

Online Auctions: A Primer

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Because of the Internet, auctions are becoming a more and more popular way to buy and sell goods. Each style of auction specifies the rules for revealing information and discovering prices in its own way. The Internet has not only made traditional auctions more accessible to buyers and sellers—lowering transaction costs and spreading market efficiency—but it has enabled new types of auctions with new rules and new ways for patrons to customize risk/return characteristics.

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Introduction

Until recently, auctions were a relatively exotic way to buy and sell goods. The Internet has changed that. Online auctions have popped up like crocuses in early spring—several thousand now operate on-line, selling all manners of goods and services. Auctions specify the rules by which buyers and sellers reveal information and discover the price for the goods and services they want to exchange. Traditional auctions, in addition to providing the rules of price discovery, represent a consensus among buyers and sellers on how to transact. The business rules and conventions for transacting embodied in auction houses serve to reduce the transaction costs of the different parties—as both the buyer and seller do not have to repeatedly re-invent business rules for trading and come to terms on how they should bargain and determine the fair price for a trade.

Traditionally, there have been four major types of auctions. These are the English auction, the Dutch auction, the sealed bid auction (including the Vickrey auction), and the double auction. In different settings, different variations on these types of auctions are possible. The Internet and electronic commerce have changed the possibilities for auctions. While English and Dutch auctions traditionally required the co-location of bidders, today bidders can participate from remote locations. Furthermore, the time horizon for price discovery may change. For example, a typical auction for a work of art may take place over one afternoon at Sotheby's. Today the price discovery process can last many days on eBay. The tremendous worldwide access enabled by the Internet allows auctions to reach new customers and expand the number of bidders. Similarly, because online auctions cost less and because they do not require the co-location of buyers and sellers, they are able to generate a different level and type of interest and excitement among bidders.

Online auctions are simultaneously becoming increasingly varied in form and specialized to different markets to fulfill the strategic goals of the buyers and sellers. Using various Internet examples, we will illustrate the most popular types of auctions, highlighting their similarities and differences in processes and outcomes. Next we will discuss how the improved information access and information processing capabilities enabled by the Internet allow new types of auctions, including buyer-driven auctions, such as those created by Priceline and Mercata.

Different Auction Types

Of the many different types of auctions, the best known are the English, the Dutch, the sealed-bid, and the double auction. They differ from one another, first, in the form in which the bids are made: Are they written, visual, or oral? Are they made in private or public? The second way they differ from one another is in the rules of sequence for bidding: Must bids increase or decrease, and can they be simultaneous? All of these widely used auction types have been used online.

The English Auction

The English auction, most often associated with the selling of art, antiques, and fine items at a Sotheby's or a Christie's, is by far the most familiar type of auction to everyone. In the English auction, the auctioneer of a good or service begins with a reserve price and either increases the price in regular increments or lets bidders increase the price with whatever increments they want. This ascending price process stops when bidders are no longer willing to increase the price. As in the real world, the English auction is by far the most common type of auction on the Internet. In a randomly sampled survey of 200 Internet auctions, we found 85 percent to be variants of English auctions, for example, eBay, Yahoo! and Amazon.

Example: eBay (www.ebay.com)

eBay was founded by Pierre Omidyar in 1995. Beginning as a simple online mechanism where users could trade used goods, eBay has become one of the most profitable and visited sites on the Internet. Increasingly, eBay is used to sell both new and used goods through a modified form of the English auction. To participate on eBay, users register on the site and provide credit card and address information. Next they can post an item for sale, along with their minimum reserve price, required bid increment, and preferred closing time for the auction. Prospective buyers can then bid online for products, entering bids till the closing time or such a time as they are unwilling to revise their bids. If a bid is accepted, the buyer's account is decremented and the seller's account is credited—minus both an insertion fee for the auction listing (ranging from \$0.25 to \$2.00) and a percentage of the amount of the final bid price. The percentage depends on the size of the sale: 5 percent of any amount under \$25, then 2.5 percent of any amount between \$25 and \$1000, and then 1.25 percent of any amount in excess of \$1000.

The English auction is uniquely suited to the goals of eBay and has a number of informational properties of use to traders. First, it is especially suited for the trade of unique or rare goods to which value cannot be easily assigned, such as Mark McGwire's record-breaking homerun baseball, or a one of its kind painting by Monet. These goods cannot be valued by considering the effort expended to create them but instead are valued for their rarity. The upper price for the item thus cannot be easily determined. By sequentially and incrementally revealing their value for the good or service, buyers in this model assign a value to the product. In this model, participants always know the level of the current best bid and often know the sequence of prior bids and bidders, helping them to assess interest in the object being auctioned. The main disadvantage of the English auction is that it is not bounded in time—it can be a slow process, lasting hours or days. With the availability of remote bidding on the Internet, users no longer have to be co-located, but must pay active attention to the auction, especially if no closing time is assigned for the receipt of final bids.

The Dutch Auction

The Dutch auction was invented in the 1870s by a Dutch cauliflower grower who wanted to increase the efficiency of selling his product in order to free him to focus on farming. Unlike the more common English auction, where bidders push the price up from below, the Dutch method starts at a high price level set by the auctioneer, a level at which the good or service is very expensive and unlikely to be sold. The price then progressively drops until a buyer signals to the auctioneer that he or she will take the goods at the current price. No actual sequential revelation of bids or preferences is involved. The bidder must choose how high to bid without knowing the other bidders' valuations or interests in the goods. As the announced price is progressively lowered, the possibility of a gain emerges, but the probability of securing this gain diminishes.

Example: The Tele Flower Auction (www.tfa.nl)

The Netherlands is the world's leading producer and distributor of cut flowers. Dutch dominance of this industry was in part enabled by their flower auctions, where flowers from all over the world arrived daily, to be priced and traded between buyers and sellers in Dutch auctions. Every day, an

average of 30 million flowers—originating not only from the Netherlands, but also from countries such as Israel, Kenya, and Zimbabwe—were traded in 100,000 transactions in the two major auctions at Aalsmeer and Naaldwijk. These traditional auctions the size of ten football fields housed many auction halls where buyers would gather under large clocks set to an initial high price. As the clock hands fell the price would fall till a bidder stopped the clock and accepted the consignment of flowers at the stopping price. The clock would then be reset for the next auction.

In 1994, the Dutch grower cooperatives who owned the auctions limited foreign access to the auctions, because foreign flower supplies were reducing the prices of the Dutch product. This led to the creation of the Tele Flower Auction (TFA), an online Dutch auction. Buyers can now work from remote offices using a personal computer and ISDN to connect to central auction servers. Buyers see a price clock onscreen and use the price information from the screen to undertake their bidding. By going electronic, the TFA has enabled the physical separation of price discovery and logistics processes. Previously both were combined in one big auction facility—today the pricing is done virtually, far from the central warehouse distribution facility. We will come back to TFA example later in the book.

As the example shows, the Dutch auction is ideal for perishable goods, like flowers, or seats in an airplane, tickets for concerts, and container space on an ocean-going vessel.

Example: Intermodalex (www.intermodalex.com)

Intermodalex.com provides an auction for shipping firms and shippers of goods, helping match shipping services with manufacturers who need to ship a product, for example, from Rotterdam to Chicago. The Intermodalex website provides buyers with a Dutch auction which lists and sells any excess container space on an ocean-going vessel. Like flowers, excess shipping container space is a perishable good—its value is effectively zero as soon as the ship casts off. And because the space is a commodity, buyers can lease it without requiring in-depth information or physical inspection.

The importance of timing has required bidders in Dutch auctions, up to now, to be co-located in space in order to be co-located in

time. It is difficult to implement such fast auctions over the distributed Internet, as there are no communications service guarantees ensuring that network traffic and congestion will not delay the delivery of a bid. We expect the use of these auctions to grow as networks improve and new technologies guarantee that the most timely online bidder wins the auction. The Dutch method offers real advantages when dealing with perishable goods and inventory, such as flowers or container space. This is because the auction method is fast and transaction-cost efficient for pricing large quantities of either low value goods or goods that must be sold quickly, and where a reasonable high starting price for the auction can be set easily. Usually the upper limit can be reasonably estimated based on the recent history of sales of similar goods. In contrast, the English auction is especially useful for rare and one of a kind goods for which the upper price cannot be easily set. The sequential English auction also reveals the extent to which other bidders are interested in a product and the prices they are willing to go to, while the Dutch auction only reveals the price at which the winner takes the product.

While theoretically the Dutch and English auction should lead to similar valuations of a good, in practice the Dutch method can generate higher prices for sellers. To avoid losing a particular lot, buyers will often stop the clock at a higher price than they would have offered in the competitive bidding of an English auction. Recognizing these advantages, a number of e-businesses are adopting the Dutch method.

The First-Price and Second-Price Sealed-Bid Auctions

Auctions that utilize written bids are commonly referred to as sealed-bid auctions. Sequencing tends not to be a major issue since normally each bidder is allowed a single bid. Bidders in the first-price sealed-bid auction send in sealed bids to the auctioneer by a fixed time. The highest bidder (first price) wins the auction and gets the product or service. This auction type is also called a tender. A bidder must choose how high to bid without knowing any bids by competitors. Thus, the first-price sealed-bid auction is very similar to the Dutch auction in terms of how information is revealed.

Example: Freemarkets (www.freemarkets.com)

One innovative example of a first-price sealed-bid auction is FreeMarkets Online. It uses its web-based software and hardware tools to coordinate private online auctions that allow businesses to solicit bids from suppliers. Instead of the laborious process of sending out a request for proposals directly to many suppliers, a business can list its request for proposals with FreeMarkets. Qualified suppliers can then submit an offer price through an auction. In 1998 alone, FreeMarkets created online markets for over \$1 billion worth of industrial materials and components. The competition created by these online markets drives savings for buyers in a variety of industrial markets. FreeMarkets gives firms a way of beginning electronic procurement without first investing in their own integrated system. This form of auction is a fundamentally new way for buyers to negotiate prices and for suppliers to generate low cost sales.

The second price sealed-bid or Vickrey auction is named after William Vickrey, Nobel Laureate in Economics in 1996. The winner is the one with the highest bid, but he or she will only pay the second-highest price.

Example: Antebellum Covers (www.antebellumcovers.com)

Antebellum Covers conducts auctions of manuscripts and ephemera, for example, Civil War paper, small war relics, and eighteenth and nineteenth century war-related letters and documents. Bids are accepted by mail, phone, or e-mail. Lots are sold to the highest bidder at one increment above the second-highest acceptable bid. For example, if the highest bid is \$300 and the second-highest bid is \$250, the high bidder would pay only \$260 (\$250 plus the bidding increment of \$10) instead of \$300. All bids are confidential, and the high bid is not disclosed during the auction process. Only the starting bid is disclosed.

As William Vickrey said in his famous article: "If this strategy is carried out (assuming . . . the absence of collusion among bidders), then the optimal strategy for each bidder will obviously be to make his bid equal to the full value of the article or contract to himself."¹ Vickrey concludes that this auction type, then, encourages all bidders to bid the amounts of their private valuations. If, that is, there is no collusion among the bidders.

The next example exposes this vulnerability of the Vickrey auction.

Example: New Zealand PCS auction

In New Zealand, Personal Communication Services (PCS) frequencies such as those used for cell phones, were auctioned off using a Vickrey auction. In one of the auctions, the winner bid NZ\$ 100,000 (\$60,000) but paid then the second highest price, NZ\$ 6. The public in New Zealand was furious, because the auction did not result in a price that was deemed fair, and did not bring the revenues expected by the government for the sale of this public resource.

In practice the second-price sealed-bid auction is seldom used, since once the highest price is discovered, the sellers are rarely satisfied by the second-highest price. First-price sealed-bid auctions are the preferred method used in the auctioning of contracts, such as government public works projects, or fiduciary instruments, such as government bonds.

The Double Auction

In a double auction, buyers and sellers each submit combined price-quantity bids to an auctioneer. The auctioneer matches the sellers' offers (starting with the lowest price, and then going up) to the buyers' offer (starting with the highest price, and then going down) until all the quantities offered for sale are sold to the buyers. This type of auction only works well for items of known quality regularly traded in large quantities, such as securities or graded agricultural products. Double auctions can be operated in either sealed-bid or open-outcry formats.

The sealed-bid double auction, also called a clearinghouse auction, allows sellers to specify their offer prices and buyers to specify their bids. The various offers and bids are matched using a simple algorithm at a fixed time. In short, each of the offers, with its price and volume, is mapped, as in the graph below, to create a supply curve. Next, each of the bids, with its price and volume, is mapped to create a demand curve. The clearinghouse price and volume traded is at the intersection of the two curves. (See figure below). Buyers and sellers cannot modify their bids.

Example: The Arizona Stock Exchange (www.azx.com)

The Arizona Stock Exchange offers a call auction—a type of clearinghouse auction—for stocks. In a call auction, trading takes place only at certain prearranged times—the "calls." Between calls, orders accumulate. At the call, a price is established by identifying the supply and demand. Bringing sellers and buyers together at the same time, and at a single price, avoids the market spreads and random turbulence common in continuous markets.

The clearinghouse auction is especially useful for trading large volumes of commodity goods and redistributing them among many different buyers and sellers.

In an open-outcry double auction, there is a continuous updating of offers as well as bids. Traditional double auctions take place with multiple buyers and sellers trading multiple units of the same commodity. Floor trading at the Chicago Commodities Exchange is one of the best known examples of double auctions. Buyers and sellers are constantly revising their offers and bids and trades occur when the offer price and volumes coincide with the bid price and volume. Open-outcry double auctions capture the preferences of sellers as well as buyers, allowing them to continuously adjust their offers and bids to adapt to varying market conditions and best match supply to demand.

Example: FastParts (www.fastparts.com)

FastParts facilitates the trading of excess electronic components inventory and used manufacturing equipment over the Internet. The company pre-qualifies buyers and sellers, facilitates anonymous transactions, arranges for transportation through a central shipping point, and provides collection services. FastParts offers two marketplaces: the "Trading Exchange" and the "Sold!" auction. The Trading Exchange, FastPart's core offering, is an anonymous, neutral, real-time trading venue employing a double auction modeled after the NASDAQ. It has hundred of listings of both "parts for sale" and "parts wanted to buy." The Sold! Auction offers products for immediate sale. Auctions are pre-announced to all members, and bidding is generally open for two or three days. Sellers often choose to liquidate parts that do not sell on the Trading Exchange in the Sold! auction.

The Internet: Expanding the Possibilities

As we discussed earlier, the Internet has already liberated pricing from a static form to a dynamic form. Auctions provide some of the conventions for dynamically and socially constructing prices. However, the major impact of the Internet lies in making auctions more accessible to buyers and suppliers—creating greater market efficiency, enabling new conventions for pricing to allow for new types of auctions, and providing opportunities for customers to specify and seek new risk/return characteristics to their trade.

Consider the earlier case of the Dutch Flower markets. Online auctioning liberates the buyers from the auction hall, separating the physical product flows from the information flows. Similarly, with Ebay, buyers and sellers skip the flea market and instead meet online to bargain and trade, designating a third-party provider to handle the actual product distribution. The separation of the physical and information flows, combined with the tremendous access to both suppliers and buyers enabled by the Internet, make auctions more viable as a price discovery mechanism. For buyers, more suppliers means it is more likely that they will find exactly what they want, and competition amongst suppliers should drive down prices. For suppliers, more buyers means quicker sales and lower transactions costs, and that competition amongst buyers could drive up prices. Thus greater market participation should lead to greater market efficiency.

The second impact of new technologies and the Internet on auctioning are the new models of auctions that become feasible. A number of new auction methods are being constructed for trading all manners of goods, from automobiles through knowledge. Many of these new auctions, such as the "Yankee Auction" first introduced by Onsale.com, are variations and extensions of traditional auction models. The flexibility and low cost of developing software makes it possible to specify new auction rules and thus specialize auction models for different product/service markets and customer segments.

Example: The Yankee Auction

Onsale (www.onsale.com) offers round-the-clock, interactive auctioning for all types of computer equipment and consumer electronics by means of an innovative

arrangement called a "Yankee auction." In this auction method, one or more identical items are offered for sale at the same time. When the auction closes, the highest bidders win the available merchandise at their bid price. Bids are ranked in order of price, then quantity sought, and then time of the initial bid. Specifically:

- Bids are first ranked by price;
- If bid prices are the same, larger quantity bids take precedence over smaller quantity bids;
- If bid prices and quantities are the same, then earlier initial bids take precedence over later initial bids.

The Yankee auction is especially suited to selling large lots of moderately priced items in small lot sizes.

In addition to the Yankee auction, a number of new business conventions have evolved that empower the customer and force companies to bid for their custom. Priceline popularized the reverse auction, where users specify what they are willing to pay for a good or service, in Priceline's case, ranging from hotel rooms to airline tickets. If a vendor is willing to accept the price, then Priceline confirms the transaction, committing the buyer to the transaction and earning itself a brokerage fee.

Example: Priceline (www.priceline.com)

In the traditional model of commerce, a seller advertises a unit of supply in the marketplace at a specified price, and a buyer takes it or leaves it. Priceline turns that model around. They allow a buyer to advertise a unit of demand to a group of sellers. The sellers can then decide whether to fill that demand or not. In effect, Priceline provides a mechanism for collecting bids and forwarding units of demand to interested sellers—a demand collection system. Buyers have the potential to get lower prices. When the buyer makes an offer for, say, an airline ticket through Priceline, the buyer is announcing the price for a generic service—getting from point A to point B on a given day. The buyer can't specify the airline or the precise route, and can't even specify the particular departure or arrival times. Priceline not only offers airline tickets, but also hotel rooms, rental cars, new cars and trucks, home financing, and groceries.

While the buyer can sometimes get a real bargain, what is in it for Priceline's suppliers? According to Priceline's CEO Jay

Walker, the Priceline system enables sellers to see the latent demand in the marketplace, the demand that exists beneath the established price of the product or service. And because the customer's offer is irrevocable, guaranteed with a credit card, it's real demand—the seller can count on it. Because the seller remains anonymous throughout the buying process, it gets two clear benefits in addition to the incremental sales. First, it gets a brand shield. If it had publicly advertised a lower price for its product or service, it would have eroded the value of its brand. But since it can accept the unit of demand without letting the buyer know the brand in advance, it suffers no such erosion. Second, the seller gets a price shield. The seller can maintain the integrity of its established, posted offer prices because it never advertises that a lower price is being filled. The seller avoids the problem of free riders—people who take a discounted price even though they would have been willing to pay the full price.

Similarly, the U.S.-based Mercata.com and Accompany.com, and the Swedish-based Letsbuyit.com, create new methods of buying where buyer power is aggregated to negotiate better supplier deals in real time. At these sites we have an entirely new form of electronic bargaining with suppliers. As more and more buyers commit to the purchase of a specific good, the price of the good falls lower towards a limit. This new form of auction with predetermined pricing rules is enabled by the power of the Internet to aggregate buyer power and demand for a product.

Priceline and Mercata illustrate the increasing variety of auction methods and the greater specialization of auctions to customer needs. They also illustrate the third important value added by electronic auctions for buyers and sellers. Auctions allow customers to buyers and sellers to buy, sell, or re-configure goods and the trade into new bundles with different "risk-reward" possibilities. For example, consider the many auctions available for airline seats, such as, for example, the Lufthansa auction.

Example: Lufthansa (www.lufthansa.de)

Since 1997, the German air carrier Lufthansa has auctioned off airline tickets once every month. There are 50 auctions, one for each set of tickets to a certain destination. The auctions are held between 10 A.M. and 10 P.M. On average there are 60 participants per auction. They use

the English auction mechanism. Many tickets are obtained by frequent flyer program customers. Lufthansa implemented this auction to attract potential customers without massive advertising and without alienating traditional distribution partners. The tickets are carefully selected to avoid empty seats in specific routes. Lufthansa also obtains customer feedback, researches preferences in the market, and gets plenty of publicity in the traditional media.

Lufthansa's auction of excess seat inventory allows the company to better manage its inventory. One could also imagine the airline creating its own Mercata type system to ensure a certain amount of inventory is filled to break-even. Emerging auction forms thus give suppliers new ways to manage inventory and demand risk and segment customers based on their price and risk sensitivity. Similarly, for customers this increased variety of transaction forms allows them to specify new "risk-reward" preferences. If I had to travel between Berlin and Frankfurt for an important business meeting, I would probably pay full fare and get a guaranteed seat, since I don't know ahead of time if there will be available inventory for a last-minute booking. If, on the other hand, I wanted a cheap flight to Frankfurt to visit family, I might choose the auction to see if I can get an inexpensive seat at a price I want to pay. In the latter case, I can be flexible about my travel plans and take the risk that the seats will not be available. In sum, different auction forms allow both suppliers and buyers to specify different "risk-reward" characteristics for the trade.

Opportunities Created by Online Auctions

Online auctions create tremendous new opportunities and value for both buyers and sellers, making them an increasing and inevitable part of business to business and business to consumer commerce. As illustrated by Priceline (add three other names) the benefits of online auctions include:

- The ability to select and manage different risks and participate in new opportunities with new "risk-reward" trade-offs better suited to the true needs of suppliers and buyers.
- Greater market efficiency, as both suppliers' and buyers' needs are aggregated and processed efficiently through online access mechanisms.

- Lower transactions costs than traditional auctions and other alternatives. Cheap access to the Internet allows greater global access to auctions with lower transactions costs. This in turn improves market efficiencies.

We expect companies and individuals will increasingly have to seek the efficiencies and rewards enabled by online auctions.

Choose The Auctions That Are Right For You

As illustrated in this paper, there are many different types of auctions, and they are increasing in variety. While the English auction has been the most popular, we expect more use of other types of auctions as businesses and consumers become more knowledgeable and experienced with online auctions. Different auctions have very different transaction cost characteristics from the perspective of buyers, sellers, and the auctioneer. They trade off different levels of participant attention, effort, and risks for different levels of price. Different auction models are also appropriate for different types of goods. Designing, implementing, or electing to participate in auctions requires careful consideration of the appropriateness of the auction model in the context of its use. Ultimately, auctions form a part of a broader set of activities necessary to trade goods or services. These related activities and the context of the trade are likely to impact the feasibility of specific auctions in different markets. As illustrated by Intermodalex, Lufthansa, and Priceline, we expect auction models to become increasingly specialized to the needs of different industries and user segments.

Use Auctions in the Portfolio of Pricing Strategies

As online auctioning becomes more feasible, it must become part of the portfolio of dynamic pricing strategies used by firms. While some may say that e-Commerce makes pricing more transparent and price competition more intense, driving down margins, auctions also provide new opportunities for price discrimination. As auctions enable new "risk-effort-reward" opportunities to be created for customers, they can be utilized to segment between price-sensitive and less price-sensitive customers. Similarly, auctions can be used to evaluate the demand for goods, and set the price levels in other channels to customers. Thus we expect nearly every company to either own or participate strategically in auctions to enable better segmentation and identify new price discrimination opportunities.

References

1. Vickrey, W., (1961) Counterspeculation, Auctions, and Competitive Sealed Tenders, *Journal of Finance* (16), p. 20.
2. We follow the definition of auctions as providing a structured set of rules for price discovery and information, revelation by buyers or sellers.

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