Auctioneers as Emcees: Evidence from Chittagong Tea Auctions*

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Abstract

In an auction market, the auctioneer exerts significant influence in choosing and administering a selling strategy. We make the case for viewing the auctioneer as a market maker, whose success depends on how well he manages externalities without jeopardizing the trust of the buyers and sellers. We illustrate that incentives of the market maker may not be aligned with that of individual sellers. Using a unique data set, from tea auctions in Chittagong, Bangladesh, we argue that an auctioneer's actions maintain a careful balance of his own incentives vs. those of his clients, and the auction outcomes are affected by how much discretion the auctioneer has in choosing the selling strategy. Specifically, we find that raising the reserve price for a *lot* exerts a positive price externality on subsequent lots within the auction. To maintain the momentum of market prices, the auctioneer chooses higher reserve prices for tea produced by tea estates in which he has an ownership stake. While these teas receive a higher price when sold, they sell less frequently creating a short run cost to the auctioneer but an overall positive impact on market prices. Thus, consistent with the role of a market maker, a desire to appear non-opportunistic, rather than opportunism, seems to better explain the auctioneer's actions.

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1 Introduction

Auctioneers are intermediaries in two-sided markets and they play a major role in the markets they operate. They may have significant discretion in choosing a selling strategy, communicating it to the buyers, and administering it. They are emcees who "set the tone" and "draw the line,"[1] who must organize the auction offerings in a way to keep the auctions interesting for the buyers and prevent prices from collapsing. They must maintain a brisk price momentum and avoid "dead spots" of languid bidding (*cf.* Cassady (1967)). An auctioneer is a market maker, an eBay or Amazon.com in miniature. They must earn the trust of all clients, and establish a reputation for non-opportunism; after all, "market makers are in the trust business" (McAfee (2004)).[2] While auctioneers occupy a dynamic presence in the popular imagination, they are largely absent in the auction literature, and auctions are assumed to be run by an entity whose incentives are aligned with the seller's.[3] Since auctioneers (auction houses) receive only a share of revenue as commission, one may suspect agency issues to prevail. However, they are typically long run players with repeated interactions with clients and they receive commission from all auctions they run. Given interdependent transactions, their success depends on how well they manage the externalities without jeopardizing the trust of the buyers and sellers. Indeed, using a unique data set, we argue that they are market makers, entities distinct from the sellers of individual objects, and that they must maintain a careful balance of their own incentives vs. those of their clients.

A simple example illustrates a key tension between an auctioneer's incentives, to maximize overall profit, and those of a single seller, who cares only about the profit from the units that she owns. Consider an auctioneer who has been hired to sell ten identical units of a product. However, perhaps after receiving more information about the demand, he

[1] This colorful language was used by actual officials and participants in Chittagong to describe the role of the auctioneer in selling tea *lots*.

[2] There has been a number of papers that investigate the impact of trust between buyers and sellers on auction outcomes, especially, in the context of reputation ratings in online auctions (e.g., Resnick and Zeckhauser (2002), Hauser and Wooders (2006), Cabral and Hortacsu (2010), or Nosko and Tadelis (2014)). However, as far as we know, ours is the first paper to analyze how trust between the auctioneer and market participants (esp. sellers) impact auction outcomes.

[3] Exceptions: McAdams and Schwarz (2007), Skreta (2010), and Lacetera et al. (2013).

realizes that selling only eight units will maximize the overall profit. As a market designer who wants to maximize the overall profit, he will choose the prices in a way that two of the units are not sold. If each unit is owned by a different seller, however, each seller will prefer someone else's unit to go unsold.[4] How well an auctioneer manages this externality among sellers to keep overall prices high proves to be an important component in our analysis. We empirically illustrate that outcomes of individual auctions within an auction market depend on how well the incentives of the auctioneer and the seller are aligned and how much discretion the auctioneer has in choosing the strategic variables. Moreover, this example also suggests that for some auction markets – namely, those characterized by interdependence among market offerings – the appropriate unit of analysis in empirical work should be the whole market itself, rather than each individual auction.

To address the empirical challenges of identifying the role of an auctioneer, we rely on a unique data set with the special property that part of an auctioneer's portfolio constitutes lots in which he has an ownership stake.[5] Our data is from tea auctions in Chittagong, Bangladesh, a large well-organized market for tea, which provides a rich and colorful economic environment for our analysis. We exploit a difference in ownership of tea estates, with some being *affiliated* with the auctioneer, to measure the extent of this tension between the incentives of an auctioneer vs. individual sellers.[6] Another nice feature of the data set is that the auctioneers provided us with their private quality notes about the tea they sold. These allow us to control for virtually all differences in the quality and other characteristics of tea and separate product heterogeneity from strategy. By relating the variation in auction outcomes to the level of discretion the auctioneer has over the selling strategy, while controlling for lot quality, we can cleanly discern the impact of his strategic choices.

Conversations with auctioneers suggest that establishing and maintaining *momentum*

[4] Relying on longer-run incentives is difficult given incomplete information in the environment and the heterogeneity among sellers and the product.

[5] On an auction day, an auctioneer sells many lots of tea individually auctioned off via sequential English auctions. We refer to the auction day with many independent English auctions as the auction and each individual auction within it as a lot.

[6] Affiliated estates are owned by the same holding company as the auction house, providing the auctioneer with greater discretion in choosing selling strategies for tea from these estates.

in prices is of prime importance. We begin with the premise (which we verify empirically) that if a lot fetches a higher price, it generates a positive price externality on subsequent lots: that is, prior prices provide *benchmarks* for subsequent lots.[7] Similarly, a low sale price generates a negative externality. Hence, strategic withdrawal of a lot that is not receiving a high enough bid may be needed to maintain momentum, *viz.* prevent prices of subsequent lots from teetering. An auctioneer who is charged with *setting the tone* by keeping prices from collapsing for *all lots*, therefore, would like to choose a higher reserve than sellers who benefit less from this externality. This suggests that, fixing the number of potential buyers, the probability of selling a lot will be lower but the price conditional on selling will be higher if the reserve prices were chosen by the auctioneer rather than the owner/seller of a lot.[8] To implement his strategy and address the *public goods* aspect of withdrawals, the auctioneer relies more often on affiliated lots to *draw the line*.[9]

Our data largely confirms this story. We find that an auctioneer is able to obtain a higher price, on average, for tea from affiliated estates. Also, he is more willing to postpone the sale of these lots. At first blush, one may be tempted to interpret this as another example of an opportunistic agent favoring tea from his affiliated estates. Interestingly, however, we find that postponing the sale of a lot does not typically increase the price of the lot when it is again up for sale on a future auction day. Thus, there seems to be a withdrawal penalty, which apparently hurts the auctioneer's affiliated estates adversely: this contradicts the simple agency story. Our explanation is more subtle. In a dynamic auction setting, the auctioneer needs to manage the externalities between auctioned lots well as suggested in our simple example above. A high price on a current lot positively

[7] This assumption is also consistent with the theoretical model of Rosenkranz and Schmitz (2007) where a buyer's utility from an object is affected by a reference price that is independent of her valuation for the object. As a result, this reference price affects her bidding behavior.

[8] While Cassady (1967) listed the behavior of prices during an auction session as a challenging open question almost five decades ago, there has been little work on interdependence of prices across lots within an auction session. Our study takes a step in that direction by analyzing how the outcome of a lot affects the outcomes of subsequent lots and how that affects strategic behavior by auctioneers.

[9] In contrast, in Horstmann and LaCasse's (1997) model a better-informed seller may use a secret reserve to withdraw a common-value object from the auction to signal a higher common value and sell it in a future auction. In our setting, as a result of price inter-dependence, subsequent lots listed on the same auction day sell at a higher price. However, the strategically withdrawn lot itself may not sell at a higher price when auctioned off at a later date.

impacts the price of a future lot and a low price may do the opposite.[10] By taking costly actions on lots from estates with whom he enjoys greater trust and whose policies he has greater control on, the auctioneer creates benefits for all sellers and, presumably, increases his own payoff in the process.

Additional results confirm our main story. Some sellers own a number of tea estates and have many more lots up for sale compared to a typical seller. These sellers with larger portfolios can internalize some of the externality gained from the auctioneer's strategic behavior. Their objective functions are more aligned with those of an auctioneer implying they are likely to allow the auctioneer more flexibility in choosing the reserve price. Indeed, in our data set, lots from larger sellers have higher reserve prices than do lots from sellers with small portfolios (but not as high as for affiliated lots).

Another aspect of this auction market comes from large *vertically integrated* buyers. These buyers also own tea estates and they buy tea to market it under their own label of tea to final consumers. They value an unsold lot from their estate differently from the typical seller. They can use their own tea for their own blend of tea rather than incurring the cost associated with an unsold lot or letting a competitor buy the lot at a low price. We find that their purchase strategy during the auction implies sort of a price floor for their tea and the probability of sale is higher. Thus, the purchase strategy for vertically integrated buyers for their own tea creates effects similar to the withdrawal strategy of auctioneers on tea from their affiliated estates.

In the following section, we first describe tea auctions in Bangladesh. Then we sketch a simple model of auctioneer behavior, and derive some empirical predictions related to the auctioneer's willingness to withdraw lots of tea when a reserve price is not met. Subsequently, we test these predictions using our data.

[10] Such a dynamic price externality may arise from buyers' rational updating from prices about an unobserved demand state. It may also arise from behavioral models of "reference price dependence" (*cf.* Koszegi and Rabin (2006)). We do not explore the causes of the price externality here.

2 Data and Market Description

Bangladesh, where tea is the most popular and affordable drink, is a large tea producer. The bulk of the produced tea is sold in the open market via auctions as the producers are required, by government regulation, to sell at least 80% of tea in the open market.[11] There are usually 45 auctions every year, with an auction held each Tuesday during the months of April to January except for the two religious holidays.[12] The auctions are organized by the Tea Association of Bangladesh (the association of tea estate owners) and are administered by six auction houses or auctioneers in the same venue in the city of Chittagong.

The timeline or auction design is as follows: the tea to be sold on a specific auction day is entered in a catalog almost two weeks in advance. Sellers send tea from various tea estates of the country to Chittagong, where the auctioneers take control and store them in bonded warehouses dedicated for tea storage. The auction catalog by a specific auctioneer for a specific auction day lists the sequence of the lots of tea that he will put up for sale on that day and typically includes all the tea that he has in the warehouses. The catalog describes each lot by the grade of tea denoting the type or category of the tea, the name of the tea producing estate, the tea leaf processing factory, the warehouse where the tea is stored, number of bags in the lot, net weight of each bag, and the total weight of the lot. A lot usually contains 10 bags of identical weight (usually around 55-60 Kg.). Once the catalog is prepared, the auctioneer tastes every lot of tea, from which he derives the valuation for the lot which is entered into the catalog. We will say more about this valuation process later. The final catalog is sent to buyers along with randomly drawn tea samples from each lot, typically five days before each auction.

On the auction day, the six auctioneers sell their lots one after another. The sequence

[11] The purpose is to create a credible base for the excise tax government charges for tea sale. However, the restriction does not seem to be binding as sellers choose to sell almost all of their tea via the auction. These well-run auctions provide transparency in the pricing process for all the stakeholders—government, tea estates, buyers, and auctioneers. Indeed, even integrated producers, who are also retail packaged tea sellers, prefer to sell almost all their tea through the auction rather than engaging in transfer pricing between producing and marketing units.

[12] December and January are lean periods in tea production and, as a result, the auctions are not held in February and March.

of auctioneers in the first auction of the year is decided by lottery. This sequence is changed every week where the first auctioneer in the previous auction goes to the sixth position and all other auctioneers move up one position in the sequence. During his turn, an auctioneer sells his lots sequentially (according to the sequence listed in the catalog) using English auctions. We will say more about the choice of lot sequencing in section 3.3. The auction determines the per Kg price of tea in the lot.[13] An auctioneer is allocated 15 seconds (on average) to auction off a lot. After an auctioneer auctions off all the lots on his catalog, the auctioneer next in line sells his lots. The auction day ends after all six auctioneers auction off the lots on their catalogs. The lots that are sold in the auction are delivered to the buyers from the warehouses and the lots that are not sold are kept in the warehouses to be sold in a future auction.

Sellers, who are the owners of the tea estates, contract with an auctioneer to sell tea on their behalf. Contracts between a seller and an auctioneer are typically a year long and the tea estate can choose a new auctioneer once the contract expires. However, in practice, only a small number of estates move from one auctioneer to another each year. There is variation among the sellers. As mentioned earlier, some tea estates are owned by the auctioneer's holding company, but most are owned by client companies. We refer to these two kinds of sellers as *affiliated* and *unaffiliated* sellers, respectively. Some tea estates are stand alone operations owned by companies that own a single tea estate. On the other hand, some companies own a number of tea estates. In our data set, almost 42% of the auctioned lots are from estates owned by two large and established tea producing companies. These two companies specialize in tea production and do not engage in retail tea sale. We refer to them as *major* estates. Major estates are known for greater uniformity in the quality of the tea they produce.

There is also considerable variations among the buyers in this auctions, who have to be registered with the Tea Traders Association of Bangladesh. They vary by size and the types of markets they serve. Some of the buyers are wholesalers of tea who later sell

[13] Unlike Athey and Levin (2001), however, the total weight of a lot is clearly known to all the bidders. Any potential uncertainty about a lot from a buyer's point of view can only come from the unobserved quality as all other relevant information such as the category, the producing estate, and the processing plant for a lot are publicly known.

the loose tea to retailers country-wide. Some buyers are large packeteers who blend and package the loose tea for retail sale to the public under recognized brand names. Some buyers buy tea for direct export as loose tea. However, with the steady income growth, the domestic demand is increasing, and the share of tea sold for export has decreased over time. With the rise in incomes, the market for blended tea packaged and sold under recognized labels is also becoming very significant. An interesting feature of Chittagong tea auctions is that some of these large buyers, in addition to having their own brand of packaged tea for the retail market, also own tea estates and even purchase their own tea from the auctions. We refer to these buyers as *vertically integrated* as they can be both the seller and the buyer for a lot.

The auctioneer receives 1% of the sale price as a commission from the seller and Tk. 0.05/Kg, irrespective of the sale price, from the buyer of each lot. The commission rates have been fixed by negotiation between the Tea Traders Association of Bangladesh, The Tea Association of Bangladesh, and the Bangladesh Tea Board of the government. These rates have not been changed in a long time.

We have catalog data from the two largest auction houses for 16 auction days from August 2005 to November 2005 totalling 17629 lots of tea.[14] These two houses account for more than 65% of the total tea sold. The largest auction house is a *pure auctioneer*—only sells tea lots from estates owned by client sellers. The second largest one, we call it the *integrated auctioneer*, also sells tea from estates owned by its own holding company along with lots of tea from clients. We also have the list of the lots that succeeded in selling during the auction and the final price and winner list for these auctions.

Auctioneers' private tasting and publicly announced valuation From each lot of tea, 1.8 Kg of tea is set aside as a sample. From this, the auctioneer as well as all buyers can sample each lot prior to the auction. The auctioneers in Chittagong tea auctions are typically expert tea tasters who taste the tea to be auctioned off themselves prior to the publication of the final catalog to judge the quality of each lot. The auction houses provided us with their private tea tasting notes. These notes clearly state the quality

[14] The exchange rate was around USD 1 = Tk. 65.70 during the time the data was collected.

of the tea, but they are only for the auction houses' internal use and are never shared with buyers or sellers. The tasters (auctioneers) usually write detailed comments on the appearance of the tea leaves and the liquor or give some alpha-numerical rating to the lot. From these notes, in consultation with the auctioneers, we created an index of quality rating and assigned a numerical score between 1 to 10 to each lot.

This private information from the auctioneers allows us to control for unobserved quality heterogeneity across lots. As strategic choices by the auctioneers, sellers, and buyers are likely to depend on the quality of a lot, this is a particularly useful feature of our data set. Our quality rating aids us in disentangling the differences in auction outcomes arising from participant strategies and those arising from heterogeneity in tea quality. Instead of figuring out the quality of lot from bidding behavior, we can directly use the quality ratings to analyze auction outcomes and choice of reserve.[15] By directly controlling for product heterogeneity, we can more easily analyze the strategic interaction between the auctioneer and the seller that determines reserve prices.

The auctioneers actively conduct market research about the future demand of tea due to local consumer demand and demand from exporters. They use the information on quality and future demand to estimate a valuation for each lot. This valuation is listed on the catalog and we refer to it as the publicly announced valuation. This is an indicator of the expected price for a lot.

Withdrawing of lots The auctioneer is allotted around 15 seconds, on average, to auction off a lot. To quicken the auction process, he typically starts the auction of a lot around Tk. 1 to 2/Kg below the publicly announced valuation. If there is a bid at the starting price, the auction proceeds as a regular English auction. However, this starting price is typically above the reserve price, which is not announced. If there is no bid at the starting price, the auctioneer decides whether to reduce the price, in intervals of Tk. 0.50/Kg or Tk. 1/Kg. A buyer can place a bid and buy the lot at the reduced price during this process. If no buyer offers a bid even at the reserve price, the auctioneer moves on

[15] Roberts (2014) presents a novel way of controlling for unobserved heterogeneity using the reserve price under the assumption that it is chosen by seller.

to the following lot in the catalog without selling the current one. We refer to this as *withdrawing* a lot or keeping a lot *unsold*.[16] Withdrawing of a lot, hence, is a strategic variable that is exercised during the auction. If the auction outcome of a lot affects the outcome of subsequent lots, each lot acts an instrument for the auctioneer to influence the overall auction. We will explicitly model the auctioneer's withdrawal decision during the auction of a lot in the context of the auction market in the following section.

There are costs associated with withdrawing a lot. A withdrawn lot can be re-listed in a future auction, typically two weeks after the lot is withdrawn (there must be at least a two week gap before the lot can be re-auctioned as the lots for the auction on the following week are already decided). The seller incurs costs associated with storage and bank loans, and also needs to provide an additional 1.8 Kg from the tea lot as a sample; the auctioneer incurs some re-auctioning costs which are relatively small. Moreover, while tea is not perishable, the freshness of tea reduces over time losing some of its value.

How much lower the actual reserve price is relative to the starting price is uncertain. This depends on a number of variables such as the quality of the lot, expected supply and demand in future auctions, and realized demand in the current auction. As the auctioneer usually has more information than the buyers and sellers due to deep knowledge of the client tea estates and market research, there is asymmetric information between the auctioneer and the other market participants. Nevertheless, the reserve price is, on average, very closely correlated with the publicly announced valuation. Thus, even though we do not observe the exact reserve prices in these auctions, this valuation provides us with a good proxy for that.

2.1 Auctioneer Behavior: A Model Incorporating Externalities

Given the auctioneer's superior information and the power in influencing sale prices, potential for opportunism arises. However, numerous conversations with market participants (not only the buyers and sellers, but also the auctioneers) have convinced us that it is

[16] If the starting price equals the actual reserve price, then the auctioneer withdraws the lot without reducing the price from the starting price if there is no bid. As the auctions are run extremely fast and there is uncertainty about the price at which the auctioneer will withdraw the lot, buyers typically do not collectively refrain from bidding if they are interested in buying at the starting price.

overly simplistic to assume that auctioneers exploit their advantageous position to line their pockets. Typically, being an auctioneer is a lifetime career, and in order to succeed, auctioneers need to earn the trust of sellers, as well as establish a reputation for non-opportunistic behavior. In this sense, tea auctioneers in Chittagong are akin to market makers like eBay or Amazon.com, in miniature scope. Thus, we assume that the auctioneer's goal is to maximize profit for *all* sellers. We illustrate below that when the prices from lots within an auction market are correlated, optimal strategies from the points view of the seller of a single lot and the market maker are different.

Model. In what follows, we sketch a model in which the auctioneer's goal is to maximize the total revenue from all auctions in the market where revenue from a lot equals the price if the lot is sold and equals the value to the seller of the unsold lot otherwise. There are T lots up for sale in the auction. The reserve price for lot $t \in \{1, 2, \ldots, T\}$ is denoted by r_t; that is, the lot is withdrawn if it fails to to sell even at a price of r_t. We refer to the highest amount a bidder is willing to bid in the English auction for lot t as her bid on that lot. Suppose the realized highest and second highest of all bids for lot t are denoted by p_{1t} and p_{2t}, respectively. Given the auction structure, the observed price p_t^* for lot t is generated by the following equation:

$$p_t^* = \begin{cases} 0 \text{ if } p_{1t} < r_t \\ p_t = \max\{r_t, p_{2t}\} \text{ if } p_{1t} \geq r_t \end{cases} \tag{1}$$

Next, we introduce the dynamic price externality in a given auction. Let h_t denote the *benchmark* price for lot t; we define this benchmark as equalling the price that the previous lot (lot $t-1$) received if it was sold and the price at which the lot was withdrawn if the lot went unsold. That is:

$$h_t = \begin{cases} p_{t-1} & \text{if lot } t-1 \text{ was sold} \\ r_{t-1} & \text{otherwise} \end{cases} \tag{2}$$

Thus, the benchmark price is a measure of the "prevailing" price level around the time when lot t is on the selling block. This benchmark price can be an indicator of the overall market demand on the auction day, with a high benchmark indicating that the demand is likely to be strong and a low benchmark suggesting the opposite.[17]

[17] When a lot does not sell, a high reserve indicates that the auctioneer and seller believes that the demand that day should be high. A low reserve, on the other hand, indicates that the expeceted demand

The auctioneer's goal is to choose a sequence of reserve prices $\{r_1, r_2, \ldots, r_T\}$ to maximize the expected revenue across all the lots in an auction given the information she has. We assume that the auctioneer is better informed about market conditions, and the quality of the teas under his gavel, than the buyers and the sellers. Because of the dynamic price externality, the auctioneer faces a dynamic optimization problem in which the benchmark h_t is the state variable:

$$V_t(h_t) = \max_{r_t} \mathbb{E}\left[u_{0t}\mathbf{1}_{\{p_{1t}<r_t\}} + p_t^*\mathbf{1}_{\{p_{1t}\geq r_t\}} + V_{t+1}(r_t)\mathbf{1}_{\{p_{1t}<r_t\}} + V_{t+1}(p_t^*)\mathbf{1}_{\{p_{1t}\geq r_t\}}|h_t\right]$$

where

$$V_T(h_t) = \max_{r_T} \mathbb{E}\left[u_{0T}\mathbf{1}_{\{p_{1T}<r_T\}} + p_T^*\mathbf{1}_{\{p_{1T}\geq r_T\}}|h_t\right].$$

In this problem, $V_t(h_t)$ denotes the value function, the continuation revenue, starting from lot t when the current benchmark price is equal to h_t. We denote the expected net future payoff from lot t if it is not sold in the current auction by u_{0t}.

While the auctioneer's job is to maximize *overall* revenue from the auction, each individual seller desires only to maximize the revenue from the lots that she owns. The auctioneer chooses r_t to maximize her value function given the current information. If lot t sells at price p_t^* then the benchmark price for lot $t+1$ equals p_t^* and, otherwise, it equals r_t. On the other hand, the owner of the lot, assuming she does not own any other lot, aims to maximize the value $\mathbb{E}\left[u_{0t}\mathbf{1}_{\{p_{1t}<r_t\}} + p_t^*\mathbf{1}_{\{p_{1t}\geq r_t\}}|h_t\right]$. It is easy to see that if the price function is independent of the benchmark price h_t, *i.e.* the underlying market demand does not affect a bidder's bidding behavior, then the objectives of the seller and the auctioneer are aligned. As the outcome of lot t does not affect the value function for lot $t+1$, the optimal reserve price from the view point of the auctioneer is the one that maximizes just the expected revenue from lot t.

However, when the benchmark price and the underlying market demand affect a bidder's bidding behavior, the auction outcome of lot t affects prices for the subsequent lots. Specifically, suppose that the price function is increasing in the benchmark price.[18] This

is low, but the lot still did not sell.

[18] We empirically verify this assumption on the relationship between the price p_t and the benchmark h_t in the following section.

can be viewed as a reduced form assumption to incorporate the interdependence in the bidding behavior across lots within an auction. In that case, the reserve price r_t for lot t will have a positive externality on future prices. As a result, the optimal reserve from the auctioneer's point of view is higher than that from the point of view of the seller. This implies that if the auctioneer chooses the reserve prices, the probability of sale will be lower and the price conditional on sale will be higher relative to when the seller chooses the reserve. Nevertheless, if the lot is unaffiliated, we assume that the seller chooses the price at which to withdraw the lot or the reserve price—the auctioneer has less discretion in choosing strategies. For affiliated lots, the auctioneer chooses the reserve or at least has more control there (the owner of the overall company *trusts* the auctioneer to take a decision that is best for the company, but we can have the reserve price be completely transparent here). Hence, we will expect the reserve price higher, probability of sale lower, and conditional price higher for affiliated lots. To simplify the exposition and the proof of this result, we assume that all the bidders are symmetric in the sense that the highest bid a bidder is willing to place for a given lot is drawn from the same distribution for all bidders. This assumption is not necessary for the results.

Proposition 1 *Between two otherwise comparable lots, an affiliated lot will have a lower probability of sale but a higher price conditional on sale compared to a lot owned by an unaffiliated seller.*

Proof. Suppose there are N bidders and the highest bid one is willing to place in the English auction is drawn from the distribution F on $[0, 1]$. Here we implicitly assume a private-value paradigm in the sense that this value is not affected by the behavior of other bidders or the auctioneer. That is, the bidders do not receive any new information during the auction of the lot. Nevertheless, the function F can be allowed to be affected by the benchmark price for that lot, h_t. In this proof, we suppress conditionality on h_t for convenience. We assume that $f/(1-F)$ is an increasing function. The optimal reserve

r_t^S from the viewpoint of the seller is

$$
\begin{aligned}
r_t^S &= \arg\max_r \mathbb{E}\left[u_{0t}\mathbf{1}_{\{p_{1t}<r_t\}} + p_t^* \mathbf{1}_{\{p_{1t}\geq r_t\}} | h_t\right] \\
&= \arg\max_r \left(F^N(r)\, u_{0t} + N(1-F(r))\, F^{N-1}(r)\, r + \int_r^1 y d\left(F^N(y) + N(1-F(y))\, F^{N-1}(y)\right)\right).
\end{aligned}
$$

Thus, r_t^S satisfies

$$
f\left(r_t^S\right)\left(u_{0t} - r_t^S\right) + \left(1 - F\left(r_t^S\right)\right) = 0. \tag{3}
$$

The above characterization of the optimal reserve is a standard result from auction theory (see, for example, Krishna, 2002).

On the other hand, the optimal reserve r_t^A from the viewpoint of the auctioneer is

$$
r_t^A = \arg\max_r \left(\begin{array}{c} F^N(r)\left(u_{0t} + \mathbb{E}\left[V_{t+1}(r)\right]\right) + N(1-F(r))\, F^{N-1}(r)\left(r + \mathbb{E}\left[V_{t+1}(r)\right]\right) \\ + \int_r^1 \left(y + \mathbb{E}\left[V_{t+1}(y)\right]\right) d\left(F^N(y) + N(1-F(y))\, F^{N-1}(y)\right) \end{array} \right).
$$

The first order condition is,

$$
f\left(r_t^A\right)\left(u_{0t} - r_t^A\right) + \left(1 - F\left(r_t^A\right)\right) + \left(\frac{F\left(r_t^A\right)}{N} + 1 - F\left(r_t^A\right)\right) \left.\frac{\partial \mathbb{E}\left[V_{t+1}(r)\right]}{\partial r}\right|_{r=r_t^A} = 0. \tag{4}
$$

If the benchmark price has a positive impact on the distribution of bids, and, hence, the price received for a lot, the value function is increasing in the benchmark price. That is, $\frac{\partial \mathbb{E}[V_{t+1}(r)]}{\partial r}$ is strictly positive. Then, comparing equations (3) and (4), we can easily see that $r_t^A > r_t^S$. Since the auctioneer chooses the reserve price for an affiliated lot and the seller chooses the reserve price for an unaffiliated lot, the probability of sale will be lower and the price conditional on sale will be higher for an affiliated lot for given F and N. ■

The above predictions are testable if we assume that the publicly announced valuation is a good indicator of the reserve price. It is instructive to contrast our setting with that of Levitt and Syverson (2008) since our predictions about affiliated lots selling less frequently and at a higher price seems similar to their insightful finding that real estate agents are more willing to keep their own houses on the market longer, waiting to sell at a higher price. There, however, suboptimality arises because the real estate agent may not follow the principal's objective/instruction in the presence of asymmetric information (through a cheap talk game). On the other hand, in our case, suboptimality arises because the auctioneer (the market maker) does not want to appear opportunistic to sellers who are aware that the auctioneers can better internalize the impact of strategies on the market outcome. Hence, the seller would want the auctioneer to sell more often than optimal from the market maker's point of view. The divergence in optimal strategies come from the fact that the seller has a more narrow focus relative to the auctioneer.

3 Empirical Results

In this section, we report the empirical results pertaining to the auctioneers' actions and auction outcomes. Table 1 presents summary statistics on the number of lots, auction outcomes, and the publicly announced valuations for the two auctioneers. For the lots auctioned off by the integrated auctioneer, we also present the outcomes for affiliated and unaffiliated lots separately. The last two columns suggest that there are significant differences in auction outcomes between affiliated and unaffiliated lots.

We focus on testing whether the implications of the model in the previous section – particularly, Proposition 1 – are confirmed in the data. With this objective, we transform the above into an empirical model: the price for lot t is given by

$$p_t = g\left(h_t, \Theta_t, \epsilon_t\right) = \alpha_0 + \alpha_1 h_t + \Theta_t^{'}\alpha + \epsilon_t. \tag{5}$$

Here, the vector Θ_t includes variables that describe the characteristics of lot t. The lot quality and the publicly announced valuation are elements of Θ_t. Moreover, ϵ_t denotes unobservables which affect price. Condition (5) summarizes the auction including the impact of all strategic decisions by participants. Note that, price p_t for lot t is only observed if the lot is sold. That is, as before, the observed price p_t^* equals p_t if the lot sells and equals 0 otherwise. We assume that whether a lot sells is generated by a latent variable model. That is, we define a linear index variable:

$$y_t^* = Z_t'\beta + \eta_t$$

where y_t^* is a dummy variable that equals 1 if lot t succeeded in selling. That is,

$$y_t^* = 1 \quad \Leftrightarrow \quad p_t^* > 0 \tag{6}$$

In the above, Z_t contains variables which affect whether the auctioneer decides to withdraw lot t. Specifically, equations (3) and (4) suggest that Z_t contains variables related to lot ownership. Moreover, η_t captures unobservables which also affect the withdrawing decision. Putting equations (1), (5), and (6) together, and assuming that (ϵ_t, η_t) are jointly normal distributed, we have a Heckman selection model.

3.1 Lot Ownership and Auction Outcomes

The theoretical model in Section 2.1 suggests that auction outcomes such as the price conditional on sale and the probability of sale depends on how closely the incentives of the auctioneer and the seller are aligned. Next, we present empirical tests of this. Based on the above empirical model, we present coefficient estimates for price conditional on sale using a Heckman selection model. First, we regress price on lot characteristics including whether the lot is from an affiliated or an unaffiliated estate. The basic regression equation for the price is:

$$p_{it} = \alpha_{0i} + \alpha_1 PV_{it} + \alpha_2 Aff_{it} + \alpha_3 Pure_{it} + \alpha_4 NT_{it} + X_{it}'\gamma + \epsilon_{it} \tag{7}$$

Here p_{it} denotes the price for lot t of auction day i. Note that the price is observed only when the lot succeeds in selling. The variable PV_{it} denotes the publicly announced valuation for the lot and Aff_{it} is a dummy variable denoting whether the lot is from an affiliated estate. Lots auctioned off by the pure auctioneer is denoted by the dummy variable $Pure_{it}$. The variable NT_{it} indicates the number of times that particular lot had been brought to the auction for sale (but was unsuccessful) prior to auction day i. To control for the quality of tea, we include nine dummy variables to indicate the quality rating score generated from the auctioneers' tasting notes in the vector X_{it}. In addition to these variables, X_{it} includes independent variables pertaining to the lot such as dummy variables that indicate the tea category, variables to indicate the position of the auctioneer on the day, whether the lot size is larger than average, etc. These variables allow us to control for most sources of lot-specific heterogeneity. The vector γ represents the coefficients associated with X_{it}. Auction day i specific constant is denoted by α_{0i}.[19]

[19] None of our main results change qualitatively if we allow the impact of quality ratings to be different for the two auctioneers or if we use $\ln(p_{it})$, instead of p_{it}, as the dependent variable.

Table 2 presents the determinants of the price of a lot and whether it sold based on a Heckman selection model. The first specification presents regressions based on equation (7). Examining the price regression, we see that, relative to other lots, the price for a lot owned by an affiliated estate is higher by almost Tk. 0.54/Kg. From the selling equation, we see that the coefficient for affiliated estates is significantly negative (-0.316), indicating that the high revenue on these lots is achieved at the cost of selling less frequently. Thus, the result that affiliated lots that succeed in selling end up fetching higher prices although fewer of their lots sold, found in Table 1, survives even if we control for lot characteristics and auction specific fixed effects. Proposition 1 suggests that, as the auctioneer will choose a higher reserve price for affiliated lots, the probability of sale will be lower and the price conditional on sale will be higher for an affiliated lot relative to a comparable lot from an unaffiliated seller. The first column of Table 2 is supportive of the proposition.

The above results are robust to decomposing the unaffiliated lots in terms of ownership. As described in section 2, there is heterogeneity among unaffiliated estates. Some estates are owned by major tea growers who own a number of estates and have many lots up for sale on an auction day while some sellers only own one estate and have few lots up for sale. On the other hand, some sellers also participate as buyers as they own tea estates and also tea packaging businesses. As the major and vertically integrated sellers may have somewhat different objectives, as discussed later in this section, Proposition 1 is most appropriate for a comparison between lots from affiliated estates and small unaffiliated estates. In column (2), we add a dummy variable to indicate lots from major estates and one for vertically integrated estates. We also include these dummy variables in the selection equation. The addition of these variables do not significantly affect the coefficient for the affiliated lot dummy. We will discuss the coefficients of these two new ownership variables later in the paper. Overall, these regressions suggest that the auctioneers are less willing to reduce the price for their affiliated lots. As a result, on average, affiliated lots take a greater number of auctions to sell, but obtain a higher price when they sell.

At first blush, these results may imply that the auctioneer may be exploiting his position to obtain higher prices for his affiliated tea lots by selling them in future auctions if the prices are not high, as the simple agency model would suggest. As a withdrawn lot is brought back for sale in an auction two weeks later, such an explanation requires that this lot would fetch a relatively high price in two weeks.

However, other results in Table 2 cast doubt on this simple explanation. Specifically, the coefficient for the number of times the lot was previously up for sale is negative with a size of at least Tk. 0.61/Kg. This indicates that lots which have taken longer to sell received a lower price when they sold. That is, lots which have been withdrawn and subsequently resold on a future auction day suffer a substantial *withdrawal penalty* and the withdrawal penalty is magnified as a lot fails to sell more and more times. Taking this into account, it does not appear that the auctioneer's policy of withdrawing his own affiliated lots at a higher price is for his own benefit. This third result is inconsistent with the agency explanation for these phenomena, but it is consistent with the idea that the auctioneer is willing to take costly actions – namely, withdrawing their affiliated lots in the face of a substantial penalty on subsequent sales – in order to maintain higher prices in the auctions, *even when these higher prices do not benefit him directly.*

In column (3), we allow the impact of the number of times the lot failed to sell to differ for affiliated lots. While the net withdrawal penalty is as large as those in columns (1) and (2) for unaffiliated lots, it is positive but not statistically significant for affiliated lots. Nevertheless, considering the cost of re-listing a lot that the auctioneer has to bear for affiliated lots, we can say that the auctioneers do not benefit from a higher future profit on the lots that they hold back.[20] The reduction in prices is likely to be caused by the reduction in freshness of the tea. An unsold lot may also provide some negative signal regarding the quality of the lot. Our main hypothesis is that the reserve price conditional on quality is higher for affiliated lots. Hence, fixing everything other than quality, an unsold affiliated lot is likely to have a higher quality than an unsold unaffiliated lot. This may explain why the withdrawal penalty is smaller for unaffiliated lots. Regardless of the exact underlying mechanism of why the price is reduced in a future auction, however, the

[20] Another institutional details supports the finding that a withdrawn lot does not fetch a higher price when it is relisted in a future auction. A withdrawn lot is typically relisted in the next feasible auction, which occurs two weeks later. The relisting date is not strategically chosen.

result suggests that a simple agency model is not consistent with our results so far.

From conversations with market participants and, especially, the auctioneers, it was clear to us that the momentum of price in the auction proceedings plays a critical role in determining auction outcomes. This also helps address the question raised by the preceding discussion – what is the benefit of keeping prices high? Thus, we include the benchmark price in the above price regressions to measure the effect of the price of the previously sold lot on the current lot. The results are presented in Table 3. As we defined earlier, the benchmark price for lot t equals the price of lot $t-1$ if lot $t-1$ sold and equals the reserve price of lot $t-1$ otherwise. We do not know the exact price at which the auctioneer withdrew a lot. Nevertheless, the reserve price is, on average, very closely correlated with the publicly announced valuation. Usually, the reserve price is Tk. 2 to 4/Kg below the publicly announced valuation. So, we approximate the reserve price of a lot by that lot's publicly announced valuation minus Tk. 3/Kg.[21] In general, a lot fetching a high price raises the benchmark price for the following lot and it fetching a low price reduces the benchmark price. The auctioneer can also raise the benchmark price by refusing to reduce the price for a lot and not selling it. The benchmark price, in some sense, represents the current market price or the minimum acceptable price if the lot does not sell. The coefficient for the benchmark price is positive and significant (0.107), indicating that an increase in the previous price by Tk. 1/Kg increases the price conditional on sale by almost Tk. 0.11/Kg. Clearly, we see that past prices have a strong positive externality on future prices, which would justify an auctioneer's attempts to keep price levels high as part of an overall policy of *setting the tone*.[22]

In column (2) of Table 3, we add two lags of the benchmark price. While the effect of the first lag is negative and the second lag is positive, the net effect of the benchmark prices stay unchanged. The same holds true if we add even more lags. Overall, a positive draw in the realized price for a lot raises prices of following lots. However, a negative draw brings the prices down. To manage this externality optimally, a market maker prefers to

[21] Our results do not change if we instead deduct nothing, Tk. 1, 2, or 4/Kg from the publicly announced valuation to define the reserve price.

[22] This result does not change if we exclude the ownership dummy variables as regressors.

choose a higher reserve than the optimal reserve would be if the externality is ignored. As an unaffiliated seller is less likely to internalize the externality than an affiliated seller, the reserve price is higher for affiliated lots leading to a higher rate of withdrawal but a higher price conditional on sale as seen on Tables 2 and 3.

At the same time, withdrawing a lot appears to be a drastic way of keeping prices high, and one might worry that withdrawing a lot can also have adverse effects on future lot prices. To capture this possibility, under specification (3), we include a dummy variable to indicate whether the previous lot went unsold in the price regression. We also include the interaction of this variable with the benchmark price. These two variables together measure the effect on the current lot price if the previous lot went unsold. While the coefficient for the dummy variable is positive (2.510), the coefficient for the interaction term is negative (-0.02545). Evaluated even at a very high valuation of Tk. 100/Kg, the net impact of not selling a lot is equal to $2.51 - 97 \times 0.02545$, which is positive.[23] This finding is consistent with the idea that by withdrawing lots, the auctioneer credibly demonstrates that he *draws the line*; he does not tolerate soft bidding from buyers and will withdraw lots when the winning price is not high enough. Such credibility would naturally lead to more aggressive bidding, and hence higher prices for subsequent lots, especially for highly valued lots. All these results are robust to analyzing high and low quality lots separately or analyzing lots at different times during the auction day separately. We also find the same results if we use only a sub-sample of auction days such as the first or last eight days from our sample of 16 auction days. They are also robust to alternate definitions of the benchmark price when the lot does not sell.[24] Note that auction day specific fixed effects capture any systematic differences in prices across auction days. The impact of benchmark price, thus, shows how a high realization of price for a lot or a high reserve for that lot affects the bids in the next lot. Moreover, our robustness tests show that the impact of the benchmark price is statistically the same independent of whether

[23]Note that we assumed that the benchmark price for the following lot when a lot goes unsold equals the valuation minus Tk. 3/Kg. Thus, if a lot with publicly-announced valuation of Tk. 100/Kg goes unsold, the benchmark for the following lot equals Tk. 97/Kg. The mean of valuations of all lots is below Tk. 80/Kg and 98.7% of all lots had a valuation below Tk. 100/Kg.

[24]For example, suppose the benchmark price equals the price of the last lot that sold. The results do not change in that case.

the previous lot was from an affiliated estate.

These four results together suggest that the auctioneer's strategic decisions respecting whether to sell or withdraw an affiliated lot end up – for the most part – benefiting sellers unrelated to the auctioneer. While these results are puzzling from the point of view of traditional agency theory, they support a story whereby auctioneers wish to acquire a reputation of being *tough* – that is, they draw the line in the manner described previously. In order to establish such a reputation, auctioneers need to credibly demonstrate their willingness to withdraw lots to keep benchmark prices high, even at a cost to himself. Hence, the auctioneer's *desire to appear non-opportunistic, rather than opportunism*, leads him to withdraw lots from estates related to them (affiliated sellers), because such actions – which work against their self-interest – internalizes the revenue loss from the withdrawn lots and makes their message more credible.

Another implication of this story is that auctioneers may be reluctant to withdraw lots sold by unaffiliated estates. This is because the relationship of the auctioneer with these sellers is more distant than vis-a-vis his affiliated estates, and they may (mis-)attribute such drastic actions as opportunism on the auctioneer's part. Indeed, from the results for the sold regression, we see that the coefficients for dummy variables denoting lots from major and vertically integrated estates are positive and significant. This indicates that the auctioneers are, ceteris paribus, less likely to withdraw lots from these unaffiliated sellers. For the auctioneers, the most convenient way to establish their *tough* reputation is by withdrawing lots sold by their own affiliated estates; this sustains a positive price externality which creates benefits for all sellers in the auction. One implication of this story is that the integrated auctioneer will have more flexibility in choosing optimal reserve prices and hence, will fetch higher prices than the pure auctioneer. Both Tables 2 and 3 show that the price is lower for lots sold by the pure auctioneer when we control for auction characteristics by almost Tk. 0.80/Kg. This further supports our story that the integrated auctioneer's strategies helps his clients in getting a higher price in the auctions.

As already mentioned, while our result that auctioneers are more willing to withdraw their affiliated lots for later sale is reminiscent of Levitt and Syverson (2008), the context and market structure are different. Thus, the underlying forces generating the outcomes are also different. In their setting, there is no withdrawal penalty in our sense. The expected price rises as a result of strategically waiting for a higher valued buyer in the future. In Chittagong tea auctions, on the other hand, auctioneers do not strategically choose the auction date to re-list an unsold lot. Moreover, they incur a loss by withdrawing their lots. Such actions are consistent with our model of auctioneers as market makers who must gain the trust of market participants and maintain a good reputation for non-opportunistic behavior. An important difference between an auctioneer and a real estate agent is that the auctioneer can influence the overall market outcomes by his actions while an individual real estate agent in a large market does not have much power to influence the overall market. As a result, the auctioneer acts more as a market maker while agency issues may be more problematic for a real estate agent.

Corroborating evidence: Impact of ownership on auctioneers' announced valuations Next, we consider another implication of Proposition 1 above, that reserve prices will tend to be higher for the auctioneer's affiliated lots and, more generally, for lots of tea in which the incentives of the auctioneer and the seller are better aligned. While we do not observe the reserve price directly in this data set, we use the auctioneer's publicly announced valuation for each lot, which has a close connection with the initial price at which the auction commences, and which is thus a reasonable proxy for the reserve price. We turn next to the regression results in Table 4, where the dependent variable is the publicly announced valuation. The table suggests that the auctioneer announces a valuation for his affiliated lots that is, on average, higher by at least Tk. 2.77/Kg controlling for all auction characteristics. This further supports that the main mechanism behind the high price conditional on sale for auctioneers' affiliated lots is the costly action of reducing the probability of sale by keeping the reserve price high.

3.2 Additional Results

While the discussion thus far has focused on how an auctioneer's behavior differs between lots of tea with which he is or is not affiliated, here we discuss some other findings. These largely support our story that the auctioneer chooses the strategies based on how closely his objectives are aligned with those of particular groups of sellers. Specifically we look at the strategies for lots sold by major estates and vertically integrated estates.

Lots from major estates Recall that major estates own almost 42% of the lots listed in our data set. Thus, they may benefit quite a bit from the interdependence of prices within an auction. Specifically, if there is some positive externality from high benchmark prices, they are likely to internalize that to some extent in their objective function unlike small sellers. Moreover, these estates have a very stable contractual relationship with their auctioneers and they do not usually switch auction houses. Hence, they may trust the auctioneer to take actions that are in their best interest more than do smaller unaffiliated estates. These suggest that the reserve prices for lots from major estates is likely to be higher than that of lots from non-major unaffiliated estates, but lower than reserve prices of affiliated lots. We go back to columns (2) and (3) of Table 4 to test that. Indeed, the regression of publicly announced valuation, a close indicator of the reserve price, supports this hypothesis.

Tables 2 and 3 also show that the lots owned by the major estates have a higher price by more than Tk. 0.41/Kg relative to those of a lot by a non-major unaffiliated seller. The fact that these lots have a higher price conditional on sale is not surprising in light of Proposition 1 and the above result that reserve prices for lots from major estates are higher than those for lots from smaller estates. If the lots are comparable other than the ownership, a higher reserve price will also mean a lower probability of sale. This implies that the probability of sale for lots by major estates should be lower than that for lots from non-major unaffiliated estates. However, the coefficients for major estates are positive in Tables 2 and 3. Thus, even after controlling for lot-specific heterogeneity such as the grade and quality of tea and the positioning of the lot, lots from major estates sold with a higher frequency while generating a higher price for sold lots.

We believe that this result arises because lots from major estates attract a higher number of potential buyers; specifically, they attract disproportionately more interest from small and infrequent buyers. Consequently, the keener competition for these lots pushes up both their prices as well as the probability of sale. Indeed, we have some indirect evidence that the smallest buyers buy significantly more frequently from major estates relative to other lots.[25] Underlying this may be an information asymmetry problem, because typically large buyers have better information about the qualities of each lot than do smaller infrequent buyers. First, auctioneers send a sample of each lot to large buyers, while small buyers must visit the auctioneers' offices to only visually examine samples. Second, large tea buyers invest in tea tasters who can judge the quality of tea very well, while small buyers do not have these resources. Hence, less informed buyers may depend on overall estate reputations rather then the quality of a specific lot on sale and prefer tea lots from estates with a greater reputation for tea quality and service.[26]

Lots from vertically integrated estates As noted earlier, some of the large buyers are vertically integrated estates who can be both the seller and the buyer for a lot as they both produce tea and sell their own brands of tea. Tables 2 and 3 also allow us to investigate the prices of lots from estates owned by integrated buyers. The tables suggest that the prices for lots from these estates were no different from the prices of lots from unaffiliated non-major sellers. However, in Table 5, we decompose lots from these estates by those that were bought by the seller (integrated buyer and estate owner) herself and those that were bought by some other buyer. Interestingly, the lots bought by the seller herself had prices lower by at least Tk. 0.81/Kg, on average, compared to the lots bought by a different buyer. This suggests that if the price were not high enough, vertically integrated buyers would buy back their own tea as they had a use for them. That way, they can ensure that they do not let the acceptable price for their tea become too low. Being able to buy back their own tea create a virtual lower bound for prices from these lots. This illustrates another mechanism of keeping the auction prices relatively high by the vertically integrated estates.

This also means that the probability of sale is high for lots from vertically integrated estates as seen in Tables 2 and 3. Going back to Table 4, we find that the publicly

[25] These results are available from the authors but are not presented here as they are not conclusive.

[26] Similarly, Bronnenberg et al. (2013) find that consumers with less knowledge of product quality choose prominent national brands over generic brands more frequently than more experienced consumers.

announced valuations for lots from vertically integrated estates are, basically, as high as those for the lots from affiliated estates. As the vertically integrated estates buy back their own tea if the prices are low, they effectively create a floor below which they do not allow the price of their lots to fall. In sum: vertically integrated sellers have objectives which are more closely aligned with the auctioneer and so also choose high reserve prices.

3.3 Lot Sequence

So far, we have focused on auctioneer and bidder behavior on the day of the auction, treating the sequence of lots up for sale, published in the final catalog five days prior to the auction, as exogenous. Recall that, on any auction day, an auctioneer sells many lots of tea individually auctioned off via sequential English auctions. We refer to the auction day with many independent English auctions as the auction and each individual auction within it as a lot. Furthermore, there are six auctioneer operating in each auction day, and by *lot sequence*, we refer to the position of a lot within a specific auctioneer's catalog for an auction day.

Now we briefly describe some characteristics of lot sequencing in our data set. To indicate the positioning of a lot within the auctioneer's catalog for a given auction day, we normalize the lot number by the total number of lots listed by the auctioneer on that day. We calculate the variable lot_{it} by dividing the lot number t by the number of total auctions listed by the auctioneer on auction day i. Thus, it is a number between 0 and 1 denoting the relative position of the lot. We refer to it as the normalized lot number. Table 6 presents quantile regressions of lot_{it} using the 20%, 40%, 60%, and 80% quantiles. Specification (1) of the table presents quantile regression with the publicly announced valuation, ownership dummies, number of prior times the lot had failed to sell, quality rating dummies, and some other lot characteristics as regressors. We find some consistent patterns that helps towards *setting the tone*. First, lots with a higher publicly announced value are more likely to be listed earlier in the auction day. Second, affiliated and vertically integrated lots are usually listed earlier in the auction. As we have posited earlier, strategic withdrawal is easier with affiliated lots and vertically integrated lots are less likely to be sold at a very low price because of the presence of the seller as a buyer. Since such strategic behavior is likely to have a stronger impact earlier in the auction with many more lots to follow, tea from affiliated and vertically integrated estates are listed earlier in the auction day to set the tone. Third, lots from major estates are listed earlier in the first half but later in the second half of an auction day. Fourth, lots that have previously gone unsold in an earlier auction day are listed later in the auction. Overall, the auctioneer chooses the lot sequence to manage the positive price externality on subsequent lots and also to keep the auction process interesting throughout the day.

Unlike Ashenfelter (1989) and Beggs and Graddy (1997), we find no clear evidence of a decreasing price pattern within an auction day in our data, once across-lot heterogeneity is controlled for. In price regressions based on equation (7), we find a quadratic price trend if we include the variables lot and lot^2 as long as we do not control for lot ownerships. As soon as we include lot ownership dummies, as done in Tables 2, 3, and 5, both of the coefficients become statistically insignificant. Hence, we do not control for lot sequence in the price regressions presented in those tables.[27] We do, however, include lot and lot^2 in the selection regression as instruments as both of them significantly determine whether a lot gets sold.

In all the regressions so far, we have used dummy variables for the quality ratings to allow for non-linear impact of quality. However, to explore how the quality of a lot affects where it will be listed during the auction day, we use the numerical quality rating as a regressor, instead of the quality rating dummies, in specification (2) of Table 6. The results are robust to using a other variations of the quality rating, such as the square root or square of the numerical rating. At the beginning of the auction (among the first 20% of the lots), higher quality lots are listed earlier than lower quality lots. However, the quality does not seem to play a role in the later part of an auction. This is consistent with setting a high price expectation earlier in the auction. It seems that auctioneers use higher quality lots more frequently towards the beginning of the auction to set up

[27] We checked this further, with a cleaner test, by utilizing another feature of the data. There are some large lots, which are divided into multiple *lines* and are auctioned off separately in sequence. Analyzing the price within different lines of the multi-line lots, we find no pattern either.

the momentum for high prices and to get a greater benefit from price externality. After that, they list lots more uniformly in terms of quality to keep the auction attractive to the bidders throughout the day.

4 Conclusions

Market makers such as eBay, Amazon.com, or stock exchanges, that administer large marketplaces, play a prominent role in the economy. There are numerous other auctioneers who run large auction markets on a regular basis throughout the world. They are private market designers who receive a small share of the transaction prices, and their actions determine the efficiency of the markets they operate. And yet, the precise role of an auctioneer has not been well-documented in the auction literature. As they typically receive only a small fraction of the revenue, the environment is ripe for clients and market participants to have agency concerns. On the other hand, since the auctioneer represents multiple clients, externalities can also play a prominent role. Hence, successful auctioneers must aim to address agency concerns and manage externalities at the same time. Therefore, strategies that build trust and establish good reputation are likely to be key to the efficient running of auction markets.

In this paper, we have highlighted the role of auctioneers as effective managers of the marketplace they oversee. To allay agency concerns, auctioneers undertake costly actions on lots over which they enjoy greater trust in order to generate a positive externality for others. Using a unique data set of tea auctions in Bangladesh, we investigate the strategic behavior of auctioneers as market makers. We find that the auction outcomes depend on how well the incentives of the auctioneer and the sellers align and how much discretion the auctioneer has in choosing strategies. Specifically, auctioneers are able to obtain higher prices for lots that belong to sellers with whom they enjoy a greater level of trust as these sellers allow the auctioneer greater flexibility in choosing strategies. However, to achieve that, they sell these lots less frequently. This involves short run costs as lots that take longer to sell usually sell for a lower price and there are extra storage and financial costs as well. Nevertheless, the auctioneers take such costly actions because they lead to an increase in the overall auction price. By illustrating how interdependence among market offerings affect auction outcomes, our paper also suggests that data from auction markets should be analyzed using the point of view of a market and not a single auction. As a result, structural estimation of bidder characteristics while treating auctions within a market as independent auctions may lead to incorrect estimates.

While our analysis shows that administrators of auction markets are better viewed as market makers, it is important to note that the market structure matters. In our setting, the auctioneer has market power and his strategies can affect all market transactions. Moreover, the auctioneer interacts with the same set of participants, buyers and sellers, repeatedly over a long period of time. As a result, gaining their trusts by managing market externalities well plays a prominent role in such a setting. On the other hand, if the facilitator of trade only administers a relatively small share of all market transactions in a non-repeated setting and does not have much power to influence other trades in the market, then trust and reputation are unlikely to be important factors influencing market outcomes.

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Table 1: Summary Statistics - Auction Outcomes and Publicly Announced Valuations

	Pure Auctioneer	Integrated Auctioneer		
		All Lots	Affiliated Lots	Unaffiliated Lots
Number of Auction Days	16		16	
Total Number of Lots	11925	5704	1047	4657
Lot Size	751.31 Kg	521.17 Kg	499.38 Kg	526.07 Kg
	(314.28)	(120.49)	(129.87)	(117.73)
Publicly Announced Valuation	78.97 Tk./Kg	77.35 Tk./Kg	81.29 Tk./Kg	76.46 Tk./Kg
	(6.05)	(7.22)	(2.83)	(7.60)
Quality Rating	5.47	6.45	7.01	6.32
	(1.86)	(1.46)	(1.04)	(1.51)
Percentage of Lots Sold	91.71%	83.64%	80.04%	84.45%
	(0.28)	(0.37)	(0.40)	(0.36)
Price Conditional on Sale	78.29 Tk./Kg	77.55 Tk./Kg	80.80 Tk./Kg	76.86 Tk./Kg
	(5.73)	(6.49)	(3.13)	(6.80)
Number of Weeks Needed to Sell a Lot	1.079 Weeks	1.183 Weeks	1.226 Weeks	1.173 Weeks
	(0.341)	(0.536)	(0.560)	(0.530)

Note: Standard deviations are presented inside parentheses

Table 2: Heckman Two-step Regression of the Price

	Price	Sold	Price	Sold	Price	Sold
	(1)		(2)		(3)	
Publicly Announced Valuation	0.888***	0.023***	0.888***	0.021***	0.888***	0.021***
	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)
Lot from an Affiliated Estate	0.543***	-0.316***	0.537***	-0.257***	0.422***	-0.276***
	(0.069)	(0.059)	(0.070)	(0.061)	(0.074)	(0.065)
Lot from a Major Estate			0.495***	0.234***	0.492***	0.234***
			(0.038)	(0.046)	(0.038)	(0.046)
Lot from a Vertically Integrated Estate			0.037	0.370***	0.031	0.368***
			(0.057)	(0.076)	(0.057)	(0.076)
Lots Auctioned off by the Pure Auctioneer	-0.675***	0.246***	-0.821***	0.205***	-0.823***	0.204***
	(0.039)	(0.039)	(0.041)	(0.042)	(0.041)	(0.042)
Prior Number of Auctions Where the Lot Was Up for Sale	-0.627***	-0.115***	-0.614***	-0.103***	-0.669***	-0.109***
	(0.037)	(0.028)	(0.036)	(0.028)	(0.038)	(0.029)
Prior Auctions × Affiliated Lot					0.505***	0.065
					(0.111)	(0.081)
Inverse Mills Ratio	-1.282***		-1.186***		-1.183***	
	(0.094)		(0.095)		(0.095)	
Observations	17564		17564		17564	
Wald Chi^2	138649.15		142009.76		142299.48	

Notes: We present Heckman two-step regressions of the price which is observed only when a lot sells. We control for tea type, tea quality, the auctioneer's position in the day's auctions, and other lot characteristics. A variable deonting theposition of the lot normalized by the total number of lots listed by the auctioneer, squared of this variable, and lagged variables indicating whether a previous lot was sold are excluded variables used as instruments in the selection regressions. Standard errors are presented inside parentheses. * represents significance at the 1% level.

Table 3: Impact of the Benchmark Price on the Price

	Price			Sold
	(1)	(2)	(3)	
Publicly Announced Valuation	0.819***	0.819***	0.810***	0.021***
	(0.004)	(0.004)	(0.004)	(0.004)
Lot from an Affiliated Estate	0.385***	0.381***	0.458***	-0.257***
	(0.067)	(0.067)	(0.073)	(0.061)
Lot from a Major Estate	0.453***	0.450***	0.406***	0.234***
	(0.037)	(0.037)	(0.041)	(0.046)
Lot from a Vertically Integrated Estate	-0.023	-0.025	-0.101	0.370***
	(0.055)	(0.055)	(0.062)	(0.076)
Lots Auctioned off by the Pure Auctioneer	-0.787***	-0.788***	-0.832***	0.205***
	(0.039)	(0.039)	(0.044)	(0.042)
Benchmark Price	0.107***	0.110***	0.114***	-0.007**
	(0.004)	(0.004)	(0.004)	(0.003)
Benchmark Price Lag 1		-0.011***		
		(0.004)		
Benchmark Price Lag 2		0.009**		
		(0.003)		
Previous Lot Went Unsold			2.510**	
			(0.485)	
Benchmark Price × Previous Lot Unsold			-0.025***	
			(0.006)	
Prior Number of Auctions Where the Lot Was Up for Sale	-0.473***	-0.468***	-0.423***	-0.103***
	(0.035)	(0.036)	(0.038)	(0.028)
Inverse Mills Ratio	-0.852***	-0.843***	-1.868***	
	(0.094)	(0.094)	(0.192)	
Observations	17564	17539	17564	
Wald Chi^2	154984.63	155000.21	131457.57	

Notes: We present Heckman two-step regressions of price, which is observed only when the auction results in a sale. Benchmark price equals the price of the previous lot if it sold and the reserve price of the previous lot if it did not sell. We control for tea type, tea quality, the auctioneer's position in the day's auctions, and other lot characteristics. A variable deonting theposition of the lot normalized by the total number of lots listed by the auctioneer, squared of this variable, and lagged variables indicating whether a previous lot was sold are excluded variables used as instruments in the selection regressions. Standard errors are presented inside parentheses. *, **, and *** represent significance at 10%, 5%, and 1% levels, respectively.

Table 4: Determinants of the Publicly Announced Valuation

	Publicly Announced Valuation		
	(1)	**(2)**	**(3)**
Lot from an Affiliated Estate	2.775***	3.507***	2.899***
	(0.164)	(0.165)	(0.177)
Lot from a Major Estate		0.691***	0.675***
		(0.098)	(0.098)
Lot from a Vertically Integrated Estate		3.162***	3.104***
		(0.144)	(0.144)
Lots Auctioned off by the Pure Auctioneer	3.087***	3.285***	3.255***
	(0.092)	(0.097)	(0.097)
Prior Number of Auctions Where the Lot Was Up for Sale	-2.616***	-2.505***	-2.730***
	(0.081)	(0.081)	(0.084)
Prior Auctions × Affiliated Lot			2.361***
			(0.251)
Observations	17629	17629	17629
R^2	0.4689	0.4833	0.4859

Notes: The table presents fixed effects panel regressions of the publicly announced valuation controlling for tea type, tea quality, the auctioneer's position in the day's auctions, and other lot characteristics. Standard errors are presented inside parentheses. * represents significance at the 1% level.

Table 5: Vertically Integrated Estates

	Price		Sold
	(1)	(2)	
Publicly Announced Valuation	0.888***	0.810***	0.021***
	(0.003)	(0.004)	(0.004)
Lot from an Affiliated Estate	0.530***	0.452***	-0.257***
	(0.070)	(0.074)	(0.061)
Lot from a Major Estate	0.497***	0.407***	0.234***
	(0.038)	(0.042)	(0.046)
Vertically Integrated Lot Purchased by the Seller	-0.207**	-0.356***	
	(0.103)	(0.110)	
Vertically Integrated Lot Purchased by Another Buyer	0.106*	-0.030	
	(0.062)	(0.068)	
Lots Auctioned off by the Pure Auctioneer	-0.835***	-0.847***	0.205***
	(0.041)	(0.044)	(0.042)
Benchmark Price		0.114***	-0.007**
		(0.004)	(0.003)
Previous Lot Went Unsold		2.542**	
		(0.490)	
Benchmark Price × Previous Lot Unsold		-0.026**	
		(0.006)	
Prior Number of Auctions Where the Lot Was Up for Sale	-0.614***	-0.423***	-0.103***
	(0.036)	(0.039)	(0.028)
Inverse Mills Ratio	-1.194***	-1.889***	
	(0.095)	(0.195)	
Observations	17564	17564	
Wald Chi^2	141996.94	128610.33	

Notes: We present Heckman two-step regressions of price, which is observed only when the auction results in a sale. "Vertically Integrated Lot Purchased by the Seller" is a dummy variable indicating a lot which was purchased back buy the seller and "Vertically Integrated Lot Purchased by Another Buyer" is a dummy variable indicating a lot owned by a vertically integrated seller but purchased by a buyer who is not the seller. Benchmark price equals the price of the previous lot if it sold and the reserve price of the previous lot if it did not sell. We control for tea type, tea quality, the auctioneer's position in the day's auctions, and other lot characteristics. A variable deonting the position of the lot normalized by the total number of lots listed by the auctioneer, squared of that variable, and lagged variables indicating whether a previous lot was sold are excluded variables used as instruments in the selection regressions. Standard errors are presented inside parentheses. ** and *** represent significance at the 5% and 1% levels, respectively.

Table 6: Determinants of Lot Sequencinging

	Dependent Variable: Normalized Lot Number							
	(1)				(2)			
	20%	**40%**	**60%**	**80%**	**20%**	**40%**	**60%**	**80%**
Publicly Announced Valuation	-0.007***	-0.007***	-0.008***	-0.007***	-0.007***	-0.008***	-0.009***	-0.007***
	(0.001)	(0.001)	(0.0005)	(0.001)	(0.0005)	(0.001)	(0.001)	(0.001)
Lot from an Affiliated Estate	-0.190***	-0.157***	-0.159***	-0.064***	-0.190***	-0.164***	-0.148***	-0.065***
	(0.008)	(0.015)	(0.013)	(0.015)	(0.008)	(0.012)	(0.011)	(0.011)
Lot from a Major Estate	-0.093***	-0.016	0.086***	0.153***	-0.088***	-0.013	0.097***	0.161***
	(0.007)	(0.011)	(0.007)	(0.008)	(0.008)	(0.013)	(0.008)	(0.008)
Lot from a Vertically Integrated Estate	-0.096***	-0.186***	-0.221***	-0.182***	-0.095***	-0.190***	-0.215***	-0.178***
	(0.008)	(0.009)	(0.011)	(0.012)	(0.006)	(0.009)	(0.008)	(0.016)
Quality Rating					-0.008***	0.001	0.00004	0.002
					(0.002)	(0.002)	(0.0018)	(0.002)
Prior Number of Auctions Where the Lot Was Up for Sale	0.146***	0.169***	0.156***	0.139***	0.154***	0.174***	0.157***	0.140***
	(0.008)	(0.005)	(0.005)	(0.005)	(0.008)	(0.008)	(0.006)	(0.005)
Observations	17629				17629			
Pseudo R^2	0.0993	0.1003	0.1294	0.127	0.0975	0.0954	0.1256	0.1228

Notes: The table presents simultaneous quantile regressions of the normalized lot positioning on auction and lot characteristics. We control for tea type and other lot characteristics. We also include dummy variables for the lot's quality rating in specification (1). Standard errors are presented inside parentheses. *, **, and *** represent significance at 10%, 5%, and 1% levels, respectively.