FTR Auction Design for the California ISO

TradingDynamics, Inc.

The criteria for a good Simultaneous Multiple Round auction design are:

- the design is easily understandable by all the bidders
- most if not all the bidders are comfortable with the design
- the design will lead to a reasonably efficient allocation of the resource
- the auction will produce “no regrets”: Bidders who lose will have chosen not to match others’ prices; bidders who win will not be leaving money on the table

Note that we have not included revenue maximization as a criterion. Auction theory suggests that all reasonably efficient auctions should yield approximately the same revenue in expectation and therefore other issues should come to the forefront.

III. *Auction Designs*

In a meeting with stakeholders and representatives of the ISO on Thursday August 20, 1998 discussion focused on two options for the auction, referred to as “option A” and “option C”. Option C may be thought of as a more general version of option A. The tradeoff is that option C gives bidders a little more flexibility at the cost of some extra complexity and perhaps some slightly greater opportunities to “game” the system. This section outlines those alternatives.

A. SEPARATE SIMULTANEOUS AUCTIONS, ISO NAMES PRICES

(1) the ISO sets (low) prices in round 1 for each of the 52 markets

(2) buyers submit bids indicating the quantity they would choose to buy at the round 1 price

(3) the ISO then raises the price in each market for the next round, the amount of price increase being a function of the excess of demand over supply in the previous round

(4) buyers bid for the quantities they would like to buy at the new price. A buyer may not bid for more in one round than he bid for in the previous round

(5) if demand still exceeds supply in a market, then steps (4) and (5) are repeated

(6) when demand is less than or equal to supply in an individual market, that market closes. Price is set at the last price for which demand exceeded supply

(7) bidders receive all the FTRs they demanded in the final round plus a pro rata share of any FTRs that were demanded in the next to last round

Example: Total demand in the market was 120 at a price of 100 and 90 at the next called price of 105. Total supply is 100. Then the market clearing price is 100. An individual firm had demanded 20 FTRs at a price of 100 and 11 FTRs at a price of 105. That firm is awarded 11 + (20-11)*(100-90)/(120-90)=14 FTRs at a price of 100.

C. AUCTIONS CONDUCTED IN GROUPS, ISO NAMES PRICE

Before the auction, the auctioneer in consultation with the bidders, determines whether any, and if so which, licenses across different interfaces should be grouped together, allowing bidders to take eligibility from one license and use it to bid on another. Ideally, interfaces, which are close financial substitutes for one another, are placed in the same group.

(1) the ISO sets (low) prices in round 1 for each of 52 markets

(2) buyers submit bids indicating the quantity they would choose to buy at the round 1 price

(3) the ISO then raises the price in each market for the next round, the amount of price increase being a function of the excess of demand over supply in the previous round. If demand was less than or equal to supply in the previous round then the price remains as it was

(5) bidders announce new demands based on new prices

- (a) bidders are restricted to bidding on no more than the total number of FTRs for which they bid in the previous round
- (b) if demand was less than supply in a market in the previous round, the bidder may not reduce his demand in that market in the new round. (That is, according to rule (4) the price is unchanged and according to 5(b) demand can only be increased.)
- (c) The maximum eligibility a bidder can "transfer" from one market to another within the group in a given round is the minimum of the bidder's total eligibility in the market and the aggregate excess demand in the market in the previous round

(6) if the total amount demanded on any interface within a group is greater than supply, then return to step (4)

(7) if the demand on every interface in a group is less than or equal to supply then all the markets in the group are closed. Prices in each market are the last price at which demand exceeded supply

(8) for any market in which supply exceeds demand the FTRs are awarded in the following way: Each bidder is awarded the number of FTRs it bid for in the last round plus a proportion of the excess supply on the interface. That excess supply is calculated in the following way:

   (a) calculate for each bidder that reduced demand from the last round in which demand exceeded supply the amount of the bidder's reduction. (If the bidder either held demand constant or increased demand, then this number is zero.)
   (b) sum these demand reductions to calculate a total demand reduction
   (c) subtract total demand from supply
   (d) for each bidder, assign it [(a)/(b)]*(c) additional FTRs. For example, assume that an individual bidder had reduced its demand from 20 to 17 FTRs. Total demand in the market had fallen from 120 to 90 (with no bidder increasing demand), while total supply was 100. Then the bidder would receive 17+(20-17)*(100-90)/(120-90)=18 FTRs.

An implication of the rationing rule is that a bidder may move eligibility from one market to the next and end up buying FTRs in both markets with the same eligibility. This would happen if the market from which eligibility was removed changed in that round from excess demand to excess supply.

ADVANTAGE OF A/C FORMAT

Designs A and C are similar in important ways. In fact, the low value markets which would not be grouped under C are treated exactly the same in both designs.

Both designs also have the feature that the ISO announces the price each period and the buyers simply choose quantity. This format is preferred over one in which bidders submit entire demand curves for the following reasons: First, it reduces the number of decisions bidders have to make each round, enabling the auction to be conducted more quickly. Second, when bidders submit demand curves in a simultaneous multiple round auction there are two alternative rules procedures. One is that in the next round we only require losing bidders to raise the ante. In this case the auction will take a long time, because for example if demand exceeds supply by 20 percent it will take about a half dozen rounds before all the bidders will have had to bid once. The other is that we require not only losing bidders but those within the next bid increment to raise their bids. For example, if the minimum winning price in one round was 100 we might make both losers and winners who bid under 110 bid in the next round. But in this case we would expect the auction to behave nearly identically to design C but with some added complexity.

Therefore it is our belief that the A/C format will provide the same performance as one in which bidders submit demand curves, but will do so more quickly and simply.

RECOMMENDATION and CONCLUSIONS

If there is no desire on the part of the bidders or ISO to group licenses together, then we would recommend design A. Each bidder will be told the aggregate demand in each market in each round rather than the demand by each individual bidder, to make collusion more difficult. The primary argument for mechanism A is that it is simple. A second argument is that it will be more obvious which properties should be grouped after the auction is run once or twice. So while grouping may be a good long run strategy it may provide less benefit the first time around. A third argument is that with only 25 percent of the uncommitted FTRs available in the first auction the stakes will be smaller, making a complex design less valuable to the bidders and less appropriate.

The advantage of mechanism C in principle is that it provides bidders with added flexibility. A bidder can switch back and forth between FTRs within a group (albeit with at least some risk of ending up having to buy FTRs in both markets). The added flexibility will allow bidders to change plans in the middle of the auction in a more substantial way than they can with format A. This places additional burden on bidders, but in the long run the benefits from this added complexity may well outweigh the costs.

The consensus of the ISO representatives and stakeholders was that the system should be built to accommodate system C. Since A is a special case of C, this will keep the design option available in the future. However, it was felt that for the first auction the simpler mechanism A might be more appropriate. With so little accumulated experience to date at the ISO it might be hard for the ISO and the market participants to identify the optimal grouping. Furthermore, since this would be the first time for the bidders to bid in this auction style, the simpler format A will minimize the chances of bidder. After running A for the first year, a decision could be made about what if any property groups would be appropriate for the second year. The ISO representatives also felt that if the market participants had a strong preference for C and could reach a consensus on how markets should be grouped then C could be considered already in this first year. Design A will be implemented for the first Primary FTR auction.

ISO Auction Rules for Increments

The following are specific rules regarding the increments and The process to deal with allowing de minimis winners to exit.

Increments

On the FTRs with minimal projected values choose a minimum increment ($20) and a fictional value of $100. The price could then rise according to the same formula as the other FTRs. If we underestimated the value of the low value FTRs we might at some point want to increase the increments on some of them.

The general formula is:

Start at 20% of projected value for a market, rounded down so that 1% increments will be in multiples of $5. For example, if the projected value is $3,943 then 1% is $39.43. Round this to $35 and make the initial price 20 x $35 = $700. Exception: If the projected value is less than $500 round down so that 1% increments will be an even dollar amount. Use conservative methods in calculating the projected value.
Increase at 10% of projected value so long as demand exceeds supply by more than 100%.
Reduce to 5% of projected value when demand exceeds supply by 60 to 100%.
Reduce to 3% of projected value when demand exceeds supply by 30 to 60%. Reduce to 2% of projected value when demand exceeds supply by 10 to 30%, Reduce to 1% of projected value when demand exceeds supply by less than 10%.
The ISO has the right to change these increments depending on how slowly the auction is converging to a conclusion.

Pro rata allocation

After the last round of an auction, a pro rata allocation of the bidders will typically be necessary. Assume that there are X units to be allocated by the pro rata mechanism and a demand reduction of Y in the last round. Under the original allocation mechanism each bidder would get X/Y times their own demand reduction. The objections to this scheme are that bidders may not wish to be left with only a small number of FTRs. Note that the problem only really applies to bidders who decreased their demand to 0 in the ultimate round, since other bidders would be receiving an amount greater than or equal to the amount they bid for in the last round.
Bidders who reduced their demand to zero in the last round could be given the option of requesting that their pro rata allocation be reduced. These bidders are prioritized smallest to largest. As many such bidders as possible are treated as though they had not bid in the penultimate round, subject to the constraint of supply being less than or equal to demand in the penultimate round. The pro rata mechanism is then applied.

Example:

Total demand in round 20 is 1100.
Total demand in round 21 is 900.
Supply is 1000.

So X=1000-900 = 100. Y = 1100-900 = 200.
Four bidders reduced demand in the last round. Bidder A reduced from 75 to 0. Bidder B reduced from 50 to 0. Bidder C reduced from 25 to 0. Bidder D reduced from 300 to 250. All other bidders bid for a total of 650 in both rounds 20 and 21.
Bidders C, B, and A could apply to be relieved from their pro rata allocations. However, excess demand in round 20 was only 100 and the bidders had a total demand of 150, so they cannot all be excused. Bidders B and C as the smallest would have first priority in being excused. A could only be excused if B chose to take a share.
If no one asked to be excused the old rule would apply, and each bidder would receive 100/200 of his demand reduction. That is, A would receive 38, B 25, C 12, and D 275. (The other bidders would get 650.)
If A only chose to be excused, then each other bidder would be allocated 100/125 of his or her demand reduction, leading to final allocations of 40 for B, 20 for C, and 290 for D.
If B only chose to be excused, then each bidder would be allocated 100/150 of his or her demand reduction, leading to final allocations of 50 for A, 17 for C, and 283 for D.
If C only chose to be excused, then each bidder would be allocated 100/175 of his or her demand reduction, leading to final allocations of 43 for A, 28 for B, and 279 for D.
If B and C both chose to be excused, then the remaining bidders would be allocated 100/125 of his or her demand reduction, giving A 60 and D 290.
If A and C both chose to be excused, then the remaining bidders would be allocated their full demand reduction, giving B 50 and D 300.

If A and B (or A, B, and C) chose to be excused then A would not be excused because allowing A to exit would require some other bidder to buy more than it had bid for in the next to last round. Results would be calculated as though A had not asked to be excused.

The last part of the pro rata rules include rounding rules so that bidders do not end up with fractional FTRs. The total number of fractional FTRs to be awarded are reallocated to those who would have had the highest fractions, with ties broken on the basis of who had the larger allocation in the market randomly. For example, if 3 bidders were to get 300 6/7, 200 4/7, and 100 4/7 of an FTR, the allocation would be 301,201, and 100. If the allocations were to be 300 6/7, 200 4/7, and 200 4/7 then the first bidder would get 301 and a random procedure would determine that one of the last two would get 201 and the other would get 200.

Appendix A
Early Design Considerations

I. Simultaneous Multiple Round Auction Format

The ISO has specified that a simultaneous multiple round (SMR) auction format be used for the FTR auction. There are some possible variations within this format, meant to accomplish different objectives. This section begins by outlining the case where the SMR format works best, and the issues that complicate the problem.

Assume that a seller is auctioning off two assets --- for example, a New York-California round trip plane ticket, and a New York-London ticket. Several New York-based vacationers wish to bid for these tickets. Each bidder has a value for each of the two tickets, and is interested in getting the best possible deal, defined as value received minus price paid. Each bidder bids initially on whatever ticket she prefers. If she is outbid in the first round then she makes a bid in the second round on whatever ticket would give her the best deal, taking into account any required bid increments. If both tickets become too expensive she exits the auction. When no one wishes to make a new bid the auction ends.

This format has two compelling advantages:

(1) it leads to the tickets ending up in the hands of the two people who have the highest total value; and

(2) if bidders all bid myopically on whatever ticket gives them the best deal at any given moment, none will have regrets. That is, no bidder will ever look back and conclude that she could have done better by bidding in a different way.

These advantages extend to auctions of many assets sold to many competing bidders, provided that certain conditions hold:

(i) all bidders are interested in only buying one asset
(ii) bidders know their own values going into the auction (i.e. they do not re-evaluate based on the bids of others)
(iii) bidders do not face budget constraints

II. Complications and their Relevance to the FTR Auction

Advocates of the SMR format contend that while no known mechanism can deal adequately with all the above problems, a properly designed SMR auction can do pretty well even with these real world complications. This is correct, but it is worthwhile to describe the commonly discussed issues and their implications in the special case of the FTR design.

1. *Complementarities*. Go back to the auction of the two plane tickets. Now assume that one of the bidders is interested in going from California to London, and so is only interested in buying both the California-New York ticket and the New York-London ticket, or neither. This bidder values the two-ticket package at $1500. A second bidder, based in New York, would be willing to pay up to $1000 for *either* of the two tickets. Then the SMR will not work well.

The reason is that the auction is a *price discovery* mechanism, meant to find prices that clear the market. In the example in Section I, if the seller had known in advance the final prices that would come about in the auction, he could simply have set those prices and the market would have cleared --- the two auction winners would have bought the tickets they ended up with at the auction, and the other potential buyers would have decided against purchase. The problem in a case with complementarities is that there are no prices that will clear the market. If we make the sum of the two prices less than $1500 then there will be a total demand for three tickets at the prices but a supply of only two. If we make the sum of the two prices $1500-$2000 then there will be a demand for only one ticket and a supply of two. The complication is that a buyer will have to make bids on one asset without knowing how much a complementary asset will cost.

The typical argument by SMR designers is that this problem is somewhat reduced, though not eliminated, by a format that allows bidders to move around from bidding on one asset to bidding on another. By running many auctions simultaneously buyers can move between properties and avoid getting badly trapped.

Fortunately, the complementarities problem should not be a major concern in the FTR auction, principally because the assets being sold are primarily financial assets used for hedging purposes. Go back to our example of the auction for the two plane tickets. In an auction of physical assets a buyer who wants to go from California to New York to London must buy two different plane tickets. But now consider a futures market, in which a buyer wishes to hedge against the price of a California-London trip one year from now. However, the New York-London leg is not available in the futures market. The buyer will still be able to hedge a significant part of his cost by buying one (or perhaps even two) California-New York futures tickets. While California-New York and New York-London may be complements in the physical market, if the two routes are likely to be congested and expensive at the same times then they are substitutes in the financial futures markets.

2. *Common Values*. While a bidder may start an auction with an evaluation for a property, she may revise that estimate when she observes the pricing of other properties. For

example, in buying a stock an investor will be interested in what others are paying for comparable securities. This is more true for financial assets than for physical assets. For financial assets most buyers are interested in roughly the same return characteristics and will be interested in the market consensus. For physical assets, a buyer might have a reason to buy that is specific to his own needs and the value that others place on the same asset may be irrelevant.

Because the FTRs are financial assets a premium should be placed in designing a mechanism that leads to all the principle markets closing at about the same time, so that buyers can be as informed as possible about the overall market by the time they make their most serious bids.

3. *Point Systems*. Many recent SMR auction designs (e.g. Mexican, Canadian, and Australian telecoms) have included bidding point systems. A bidder is limited to bidding on the number of points of eligibility it has, and this eligibility has a "use it or lose it" feature that keeps the auction moving along. This works well if all properties have similar values. For example, if five similar FTRs are being auctioned off on five different interfaces, then a bidder might get one point for each FTR that it bids on in each of the five interfaces. The bidder will have flexibility in moving bids around from interface to interface --- if it gets outbid along Path A it can change to bidding on Path B. But things are more complicated if some interfaces are very valuable and some are worth very little.

If bidders get a similar number of points by bidding on a cheap license as on an expensive one, then they will sometimes "park" eligibility by bidding on cheap properties they do not want while waiting for other things to sort out. On the other hand, a bidder with a budget constraint might want to buy either one expensive interface or a group of inexpensive ones. It is much easier, under SMR designs such as that used by the FCC, to move in one direction (from the expensive to the cheap) than in the other. Also, it is much easier for big bidders, with lots of points of eligibility, to be flexible than it is for smaller bidders. These problems, other than the "parking" problem, are mitigated in the FTR auction by the multiple unit nature of the auction. Still, if the 52 auctions were to be run as part of one great auction, with fully flexible eligibility, a point system, with its attendant complexity, would be needed.

III. FTR Auction Design

The key decision in choosing between the options is whether to run the 52 auctions separately or to divide the 52 interfaces into "groups", determined in consultation with bidders. Most interfaces that are expected to be relatively inexpensive could be run separately. However, if there are a group of important interfaces that might be reasonably regarded as substitutes for one another for some bidders' hedging purposes, then bidders could be allowed to move eligibility on a one-for-one basis between FTRs within the group. This would simplify the point issue and probably reduce "parking".