Upset Pricing in Auction Markets: An Overview

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25 March 2003

1   INTRODUCTION

Upset prices, also known as reserve prices in the auction literature, are a common component of most auction markets. An important element of an upset price policy is the auctioneer's value of retaining the object at a given auction, that is, the value the auctioneer puts on a "no-sale." The no-sale value should be based on the auctioneer's value of retaining the object indefinitely, as well as the value of selling the object at a later date (taking into account the administrative costs of resale).

In this memo, we first discuss how the reserve price should be set when the auctioneer knows its no-sale value. We then discuss how the auctioneer would, in practice, determine its no-sale value.

2   THE THEORY AND PRACTICE OF UPSET PRICING GIVEN AN ESTIMATE OF THE NO-SALE VALUE

The gains from trade (and thus social efficiency) at an auction are maximized if the upset price is set equal to the no-sale value of the object.[2] However, this policy may not maximize revenue. For a given estimate of the no-sale value, the seller must consider four salient factors when choosing to set an upset price that exceeds the no-sale value. These factors are:

1. A higher upset price encourages bidders to bid more aggressively, and thus may increase revenue.
2. A higher upset price discourages collusion.
3. Appraised values may not incorporate all features of a tract, and tracts that do not sell may have been appraised too high.
4. When upset prices are set so that a significant fraction of tracts do not sell, it may prove difficult to use data from past auctions to accurately predict the price of a given timber stand.

2.1   Factors that determine the optimal upset price

Setting the upset price above the no-sale value can increase auction revenues. In a sealed-bid, first-price auction, the winning bidder pays his bid. In equilibrium, a bidder submits a bid that is less than his value. In the auction literature, this action is called bid shading. The equilibrium bid balances the incentive to increase one's chance of winning by bidding aggressively with the incentive to bid lower and pay a lower price upon winning. Because the equilibrium involves bid shading, bidders on average profit

from the auction. That is, bidders capture some of the gains from trade with the auctioneer.[3] The auctioneer can mitigate the effects of bid shading by raising the upset price above the no-sale value. Intuitively, bidders with values just above the upset will not shade their bids very much, which in turn induces bidders with higher values to shade their bids less as well. In determining how much to raise the upset above the no-sale value, the auctioneer then faces a tradeoff. Specifically, the auctioneer gets more revenue on the tracts that sell, but forgoes a sale when at least one bidder's value exceeds the auctioneer's "no-sale" value and is less than the upset price.

What factors determine how much the auctioneer should increase the upset above the auctioneer's no-sale value? First, some factors do *not* matter, such as the number of bidders.[4] Rather, the shape of the distribution of bidder values is most important. For example, suppose bidder values are between 0 and 10, and the auctioneer's no-sale value is 5. If there is a substantial probability that bidder values will be between 9 and 10, the auctioneer may wish to use an upset greater than 5. However, setting the upset in the neighborhood of 9 may be unnecessary. For example, increasing the upset from 5 to 6 would reduce bid shading by bidders with values between 9 and 10, because bidders with values that just exceed 6 would bid more aggressively. But if the value distribution were skewed so that bidders would only have values of between 9 and 10, the auctioneer would optimally set the upset price to be at least 9. Therefore, the bidders' value distribution determines the auctioneer's optimal upset price.

When setting the optimal upset price the auctioneer must consider the opportunity for bidders to collude at auction. In the presence of a cartel, the auctioneer can increase revenue by increasing the upset price.[5] Furthermore, anticipating an upset price, bidders' profits would change only marginally if the cartel were to break down. Consequently, it is more difficult to sustain the cartel today. In practice, the auctioneer should monitor the level of competition at auction. If collusion is strongly suspected, it may be prudent to increase the upset price. However, if the market is in fact void of collusion, raising the upset price in response to the suspicion of collusion would reduce revenue. Caution is therefore warranted.

Third, there is typically measurement error in assessing the characteristics of a tract. For example, the stand appraisal may not include all the characteristics that determine the bidders' value of the stand. If there is error embedded in the appraisals, setting the upset equal to the appraised value would lead to a large number of sales receiving no bids. If there are costs of preparing the sale as well as costs of delay, these forgone sales would reduce significantly the auction revenues. Therefore, the seller should monitor the characteristics of timber stands that do not sell at auction. If characteristics common to all those stands are found to exist, including those characteristics in the upset calculation may be warranted. However, even when as many variables as possible have been included in the appraisal, there will still be errors in the appraisal, and so the upset should be set below the appraised value.

Fourth, if few timber stands are sold in today's market, insufficient data may be available to accurately determine an upset price in subsequent periods. Although, this factor may be irrelevant to the decision to maximize revenue in *today's* market, it is important to revenue maximization in the future. The consideration arises because the data from BC timber auctions are used in two related ways. In particular, under BC's proposed market reforms, the auction data would be used both to set future upset prices and to set stumpage prices for tenure-holders under the market-based pricing system. For both

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3.   The economic surplus created when a buyer, whose value exceeds the seller's value, purchases the good.
4.   *See* Roger B. Myerson, *Optimal Auction Design,* 6 MATHEMATICS OPERATIONS RES. 58, 58-73 (1981).
5.   In an auction where collusion is suspected, the seller can use the upset price to mitigate the effects of the bidding-ring. *See* Daniel A. Graham & Robert C. Marshall, *Collusive Bidder Behavior at Single-Object Second-Price and English Auctions*, 95 J. POLITICAL ECON. 1217-39 (1987). The upset price can also serve to reduce the cost of participating in an auction. In particular, in a clock auction, such as the Federal Communications Commission's spectrum auctions, a minimum opening bid reduces the number of rounds necessary to complete the auction.

purposes, it is important to obtain reliable estimates of the value of a tract, conditional on observable characteristics. However, when the upset price is set too high, a substantial number will not sell at the upset price. For those tracts, the analyst can learn only that the value of the tract was below the upset. The actual value to bidders is unobserved. Furthermore, if tract values are predicted using only data from past tracts that did sell, the prediction will be biased upward. Thus, a higher upset price would either necessitate a more complicated econometric model (one that would also be less transparent and provide less accurate predictions), or it would lead to bias in a simple model similar to the current one where values are estimated using only tracts that sell.

2.2   Empirically estimating the optimal upset price

The theory of optimal upset pricing can be used together with statistical analysis of bidding data to determine the seller's optimal upset price. In particular, data on bidding behavior at auctions can be used, together with the assumption that the market is in equilibrium, to infer the values that bidders must have had to place these bids. Intuitively, by looking at the distribution of bids at auctions, it is possible to quantify the incentive for bid shading. When that incentive is understood, it is possible to derive a mapping between bids and values. By applying the mapping to observed bids, we infer the distribution of bidder values.[6] With the latter in-hand, one can use the theory of optimal upset pricing to compute the revenue-maximizing upset price as a function of the auctioneer's no-sale value. These techniques work best with a large dataset of bids, potentially including all bids,[7] from auctions with a similar set of participants and similar items (or items with measurable, observed differences).

How important is it to get the upset price exactly right? The gains to revenue from "fine-tuning" the upset price are moderate. Our previous paper, "Setting the Upset Price in British Columbia Timber Auctions," is an example where an upset price that is greater than optimal one by 5% of the appraisal value leads to about a 5% reduction in revenue.

In practice, an auctioneer can gauge the effectiveness of its upset price by monitoring the auction market. First, the auctioneer should track the percent of auction lots that it is able to sell to a buyer. If a large percentage of lots are unsold, then the auctioneer might profit from a reduction in its upset price. Alternatively, if a negligible fraction of lots are unsold, the auctioneer my profit by increasing its upset prices and making additional revenue on the lots it sells. However, these are just rough benchmarks; in general, it may be optimal for the seller to have either a large or a small fraction of items unsold, depending on the no-sale value relative to bidder valuations. Second, the size of the observed bids relative to the upset price is an important piece of information. Following the intuition given above, if it is very common to see bids far above the upset, revenue may increase if the upset price is raised.

3   DETERMINING THE AUCTIONEER'S NO-SALE VALUE

We begin by considering the factors that affect the no-sale value for a small seller. We then introduce additional factors that affect the no-sale value for large sellers.

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6.   Nonparametric estimation is an example of one increasingly common method. *See, e.g.,* Emmanuel Guerre, Isabelle Perrigne & Quang Vuong, *Optimal Nonparametric Estimation of First-Price Auctions*, 68 ECONOMETRICA 525, 525-74 (2000). One advantage of this technique is that it can be applied to several auction models, such as the independent private values model or the common values model. *See* Susan Athey & Philip A. Haile, *Identification of Standard Auction Models,* ECONOMETRICA (2002). Applications to timber auctions already exist. *See* Harry J. Paarsch, *Deriving an Estimate of the Optimal Reserve Price: An Application to British Columbian Timber Sales,* 78 J. OF ECONOMETRICS 332, 332-57 (1997).
7.   While it is preferable to perform the estimation on a dataset that includes all bids that were submitted at auction, the estimation can also be performed using only the winning bids.

3.1 Small private sellers

A small private seller is only a small source of supply in the local timber market. Such a seller considers the following factors when determining the no-sale value:

1. The optimal harvest date.

2. Current and expected future market conditions.

3. Measurement error in the appraisals, and the extent to which a failure to attract bids at the current price is "bad news" about bidder values for this tract in the future.

A small private seller would make the following calculations: First, the seller would determine the optimal time to harvest timber, accounting for expected timber growth, the possibility of disease, expected conditions of the future timber market, and the current local market conditions. The small seller might also require a minimum amount of yearly cash flow. If borrowing were costly, the small seller would harvest a minimum amount of timber each year.

Second, the seller must make a choice about how much to consider current market conditions when determining the "no-sale" value. If the seller has a short time horizon, or believes that today's market values are a good predictor of future market values, then the no-sale value should be indexed to the current market prices for timber. However, if the seller believes that prices will rise in the future, the seller might wish to consider expectations of future market prices when determining its no-sale value. While forecast errors typically abound in such a calculation, the seller may choose to delay the sale if, based on the current market, the price it expects it could receive in the future substantially exceeds the appraised price.

Another important factor in determining its "no-sale" value is the seller's prediction of the future sales price of the particular tract under consideration, holding fixed the overall market conditions. The seller would start with an appraisal, but recognize that the appraisal may omit some features that are important to the bidders. The seller would also recognize that an unsold stand today is "bad news" about the future sale price. Specifically, some feature of the tract made it unattractive to local bidders, and that feature may or may not change in the future. If the tract does not sell because the local bidders cruised the tract and determined it would be particularly costly to harvest the trees (relative to the appraised value), or felt the likelihood of prior insect damage was high, the future sales price would probably be less than today's appraised value, and approximately equal to the highest amount a bidder is willing to pay today. On the other hand, if the tract doesn't sell because all local bidders with the right equipment for this tract happen to be employing that equipment elsewhere at the moment, the future sales price may be close to today's appraisal, but exceed the willingness to pay of the highest bidder today. In general, the expected value from a future sale depends on the serial correlation—that is, the correlation over time—of bidder values for an individual tract.

3.2 Large private sellers

In addition to the factors that concern small sellers, the following considerations matter for large sellers:

1. The extent to which completing a sale today will lower prices in other auctions held by the same seller.

2. The extent to which failing to complete a sale may lead to exit of buyers, and thus a decrease in the competitiveness of future auctions.

3. Whether reducing total quantity sold is an alternative to setting high upset prices.

If the seller recognizes it is a large source of timber supply, it would, in an exercise of monopsony power, optimally provide less quantity to the market than if it were a small seller. Put differently, small sellers do not internalize the negative externality they create for other sellers when they increase supply and lower the price of standing timber.

In addition, a large seller takes into account how its sales patterns affect the willingness of local mills to enter the market or increase capacity. To guarantee a source of supply for the mills and to induce the mills to continue to produce, a large seller might sign long-term contracts for part of its supply. . Local mills are essential to the value of the seller's resource, and the existence of numerous mills increases the competition for the timber.[8] Long-term contracts would typically be indexed to a market index or a spot price. Indexing the contracts induces the buyer to more efficient harvest the timber and therefore increases the gains from trade over time. If the long-term contracts are indexed to a spot price, and the market determining the spot price is sufficiently thick, the long-term contracts will have little impact on the functioning of the market. This is true because it is the marginal purchase of timber that determines the spot price, as it would in the absence of long-term contracts.

Finally, for a large seller, it should be noted that there are two ways to moderate the quantity sold or increase the selling price during downturns. The first alternative, described above, is to use a different rollback over the current appraisal depending on market conditions. The second alternative is to simply make a centralized, administrative decision to reduce quantity. Quantity reduction has the advantage that fine-tuning of the system for setting the upset price or the use of potentially unreliable forecasts is unnecessary. However, it is disadvantageous that the quantity decisions would in practice be made only periodically and would not necessarily incorporate all market feedback.

3.3 How to determine the "no-sale" value for the B.C. Ministry

The Ministry's determination of the no-sale value mimics closely that of a large, private seller. In addition to the factors that determine the no-sale value of the large firm, the ministry must also consider three additional factors:

1. Social efficiency.

2. Transparency and administrative burden of changing upset pricing systems or auctioned quantity with the business cycle.

3. Availability of data to provide an objective measure of the future sale value of a tract.

The starting point for determining the Ministry's no-sale value is an appraisal of the current selling value of the tract. Any such appraisal would take into account current market conditions. A question arises as to how much the Ministry should account for current market conditions in setting the upset.[9] If the Ministry takes current market conditions as the best predictor of future conditions, then no adjustment

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8.   Indeed, the U.S. Forest Service states as an objective, "sustain an adequate level of mill capacity to ensure a competitive market for any woody material that may subsequently be offered through stewardship sales." *See* United States Department of Agriculture, Forest Service, *Forest Management Program Annual Report: National Summary Fiscal Year 1997*, at http://www.fs.fed.us/land/fm/tspirs/tspirs97.pdf.
9.   It is important to highlight the fact that any modification to an appraisal of current market value would be important for assessing the no-sale value at an auction, but *not* for predicting what prices would be in an auction at the present time. The market-based pricing system under discussion in British Columbia seeks to accomplish the latter, that is, predict what the outcome of an auction today would have been. Thus, current market conditions should be part of the appraisal process.

is necessary. However, if forecasts indicate that the market might increase (respectively decrease) in the future, the no-sale value should be increased (respectively decreased). If revenue-smoothing matters to the Ministry, it might not respond much to such changes in market conditions. It is also important to note that if the Ministry allowed forecasting to play an important role, the (lack of) transparency and accuracy of the forecasting process could create problems.

Just as for a private seller, there are two ways to moderate the quantity sold during downturns, and potentially raise the selling price. The problems with fine-tuning the system for setting upset prices may be particularly important for a government, if transparency is valued. Quantity choices are historically less contentious, and although quantity-setting processes may not be transparent either, it may be desirable to observe "market prices" for whatever quantity is chosen. From the perspective of the Ministry, however, it is important to keep in mind that altering the quantity let at auction and changing the rollback used to determine upset prices can both achieve the same goal. High upset prices during downturns lead to more unsold tracts and less harvesting; or, the Ministry can just auction fewer tracts to start with.

Like a large private seller, the Ministry has monopsony power in the market for standing timber. If it acts to maximize revenue, it may sell less timber than in a decentralized market with many private sellers; however, if it values social efficiency, it may not wish to withhold supply. Also like a large private seller, the Ministry should consider how its actions affect the competition and capacity in the milling industry. Long-term contracts mitigate this type of concern without necessitating the continual updating of quantities and upset prices. However, if some bidders (for example, loggers) do not have long-term contracts, and entry is costly, then large decreases in supply may cause a reduction in the level of competition at future auctions.

The Ministry's no-sale value should incorporate the other factors relevant to a private seller, as described above. If social efficiency is important to the Ministry, it would want to limit the number of times a stand was let at auction. In particular, bidders assume costs when they prepare to bid at an auction. If repeated attempts are necessary to sell a single timber stand, then some of those costs are duplicated. The maximization of social efficiency would mandate that the marginal cost of re-auctioning a tract be weighed against the expected marginal benefit of the re-auction. Also, the social costs of delay in harvesting timber that could have generated gains from trade at an earlier date must be considered.

How should the Ministry determine its no-sale value in practice? A decision needs to be made as to whether to adjust the no-sale values with current conditions. If the Ministry uses the appraised value in today's market as a benchmark, and expects little change in the market in the next few years, it still must consider the future. In particular, the Ministry must estimate the expected future price conditional on not selling the timber stand at today's upset price; this depends on the correlation of bidder values for the same tract at different points in time. A sample of tracts that were let at auction at least twice would be necessary to estimate the expected future price. In the absence of such data, it may be possible to gather qualitative evidence from industry and Ministry sources about the relative importance of fixed attributes of a tract versus transient bidder demand in determining sales prices.[10]

Once the no-sale value is determined, the Ministry can then use the theory outlined above to determine the optimal rollback. One complication arises when the no-sale value is adjusted in response to predicted market changes in the future. The complication is that if the no-sale value is very high relative

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10. For example, in the Southern Forest Region in the United States, the timber appraiser has the authority to adjust the appraised upset price up or down by as much as 20 percent. Furthermore, the appraiser can rely on publications such as "Random Lengths" (www.randomlenghts.com) or the University of Mississippi Co-op's monthly timber report for guidance. For information on upset pricing in the Southern U.S. Region, contact Jim Naylor at 404.347.3994 or Randy Smith at 404.347.3847.

to the appraised value of the item in today's market, it may not be optimal to increase the upset very far above the no-sale value. Intuitively, when only a small range of values lie above the upset price, increasing the upset price has only small effects on aggressiveness of bidding. However, if the no-sale value is well below the appraised value, it may be optimal to increase the upset to induce aggressive bidding and mitigate the incentives for collusion. In contrast, if the no-sale value moves in lock step with the appraised value, the optimal upset will typically be a constant percentage of the appraisal. This characteristic is attractive because the administrative burden of setting the upset is small and the upset pricing method is transparent.

Before proceeding, we discuss briefly a deceptively simple policy for setting the upset price. It might seem that the upset price should just be set at the expected future sale price of the standing timber, adjusted to account for discounting and measurement error. There are two problems with this. First, as discussed above, the serial correlation, over time, between bidder values for a given tract is unknown, and the data necessary to determine the serial correlation of bidder values is currently unavailable. Second, this policy implicitly ignores the role that a large seller can play in setting quantity. In particular, an upset equal to the expected future price of the timber stand is consistent with *any* stumpage price. To clarify, consider the following simple model: The price timber firms are willing to pay for stumpage is given by $P(Q_t,t)$, where Q_t is the total amount of timber auctioned in year t. Market conditions change with time t (for example, world market conditions vary year-over-year). For simplicity, suppose that the demand conditions are learned at the beginning of the year. Assume that the Ministry were to abide by the following policy: aim for a particular stumpage price, p, and in each year t, choose to auction the quantity Q_t such that $p = P(Q_t,t)$. With no upset price, the Ministry would achieve its target. But the upset price should be the expected future price of the timber. Given that the Ministry anticipates its future policy, it expects the future price to be, on average, p. Hence, the upset price should be set around p (adjusting of course for sale characteristics), and therefore the average sale price this year will be around p, so that today's upset is not binding to a substantial degree. Therefore, we conclude that this policy does not, on its own, do anything to pin down upset prices.

4 COMPARING UPSET PRICES BETWEEN AUCTION MARKETS

A comparison of upset prices between auction markets, particularly government-run auction markets may prove difficult. Consider two government auctioneers that use separate appraisal methods to estimate the value of their goods at auction, and then set the upset price as a percentage of the appraised value.[11] Because the government's appraisal methods differ, both governments may use different upset rules, but still have optimal upset values. Recall that the optimal upset is set relative to the seller's implicit value, not the appraised value. Consequently, unless the appraisal methods of both auctioneers are identical, their optimal upset rules, expressed as a percentage of the *appraisal*, will be different.

A review of how upset prices are set in different auction markets in the United States displays the complex nature of upset pricing.

4.1 U.S. Timber Auctions

In U.S. timber auctions, upset prices are set differently by timber region. Regions use different appraisal methods and different rollbacks. Many regions base their upset prices around the Forest Service Transaction Evidence Appraisal (TEA) system. TEA is typically implemented using a regression-based approach that uses evidence from prior sales to form an estimate of the value of a given sale, taking as inputs appraised values of logging costs such as falling, bucking, skidding, hauling, slash treatment, road maintenance, temporary road construction, as well as the value of lumber prices published quarterly by an entity such as the Western Wood Products Association. An alternative approach used in some areas is the

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11. British Columbia, for example, generally sets its upset at 70 percent of the appraised value of a timber stand.

"residual value" appraisal system, whereby appraised harvesting and processing costs are subtracted from an index of market prices.

In 1992, the U.S. Forest Service recommended that, except in unusual circumstances, TEA be used in all regions except Region 10 (Alaska). In addition, the following guidelines have been in force since then:[12]

Timber sale advertised rates must be within 70 percent of high bid rates received over the previous 4 calendar quarters on a weighted volume basis. Establish advertised rates by comparing the advertised rates to bid rates on sales $2,000 and over in value within the appraisal zone or other logical unit of area, as designated by the Region. Make adjustments to the appraisal system to achieve the 70 percent criteria if either of the following circumstances exists:

1. Average advertised rates are less than or equal to 60 percent of the high bid rates for any given calendar quarter; or

2. Advertised rates fall between 60 and 70 percent of the bid rates for two consecutive quarters.

Regional Foresters may establish standards greater than 70 percent.

By April 30 and October 31 each year, Regional Foresters must report to the Washington Office the performance of advertised rates as a percentage of bid rates for each 6-month period ending March 31 and September 30, respectively, in accordance with such instructions as are issued by the Washington Office Director of Timber Management.

During periods when the normal timber sale program is substantially disrupted by litigation, appeals, and other actions resulting in highly inflated bid rates, advertised rates may be less than 70 percent of bid rates. In such circumstances, the Regional Forester must provide a justification for adoption of a lower bid rate percentage as part of the semiannual report on advertised rate performance.

Regional Foresters shall establish criteria that seek to achieve the sale of at least 85 percent of sales volume during each fiscal year and shall design or modify appraisal processes as necessary to achieve this standard.

Regional Foresters may base the 85 percent appraisal performance criteria on sales of $2,000 or greater minimum advertised value, or $10,000 or greater advertised value. Inform local industry representatives which basis will be used prior to implementation.

Given the Forest Service policy, each region decides whether it wants to use a rollback of less than 30 percent. The policy implicitly limits how small the rollback can be, since 85 percent of auctions must result in a sale.

As discussed above, the impact of a given rollback will depend on the details of the appraisal method. In the Rocky Mountain Region, a rollback of 10 percent is generally used, but a 5 percent rollback is used in Nebraska and the Rio Grande areas of that region. Also, the Rocky Mountain Region used a rollback of 30 percent during a market downturn in 2001. Once an upset price has been set, it may

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12. See UNITED STATES FOREST SERVICE, FOREST SERVICE MANUAL, TITLE 2400 - TIMBER MANAGEMENT, CHAPTER 2420, TIMBER APPRAISAL, Amendment 2400-2003-3, Feb. 2003 *available at:* http://www.fs.fed.us/im/directives/fsm/2400/2420.doc

be adjusted. For example, in the Rocky Mountain Region, a smaller upset (i.e. higher upset price) is used when less competition is expected at auction.

The Pacific Southwest Region uses a 20 percent rollback. However, the authority does not allow the upset price to fall below $10 on high-grade timber, $5 on middle-grade timber, and $1 on low-grade timber, where the prices are expressed in thousands of board feet.

The Pacific Northwest[13] uses a rollback of 10 percent. The 10 percent rollback has been in effect since, approximately, the beginning of 2001. In addition, this region ensures that the upset price is greater than the maximum of two price floors. The base rate is the price of reforestation, and is appraised for each timber stand before the auction. However, prices are not allowed to fall below those listed in Table 1.

TABLE 1. FOREST PRODUCT FLOORS IN THE PACIFIC NORTHWEST

Species	Region 6	
	West Side	East Side
(Minimum per CCF or equivalent net scale)	**$/CCF**	**$/CCF**
Douglas-fir	20	10
Western larch	20	10
Western white pine	20	20
Ponderosa pine	20	20
Sugar pine	20	20
Port orford cedar and Alaska yellow cedar	20	--
Western red cedar	20	10
Noble fir, Shasta red fir, sitka or engelmann spruce	20	10
Western hemlock, true firs and conifers not listed	10	5
Incense cedar, mountain hemlock, lodgepole pine, knobcone pine, all hardwoods, and ponderosa pine – young growth (black bark)	5	5

Source: Mike Daugherty, Region 6 Office of USDA Forest Service. Note: CCF stands for hundred cubic feet.

The upset price at a timber auction in the Pacific Northwest Region is the maximum of the following three values: 10 percent of the TEA, the price of reforestation, or the species specific price floors in Table 1.

Therefore, the methodology that different regional offices use to set the upset prices for timber let at auction varies.

It should be noted that in recent years, the Forest Service timber sales program has been unable to cover its costs of sale preparation and administration. Thus, the emphasis on lower rollbacks may be interpreted in part as a way to remedy this problem. Furthermore, the USFS may prefer an increase in the number of no-sales, given that many of its sales result in losses. In other words, the seller's no-sale value may often be greater than the bidders' values in the U.S. Auctions that are typically profitable do not have this characteristic.

4.2 Spectrum Auctions

The Federal Communications Commission (FCC) sets upset prices, which the FCC refers to as reserve prices, for individual spectrum licenses for each spectrum auction. The FCC determines those

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13. *See* http://www.fs.fed.us/r6/nr/fp/appr_index.htm (containing information on appraisals in this Region).

upset prices by first seeking comment from parties interested in bidding in the auction.[14] The FCC then uses its judgment in setting the upset price so that the auction is competitive.[15]

4.3 Local and Federal Construction

Contracts for state, local, and federal construction projects are typically awarded through auctions.[16] These auctions are, in general, sealed-bid. An engineer employed by the regulatory body determines a cost estimate for the project, which is in turn used to determine an upset price. For example, in the New York City School Construction Authority Auctions, the Office of Engineering determines and acceptable bid range based on an internal cost estimate. Only bids within that range are accepted.[17]

4.4 Christie's and Sotheby's Auctions

The auction houses Christie's and Sotheby's specialize in auctions for items such as art, collectibles, and wine. In art auctions, typically several appraisals are obtained by the auctioneer, and a "low" and "high" appraisal are published.[18] Although upset prices are a closely guarded secret, there is a tradition of setting the upset less than or equal to the "low" appraisal. It is possible to infer something about upset prices by looking at the probability that a bid is accepted. Ashenfelter, Graddy, and Stevens (2002) report sale rates in different departments at Christie's in London in 1995 and 1996, showing that 96% of items put up for sale in auctions of arms and armor were sold, 89% of wine at auction was sold, and 71% of impressionist and modern art items were sold. In addition, they combine statistical inference with data about secret upset prices to infer that the upset price is typically between 70% and 80% of the auctioneer's low estimate.

4.5 Real Estate Auctions

In a model somewhat different than that considered here (affiliated signals, common components to valuations, and endogenous entry by a large number of small bidders), McAfee, Quan, and Vincent (forthcoming)[19] derive a method for computing the lower bound on the optimal reserve. Their method is based on observing the same item auctioned more than once. They apply their method to FDIC real estate auctions and find that the lower bound on the optimal reserve price for real estate is about 75% of the appraised value.

5 CONCLUSIONS

In this report, we have summarized a number of issues that arise in designing a procedure to set the optimal upset price. We focused on two classes of considerations: (1) how to set the upset relative to the no-sale value to maximize revenue, and (2) how to calculate the no-sale value to the seller.

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14. *See, e.g.,* C and F Block Broadband PCS Spectrum Auction Scheduled for November 29, 2000, Rescheduled for December 12, 2000, DA Dkt. No. 00-2038 at 10 (released Sept. 6, 2000) (discussing that the Commission seeks comment on opening bids on an auction-by-auction basis).

15. *See, e.g., id.*

16. Highway, bridge, and municipal building construction projects are almost always awarded through some form of competitive tender.

17. *See* New York City School Construction Authority, Advertised bids, *available at:* <http://www.nycsca.org/apps/cms/advbids.>

18. *See* Ashenfelter, O. and K. Graddy (2002): *Art Auctions: A Survey Of Empirical Studies*, NBER WORKING PAPER Number 8997; Ashenfelter, O., K. Graddy and M. Stevens (2002): *A Study of Sale Rates and Prices in Impressionist and Contemporary Art Auctions*. Mimeo, Princeton University.

19. McAfee, R., Quan, D. and Vincent, D. (forthcoming): *How to Set Minimum Acceptable Bids, with an Application to Real Estate Auctions*, J. INDUSTRIAL ECON.

A few issues, both pertaining to the no-sale value, deserve to be highlighted. First, the reliance (if any) of the estimated no-sale values on current market conditions and the business cycle should be carefully weighed. In making this decision the Ministry should consider the value of revenue smoothing, the value of ensuring future competition, the accuracy of market forecasts, and whether the Ministry intends to adjust the auction volume with the business cycle. A second concern is that, at the present time, we do not have data available that will allow us to estimate the expected future selling value of an unsold tract today. Finally, some of the "fine-tuning" that is discussed here may have serious costs in terms of administrative burden and transparency. Any benefits from such practices may not justify their costs.

We also surveyed practices for setting upset prices in the U.S. Across a wide range of items, the procedure is to obtain an appraisal and then set the upset price using a rollback. The rollbacks range from 5-30%, depending on the setting. It is relatively rare for the process to involve much fine-tuning, especially in government auctions. Occasionally upset prices are adjusted in response to business cycle conditions, as in the U.S. Forest Service where rollbacks were increased during a downturn.[20] However, such adjustments are not common.

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20.   Above, we gave reasons why it might be optimal to decrease them in such circumstances, if appraisals do not adequately respond to current market conditions. *See infra* p. 5-6.