figure 4. Equation (4) implies that the low and relatively stable value of the quality-adjusted price premium implies a similarly modest and stable role of relative preferences for quality in driving the international price premium. Given this measure of relative preferences, it therefore must be an the specific costs that are behind the heights of the international quality premium in the early portion of the sample. The dynamics of the price premium tend to support this story: In the early years when information about Chinese artists was relatively scarce outside of China and the specific cost of acquiring that information was great, the relative quality of international sales was very high. Then, as the international community of art buyers better acquainted itself with Chinese art, these costs began to fall and so did the relative quality of

international sales. All the while, preferences for quality also contributed to prices at relatively high levels outside of China, albeit relatively modestly. The dynamics of the estimated preference for quality implies that international taste for Chinese art grew steadily relative to mainland China over the first part of the sample, and then tapered off in the more recent years. This latter change may indicate that Chinese preferences for quality have increased in line with the recent burgeoning of the domestic market.

4. Conclusion

This paper takes preliminary steps in identifying the drivers of quality and markup heterogeneity across international markets. Our study of the Chinese art market suggests that product quality exerts a considerable influence on international price differences, operating through higher markups. The results also shed light on the dynamic nature of product quality over the course of an international markets inception. We find that the international quality premium was particularly high as sales were first being made abroad and tapered off thereafter, an indication that the per unit costs associated with purchasing Chinese art outside of China were initially high but declining. Relative preferences for quality also appear to contribute to the quality premium, albeit less so than specific costs and in a more stable manner over time.

Chinese art may also be a useful lens through which to view other open issues in international pricing. For example, a particularity to art auctions is that all sales take place through intermediaries (i.e., the auction houses) as opposed to directly between buyers and sellers. Indeed, we do not actually observe who either transacting party is, but only that a transaction occurred at the intermediating firm. While our analysis accounts to some extent for the influence of auction intermediaries on prices, through auction house controls and auction house estimates in the hedonic regression, there is much more to be said about the role of intermediaries at both distributing goods and services internationally and creating value.

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Finally, we acknowledge that art, as a cultural export, is at best an analogy for international trade in more standard types of goods. That said, however, art bears a resemblance to manufactured goods in certain respects that warrant further investigation. For instance, total auction sales value across artists appears to be distributed following a power law, which is a hallmark of the firm size distribution and a highly cited fact in the international trade literature. Whereas for standard manufactures this distribution is often taken as evidence of a firm productivity distribution with a fat right tail, it must be other factors either on the supply-side or demand-side which generate this pattern of sales for art. This similarity with manufactures may also imply more general applicability of lessons gleaned from the art market.

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Appendix

A. Control Variables for the Quality of Artworks

The quality control variables used in the hedonic regressions are listed below.

1. The type of artwork

   We identify whether the artwork is an oil painting, an ink or watercolor painting in the classical style, or a work of calligraphy.

2. The period in which the artwork is produced

   For each artwork where the information on the time period in which it was produced is available, we classify it into one of four periods: Pre-1840, Late Qing Dynasty (1840-1910), Republican period (1911-1948), and Contemporary period (Post-1949).

3. The order in which the item is sold at auction

   Given evidences of the declining-price anomaly found in art auctions (Beggs and Graddy (1997)), we identify the order in which items are put on sale in each auction. Dummy variables are created indicating in which quintile each item was auctioned.

4. The size of the artwork

   Consistent with existing literature on Hedonic Regressions, we include measures of the artwork's height (cm), width (cm), height-squared (cm^2), width-squared (cm^2), and total surface area (cm^2).

5. The medium of the artwork

   We include in the regression dummy variables indicating whether the artwork is of the following medium: Acrylic, Ink, Oil, Tempera, On Canvas, On Panel, On Paper, On Silk, or On Xuan Paper.

6. The authenticity and provenance of artwork

   We construct dummy variables based on the presence of other features of artwork, including 1) whether the work was signed, 2) whether the work was stamped by the artist or subsequent collectors, 3) whether the work was inscribed, 4) whether the work was titled, 5) whether the work is dated, 6) whether there is any evidence of authenticity of the work, including statements signed by art history experts, 7) whether the work took part in major exhibitions, 8) whether the work was included in major publications, and 9) whether the work has significant provenance.
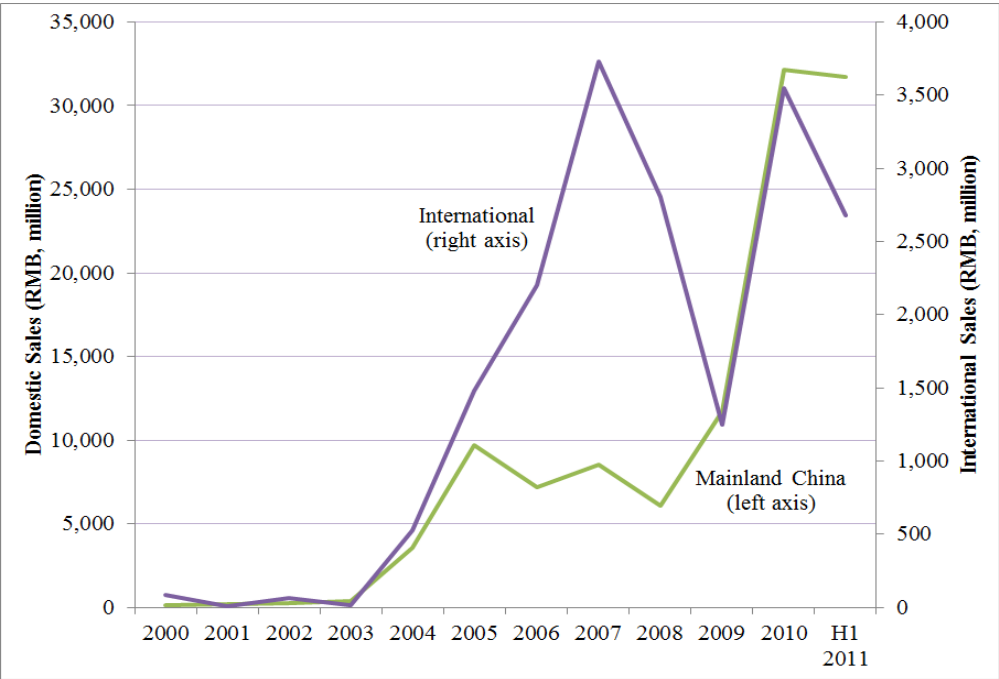
Figure 1: **Domestic and International Sales Outstanding of Chinese Artworks in Calligraphy and Paintings**. Domestic sales include all revenue from auctions houses in mainland China, while international sales include revenues from auction houses out of mainland China.
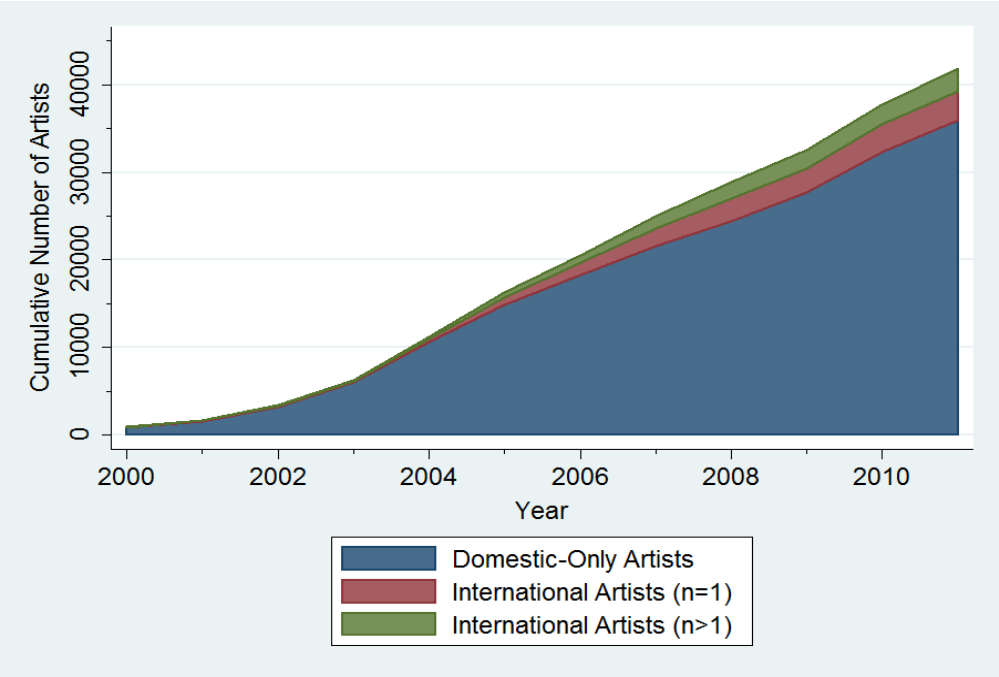
Figure 2: **Cumulative Number of Domestic-only and International Artists**. This figure shows the cumulative number of artists in our database at the end of each calendar year. Artists are grouped based on the total number of works sold outside mainland China up to the end of each year. Domestic-only artists never have works auctioned in the international market, whereas international artists have $n(n > 0)$ works sold internationally.

A. Level
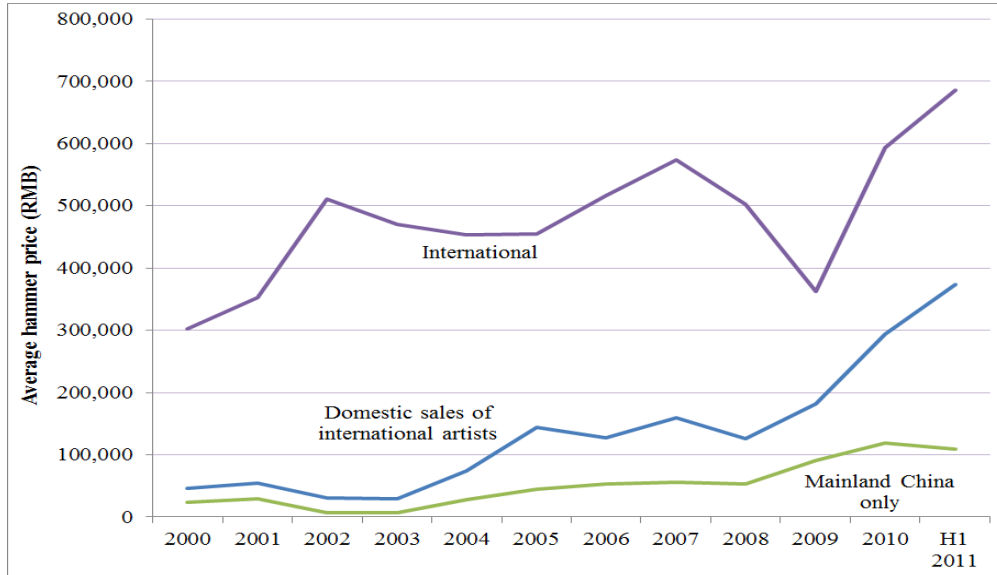
B. Growth
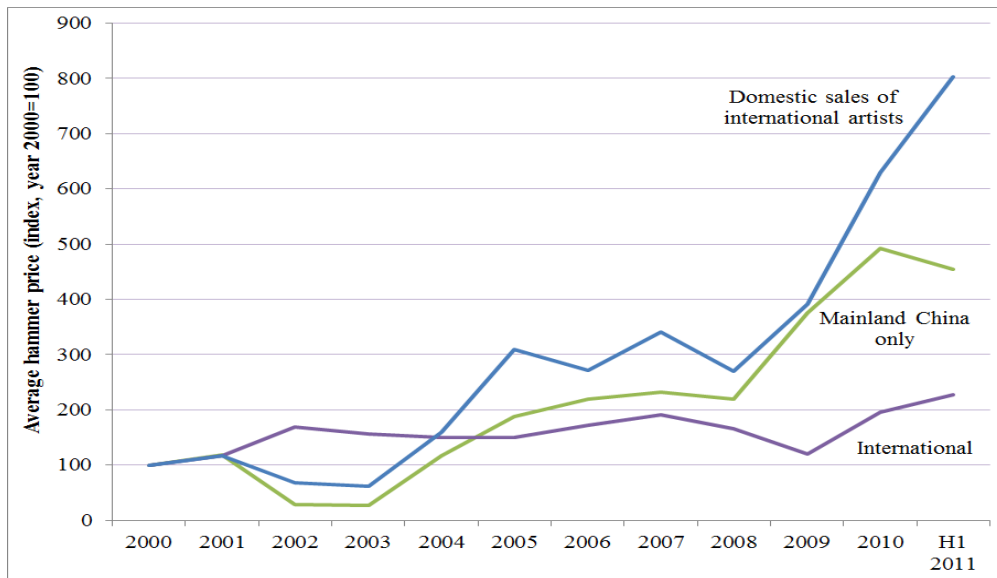
Figure 3: **Hammer Price of Domestic-only and International Chinese Artists**. Panel A shows the average hammer price and Panel B shows the growth of average hammer price based on the level of 2000 (Index2000=100). Domestic-only Chinese artists never have works auctioned in the international market, whereas international artists have works sold internationally.
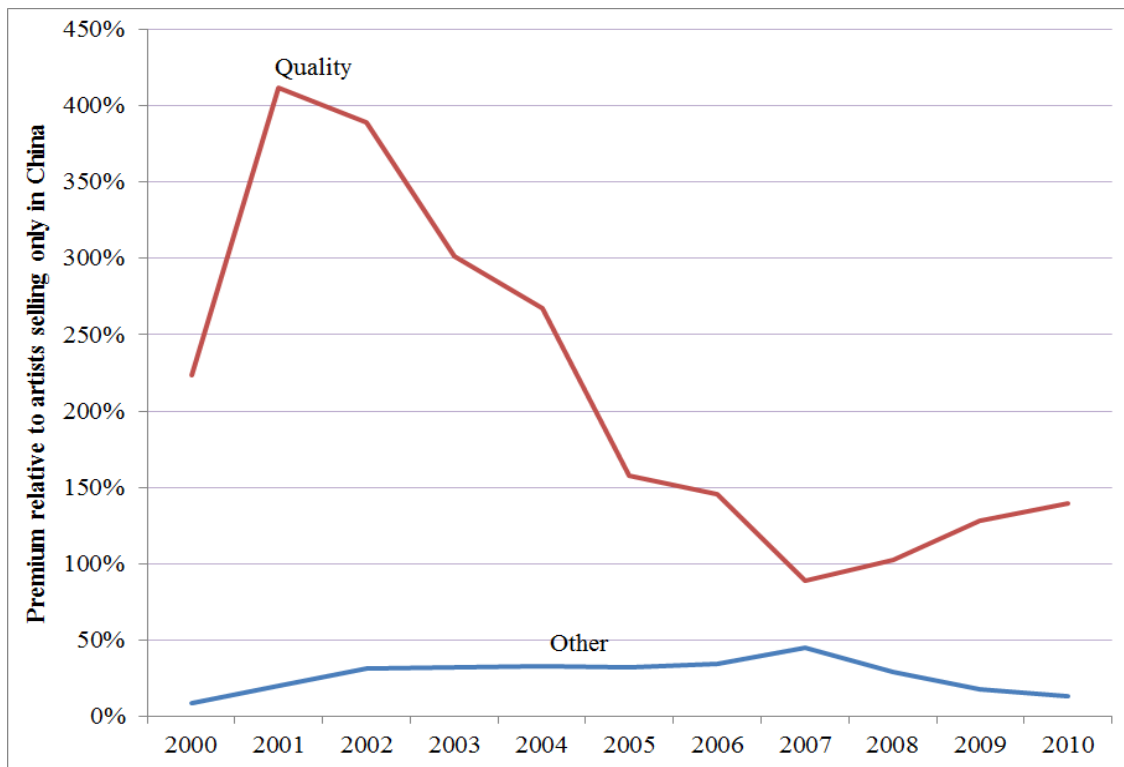
Figure 4: **The Evolution of International Premium decomposed into Quality and Markup**. The decomposition of international premium is based on equation (1).

Table 1: Auction Results by Location

This table reports auction results of Chinese art during 2000 - 2011 in the domestic and international market. We categorize the domestic market as Beijing, Shanghai, and others; we categorize the international market as Hong Kong, Macau, Taiwan (HMT), United Kingdom (UK), United States (US) and others.

Panel A: Total Sales (RMB Million)

	Domestic				International					Total
	Beijing	Shanghai	Other	Subtotal	HMT	UK	US	Other	Subtotal	
2000	81.1	0.5	15.1	96.7	82.7	-	-	-	82.7	179.4
2001	164.4	26.0	17.7	208.0	7.3	-	-	-	7.3	215.4
2002	114.0	88.6	26.2	228.8	66.9	-	-	-	66.9	295.8
2003	201.0	148.8	44.8	394.5	16.9	-	-	-	16.9	411.4
2004	2,206.5	848.5	525.0	3,580.0	528.4	-	-	-	528.4	4,108.3
2005	6,298.2	1,977.0	1,439.4	9,714.7	1,468.0	-	8.9	4.9	1,481.8	11,196.5
2006	4,760.3	763.0	1,675.7	7,198.9	2,024.7	-	177.1	-	2,201.8	9,400.7
2007	5,833.2	985.2	1,728.2	8,546.7	3,189.7	45.0	493.7	-	3,728.4	12,275.0
2008	3,957.2	786.5	1,330.5	6,074.2	2,343.6	278.9	184.6	-	2,807.1	8,881.4
2009	8,333.2	1,312.7	2,100.3	11,746.1	1,177.2	21.4	33.4	14.6	1,246.7	12,992.8
2010	22,138.9	4,120.0	5,878.4	32,137.3	3,497.6	13.6	19.5	17.5	3,548.2	35,685.5
2011	21,157.9	3,278.8	7,284.7	31,721.4	2,655.1	-	14.1	5.7	2,675.0	34,396.4
Total	75,245.8	14,335.5	22,066.0	111,647.3	17,058.3	359.0	931.3	42.7	18,391.3	130,038.6

Panel B: Total Number of Works Sold

	Domestic				International					Total
	Beijing	Shanghai	Other	Subtotal	HMT	UK	US	Other	Subtotal	
2000	1,881	32	305	2,218	274	-	-	-	274	2,492
2001	2,512	902	639	4,053	6	-	-	-	6	4,059
2002	5,429	1,975	1,145	8,549	131	-	-	-	131	8,680
2003	9,296	5,545	1,939	16,780	81	-	-	-	81	16,861
2004	24,893	17,777	11,654	54,324	1,166	-	-	-	1,166	55,490
2005	33,919	22,318	20,320	76,557	3,192	-	14	66	3,272	79,829
2006	35,221	7,886	23,295	66,402	4,043	-	215	-	4,258	70,660
2007	35,012	8,126	20,841	63,979	6,051	87	354	-	6,492	70,471
2008	30,227	8,900	16,961	56,088	5,273	86	233	-	5,592	61,680
2009	38,672	12,930	20,292	71,894	3,317	20	37	64	3,438	75,332
2010	63,945	20,218	39,355	123,518	5,872	25	33	52	5,982	129,500
2011	48,910	14,674	36,780	100,364	3,838	-	35	26	3,899	104,263
Total	329,917	121,283	193,526	644,726	33,244	218	921	208	34,591	679,317

Panel C: Number of Auction Houses

	Domestic				International					Total
	Beijing	Shanghai	Other	Subtotal	HMT	UK	US	Other	Subtotal	
2000	3	1	2	6	2	0	0	0	2	8
2001	5	3	4	12	1	0	0	0	1	13
2002	5	7	5	17	2	0	0	0	2	19
2003	6	9	8	23	2	0	0	0	2	25
2004	9	15	18	42	4	0	0	0	4	46
2005	23	18	27	68	5	1	0	1	7	75
2006	39	17	43	99	8	1	0	0	9	108
2007	37	12	44	93	12	1	2	0	15	108
2008	39	14	42	95	13	3	2	0	18	113
2009	32	13	41	86	13	3	2	1	19	105
2010	51	21	56	128	14	2	2	2	20	148
2011	52	19	71	142	13	2	0	1	16	158

Panel D: Average Sales Price per Work (RMB)

	Domestic				International					Total
	Beijing	Shanghai	Other	Subtotal	HMT	UK	US	Other	Subtotal	
2000	43,120	15,044	49,458	43,587	301,960	-	-	-	301,960	71,996
2001	65,436	28,770	27,678	51,323	1,224,521	-	-	-	1,224,521	53,057
2002	20,996	44,863	22,908	26,766	510,929	-	-	-	510,929	34,073
2003	21,620	26,831	23,099	23,513	208,592	-	-	-	208,592	24,402
2004	88,638	47,733	45,045	65,900	453,150	-	-	-	453,150	74,038
2005	185,683	88,584	70,838	126,894	459,914	-	632,474	74,432	452,877	140,256
2006	135,156	96,749	71,932	108,414	500,798	-	823,653	-	517,100	133,042
2007	166,607	121,239	82,925	133,586	527,135	517,103	1,394,573	-	574,300	174,185
2008	130,916	88,375	78,446	108,298	444,452	3,243,351	792,377	-	501,993	143,991
2009	215,483	101,524	103,501	163,381	354,906	1,070,826	903,964	227,888	362,615	172,474
2010	346,218	203,777	149,369	260,183	595,636	545,415	590,545	336,774	593,147	275,564
2011	432,588	223,442	198,062	316,063	691,805	-	402,190	220,452	686,062	329,900
Total	228,075	118,199	114,021	173,170	513,124	1,646,642	1,011,134	205,488	531,677	191,425

Panel E: Standard Deviation of Log Sales Price per Work (RMB)

	Domestic				International					Total
	Beijing	Shanghai	Other	Subtotal	HMT	UK	US	Other	Subtotal	
2000	1.30	0.98	0.98	1.27	1.21	N/A	N/A	N/A	1.21	1.39
2001	1.14	1.22	1.02	1.21	0.88	N/A	N/A	N/A	0.88	1.22
2002	1.60	1.28	0.96	1.55	1.22	N/A	N/A	N/A	1.22	1.60
2003	1.59	1.29	1.49	1.54	1.29	N/A	N/A	N/A	1.29	1.54
2004	1.72	1.27	1.40	1.52	1.79	N/A	N/A	N/A	1.79	1.56
2005	1.72	1.44	1.58	1.65	2.16	1.49	N/A	1.51	2.16	1.68
2006	1.63	1.49	1.51	1.60	1.97	1.18	N/A	N/A	1.97	1.65
2007	1.75	1.60	1.49	1.66	2.36	1.30	1.15	N/A	2.36	1.75
2008	1.77	1.65	1.47	1.67	2.24	1.24	1.18	N/A	2.28	1.75
2009	1.87	1.74	1.58	1.78	2.04	1.46	1.58	1.01	2.04	1.79
2010	2.05	1.73	1.60	1.86	2.15	1.30	1.65	1.18	2.15	1.88
2011	1.96	1.80	1.63	1.83	2.17	1.92	N/A	1.13	2.17	1.84

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Table 2: Number of Works Sold and Average Sales Price by Artist

This table presents summary statistics on the number of works sold and the average sales price by Chinese artists. We classify artists by whether they have sold works in the international market. Domestic-Only artists have zero works sold in the international market, whereas international artists have at least one work sold internationally. The sample period is from 2000 to 2011.

Panel A: Number of Artist			
	Total	Domestic-Only Artists	International Artists
	41,812	35,931	5,881

Panel B: Number of Works Sold per Artist			
	All Artists	Domestic-Only Artists	International Artists
Mean	16	4	92
Median	1	1	7
Std Dev	147	12	381
Min	1	1	1
Max	9,145	598	9,145

Panel C: Average Sales Price per Work Sold (RMB)			
	All Artists	Domestic-Only Artists	International Artists
Mean	67,422	55,694	139,078
Median	10,450	8,960	25,888
Std Dev	816,015	837,008	669,312
Min	100	100	115
Max	109,000,000	109,000,000	39,100,000

Table 3: Number of Works Sold and Average Sales Price by International Artist

This table compares the auction results of domestic works and international works by international Chinese artists, who have at least one work sold internationally.

	A. Total Sales (RMB Million)		B. Total Number of Works Sold		C. Average Sales Price(RMB)	
	Domestic Works	Int'l Works	Domestic Works	Int'l Works	Domestic Works	Int'l Works
2000	89.4	82.7	1,915	274	46,659	301,960
2001	193.8	7.3	3,558	6	54,469	1,224,521
2002	217.7	66.9	6,945	131	31,346	510,929
2003	368.4	16.9	12,758	81	28,880	208,592
2004	3,305.7	528.4	44,571	1,166	74,168	453,150
2005	9,107.9	1,481.2	63,193	3,256	144,128	454,929
2006	6,324.1	2,201.8	49,859	4,258	126,840	517,100
2007	7,660.3	3,728.4	48,110	6,492	159,224	574,300
2008	5,361.4	2,807.1	42,606	5,592	125,836	501,993
2009	10,412.4	1,246.7	57,143	3,438	182,217	362,615
2010	29,316.4	3,548.2	99,745	5,982	293,913	593,147
2011	29,304.2	2,675.0	78,293	3,899	374,289	686,062
Total	101,661.6	18,390.7	508,696	34,575	199,847	531,907

Table 4: International Price Premium and Quality Premium

	International Price Premium	Quality-Adj. Intl Price Premium	International Quality Premium
International Dummies			
International works of international artists	**1.552**	**0.285**	**1.267**
	(0.013)	(0.004)	(0.013)
Domestic works of international artists	**1.001**	**0.148**	**0.852**
	(0.005)	(0.002)	(0.005)
Time Dummies	Included	Included	
Quality Control	Not Included	Included	
Log Estimated Price	Not Included	Included	
Artist Dummies	Not Included	Not Included	
Constant	**9.164**	**1.195**	
	(0.062)	(0.018)	Number of Observations
Number of Observations	679,317	608,909	
R-square	0.096	0.872	

Table 5: Baseline Regression with Low-end Estimated Value on the LHS, Only Sold Works

	International Price Premium	Quality-Adj. Intl Price Premium	International Quality Premium
International Dummies			
International works of international artists	**1.252**	**0.387**	**0.865**
	(0.013)	(0.010)	(0.016)
Domestic works of international artists	**0.831**	**0.475**	**0.355**
	(0.005)	(0.005)	(0.008)
Time Dummies	Included	Included	
Quality Variables	Not Included	Included	
Log Estimated Price	Not Included	Not Included	
Artist Dummies for the Top 300 Artists	Not Included	Included	
(Based on # of Works Sold)			
Constant	**9.010**	**5.595**	
	(0.061)	(0.056)	Number of Observations
Number of Observations	634,350	608,909	
R-square	0.060	0.456	

Table 6: Baseline Regression with Low-end Estimated Value on the LHS, Including Unsold Works

	International Price Premium	Quality-Adj. Intl Price Premium	International Quality Premium
International Dummies			
International works of international artists	**1.212**	**0.477**	**0.735**
	(0.010)	(0.008)	(0.012)
Domestic works of international artists	**0.746**	**0.430**	**0.316**
	(0.004)	(0.004)	(0.006)
Time Dummies	Included	Included	
Quality Variables	Not Included	Included	
Log Estimated Price	Not Included	Not Included	
Artist Dummies for the Top 300 Artists	Not Included	Included	
(Based on # of Works Sold)			
Constant	**8.855**	**5.788**	
	(0.033)	(0.035)	Number of Observations
Number of Observations	1,128,390	1,084,115	
R-square	0.052	0.401	

Table 7: Balanced Panel of Artists

This table shows baseline regression results for all works by artists who were present in the dataset in the year 2000

	International Price Premium	Quality-Adj. Intl Price Premium	International Quality Premium
International Dummies			
International works of international artists	**1.519**	**0.297**	**1.221**
	(0.026)	(0.010)	(0.028)
Domestic works of international artists	**0.711**	**0.116**	**0.594**
	(0.021)	(0.009)	(0.022)
Time Dummies	Included	Included	
Quality Variables	Not Included	Included	
Log Estimated Price	Not Included	Included	
Artist Dummies	Not Included	Not Included	
Constant	**9.307**	**1.151**	
	(0.061)	(0.020)	Number of Observations
Number of Observations	367,816	337,712	
R-square	0.051	0.871	

Table 8: International Premium when International Destinations Excluding HK/Macau/Taiwan

	International Price Premium	Quality-Adj. Intl Price Premium	International Quality Premium
International Dummies			
International works of international artists	**3.311**	**0.483**	**2.828**
	(0.042)	(0.021)	(0.047)
Domestic works of international artists	**1.001**	**0.153**	**0.848**
	(0.005)	(0.002)	(0.005)
Time Dummies	Included	Included	
Quality Control	Not Included	Included	
Log Estimated Price	Not Included	Included	
Artist Dummies	Not Included	Not Included	
Constant	**8.424**	**1.165**	
	(0.069)	(0.022)	Number of Observations
Number of Observations	646,073	577,345	
R-square	0.100	0.870	

Table 9: International Premium by Classification of Artwork

Calligraphy	International Price Premium	Quality-Adj. Intl Price Premium	International Quality Premium
International Dummies			
International works of international artists	**0.793**	**0.299**	**0.495**
	(0.027)	(0.013)	(0.030)
Domestic works of international artists	**1.150**	**0.174**	**0.976**
	(0.010)	(0.005)	(0.011)
Time Dummies	Included	Included	
Quality Control	Not Included	Included	
Log Estimated Price	Not Included	Included	
Artist Dummies	Not Included	Not Included	
Constant	**8.310**	**1.216**	
	(0.167)	(0.054)	Number of Observations
Number of Observations	136,314	122,549	
R-square	0.139	0.817	

Classical-style Painting	International Price Premium	Quality-Adj. Intl Price Premium	International Quality Premium
International Dummies			
International works of international artists	**1.308**	**0.256**	**1.052**
	(0.016)	(0.006)	(0.016)
Domestic works of international artists	**1.116**	**0.142**	**0.975**
	(0.006)	(0.003)	(0.006)
Time Dummies	Included	Included	
Quality Control	Not Included	Included	
Log Estimated Price	Not Included	Included	
Artist Dummies	Not Included	Not Included	
Constant	**9.223**	**1.172**	
	(0.080)	(0.022)	Number of Observations
Number of Observations	500,814	445,729	
R-square	0.100	0.872	

Oil Painting	International Price Premium	Quality-Adj. Intl Price Premium	International Quality Premium
International Dummies			
International works of international artists	**1.726**	**0.281**	**1.445**
	(0.021)	(0.008)	(0.022)
Domestic works of international artists	**1.205**	**0.097**	**1.108**
	(0.015)	(0.005)	(0.016)
Time Dummies	Included	Included	
Quality Control	Not Included	Included	
Log Estimated Price	Not Included	Included	
Artist Dummies	Not Included	Not Included	
Constant	**9.825**	**0.098**	
	(0.110)	(0.045)	Number of Observations
Number of Observations	42,189	40,631	
R-square	0.220	0.922	

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Table 10: International Premium for Contemporary vs Non-Contemporary Artworks

Contemporary (Post-1949)	International Price Premium	Quality-Adj. Intl Price Premium	International Quality Premium
International Dummies			
International works of international artists	**2.109**	**0.285**	**1.824**
	(0.019)	(0.004)	(0.019)
Domestic works of international artists	**0.883**	**0.148**	**0.734**
	(0.009)	(0.002)	(0.010)
Time Dummies	Included	Included	
Quality Variables	Not Included	Included	
Log Estimated Price	Not Included	Included	
Artist Dummies	Not Included	Not Included	
Constant	**9.984**	**1.195**	
	(0.087)	(0.018)	Number of Observations
Number of Observations	148,676	608,909	
R-square	0.117	0.872	

Non-Contemporary (Pre-1949)	International Price Premium	Quality-Adj. Intl Price Premium	International Quality Premium
International Dummies			
International works of international artists	**1.188**	**0.231**	**0.956**
	(0.015)	(0.005)	(0.016)
Domestic works of international artists	**1.050**	**0.141**	**0.908**
	(0.005)	(0.003)	(0.006)
Time Dummies	Included	Included	
Quality Variables	Not Included	Included	
Log Estimated Price	Not Included	Included	
Artist Dummies	Not Included	Not Included	
Constant	**8.872**	**1.254**	
	(0.075)	(0.021)	Number of Observations
Number of Observations	530,641	465,527	
R-square	0.097	0.860	

Table 11: International Premium by Artists' Degree of Internationalization

Most Internationalized Quartile	International Price Premium	Quality-Adj. Intl Price Premium	International Quality Premium
International Dummies			
International works of international artists	**2.584**	**0.415**	**2.169**
	(0.024)	(0.009)	(0.025)
Domestic works of international artists	**2.140**	**0.260**	**1.881**
	(0.008)	(0.005)	(0.009)
Time Dummies	Included	Included	
Quality Variables	Not Included	Included	
Log Estimated Price	Not Included	Included	
Artist Dummies	Not Included	Not Included	
Constant	**9.075**	**1.222**	
	(0.075)	(0.029)	Number of Observations
Number of Observations	216,442	190,135	
R-square	0.305	0.907	

Least Internationalized Quartile	International Price Premium	Quality-Adj. Intl Price Premium	International Quality Premium
International Dummies			
International works of international artists	**0.268**	**0.164**	**0.104**
	(0.021)	(0.008)	(0.023)
Domestic works of international artists	**0.428**	**0.103**	**0.326**
	(0.006)	(0.003)	(0.006)
Time Dummies	Included	Included	
Quality Variables	Not Included	Included	
Log Estimated Price	Not Included	Included	
Artist Dummies	Not Included	Not Included	
Constant	**9.008**	**1.424**	
	(0.096)	(0.030)	Number of Observations
Number of Observations	291,307	252,251	
R-square	0.072	0.841	