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# An Auction Primer in the Context of the Credit Crisis

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The rescue plan known as the Emergency Economic Stabilization Plan of 2008 (the Act) to resolve the credit crisis will have major ramifications in the US and world economies for years to come. A key element of the plan is reliance on market mechanisms to purchase the mortgage-related troubled assets from current holders and sell them once the market recovers, and to inject liquidity into the marketplace. Auctions and reverse auctions are examples of such a market mechanism and are cited explicitly as part of the “troubled asset relief program” (TARP) of the Act.

So much is at stake. If the auctions are not designed and conducted properly more harm than good will be done. If participants in the auctions are not well-versed and prepared in these types of auctions, there will be significant lost opportunity at best. This auction primer provides an overview on auctions and what the key considerations are in the context of relying on auctions to help solve the credit crisis.

### What is an auction?

“Auction” can have different meanings. In some cases, informal negotiations between multiple parties are referred to as an auction. Generally, though, “auction” refers to a more structured, formal process in which rules are specified for how interested parties may participate in a bidding process. One-sided auctions involve a single auctioneer and multiple bidders. Two-sided auctions involve multiple buyers and sellers.<sup>1</sup>

In auctions that most people are familiar with, there is one seller (the auctioneer) and two or more buyers (the bidders). Formally this is referred to as a forward auction. In a forward auction, the seller may have a reserve price which is the price below which the seller will not sell. The mirror image is a reverse auction (also known as a procurement auction). In a reverse auction, the auctioneer is the buyer and the bidders are sellers, and the buyer may have a reservation price, which is the price above which the buyer will not buy. Reserve prices and reservation prices may be private to the auctioneer, or they may be revealed to bidders.

The main auction proposal from Treasury to help address the credit crisis is a one-sided reverse auction in which the US government is the buyer, and holders of troubled assets are bidding to sell their assets to the government. Two-sided auctions could be an alternative even though these are not currently a part of the TARP. However, there are indications in the financial press that some financial institutions and sovereign funds are likely to be interested in purchasing the troubled assets in addition to the Treasury.<sup>2</sup>

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<sup>1</sup>Examples of two sided-markets are stock exchanges and the recently frozen market for auction rate securities. In the latter, prices of certain bonds (for example, bonds of municipal issuers) are reset on a regular basis (for example, bi-weekly) via pay-your bid double auctions where bidders can decide on which side of the market they want to bid and then submit bid-quantity pairs.

<sup>2</sup>Recently Lone Star purchased complex troubled assets (US super senior ABS CDOs) from Merrill at 20 cents on the dollar.  
[http://www.bloomberg.com/apps/news?pid=20601039&sid=aUyHZG.Q68cA&refer=columnist\\_gilbert](http://www.bloomberg.com/apps/news?pid=20601039&sid=aUyHZG.Q68cA&refer=columnist_gilbert)

An auction is just a form of a market. In general, successful auctions minimize information and transaction costs, facilitate trade, provide an effective price discovery mechanism, and allocate resources and risks consistent with the goals of the auctioneer or the entity sponsoring the auction.

Although they have been used for millennia, auctions have received widespread and increasing publicity over the last 15 years. This is attributed in large part to advancements in game theory, auction theory, and applications; the accessibility and growth of the World Wide Web; and the increasing use of auctions by governments, industries, and businesses. Today, auctions are used regularly to buy and sell a variety of assets, products, and property rights, including financial securities, business assets, spectrum licenses, energy contracts, emissions rights, dairy products, business supplies, consumer goods, and so forth.

### Why auctions rather than some other transaction form?

There are many different transaction forms. The following table is a simplified summary and comparison.

<b>Informal, unstructured allocations</b>	<b>Requests for proposals (RFPs)</b>	<b>Formal, structured auctions</b>
Most flexibility Less transparent Criteria are more subjective More difficult to audit Process most likely to be challenged Examples are administrative assignment (beauty contest); lotteries; first-come, first-served; negotiations	Can range between informal, unstructured allocations and formal, structured auctions	Less flexible once bidding begins Most transparent Criteria are more objective Can be readily audited Process least likely to be challenged Examples include sealed bids, sequential auctions, simultaneous multiple round auctions, clock auctions, hybrid auctions, combinatorial auctions

A well designed and run auction is seen as a method consistent with the following:

- Allows a variety of economic and policy objectives to be achieved
- Minimizes information, transaction, and participation costs
- Minimizes the time needed to transact and allocate resources
- Establishes arms-length market values
- Encourages participation and promotes competition
- Provides a fair, open, transparent, and objective process

- Allows affiliates of the auctioneer to participate as a bidder
- Minimizes challenges and delays
- Winning bidders win because other bidders are not willing and able to submit better bids

### Necessary conditions for a successful auction

All of the following are required for a successful auction. For example, the best auction design will not ensure a successful auction if there is insufficient interest. Of course, there is correlation among some of the factors. All other things being equal, a well designed and implemented auction will tend to generate more interest than a poorly designed and implemented auction.

#### Uncertainty

This uncertainty refers to (at least for the auctioneer and among bidders) who places the highest value on the assets or products. (Highest value in a reverse auction refers to which sellers would find it most profitable to sell at a given price in the auction.) If no such uncertainty existed, there would be no need for an auction—the assets or products could be readily awarded.

For the troubled assets, uncertainty arises from the difficulty in determining expected cash flows of the underlying loans (for example, home loans, auto loans, and credit card loans) and the effect that has in valuing the assets. For the more complex troubled assets, it might not be possible to map back the loans to the asset. Even if this mapping can be done (as is the case for less complex troubled assets like mortgage pass-through), determining the cash flows will be non-trivial as it depends on multiple factors, including general economic conditions, interest rates, conditions in the real estate market, and other borrower- and loan-specific characteristics that affect the ability of borrowers to repay the loans.

#### Sufficient interest in the auction

Assets or products to be bought and sold must be designed to provide value, so bidders can conduct due diligence to estimate the value of the assets or products and to compare them to alternatives available to the bidders. (We call that the “product design” stage for the auctioneer.) In a reverse auction of assets, there needs to be more supply than demand, at least at the buyer’s reservation price. If there is too much uncertainty in the rights and obligations associated with the assets, in the auction process, or in the selection criteria, or if it is too costly to participate in the auction relative to bidders’ other options, then participation in the auction will be discouraged. For example, because valuing a complex troubled asset requires specialized statistical modeling, bid preparation costs might actually discourage smaller buyers from participating in the auctions.

#### Appropriate auction design

There is no one auction design that is appropriate for all situations. An auction design that works well in one market or for certain assets may not work well for other situations. The considerations that determine optimal auction design are discussed later.

### Effective auction rules

The auction rules refer to the complete, detailed set of bidding procedures that are consistent with the higher level auction design but that need to be developed for the particular auction. These rules need to be clear and free of ambiguity and loopholes. Otherwise, bidders will have incentives to invest time and energy in taking advantage of the flaws, and winning bidders will be those most adept at that rather than the bidders that should win based on the intended objectives of the auction. Along with effective auction rules, there need to be credible, material penalties for violations of the rules. Bidders need to know that all bidders are subject to the same rules—what bidders are allowed to do, what they are not allowed to do, and what the consequences are for violating the rules.

### Careful implementation

Even if all the other factors have been addressed appropriately, poor execution of the auction process will ensure failure. Many auctions have failed, leading critics to declare that “auctions are bad.” In fact, there may have been nothing wrong other than failure to administer the auction process with care and thoroughness.<sup>3</sup> Bidders must be given sufficient time and information in order to be encouraged to participate. Information must be made readily accessible to all bidders in a timely manner. Documents must be consistent and complete. There needs to be effective responsiveness to questions. Communications protocols must be followed. Bidder qualification criteria and bid selection criteria must be developed and applied carefully and consistently.

### Expertise and experience

Cutting across the factors above, successful auctions require the ability to combine auction theory, empirical economics, and practical experience. These need to be developed and adapted to the particulars of the market and the situation. This is where science meets art, particularly when there is much at stake. The assumptions underlying auction theory are fully realized only rarely, yet successful real world auctions must be developed based on sound theories, and the challenge is acknowledging tradeoffs and making the right decisions when applying the theory to real auctions.

### What is important for optimal auction design?

There are many different types of auctions. These include variations of one-shot sealed-bids, sequential auctions, simultaneous multiple-round auctions, clock auctions, and combinatorial or package bidding auctions. For each type of auction, many detailed rules need to be specified, including the pricing rule (e.g., discriminatory pricing or uniform pricing) and what information is provided to bidders.

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<sup>3</sup>Auction-rate security failures in the beginning of this year clearly indicate that the potential for the underwriter not covering the auction on account of a systemic liquidity event was not planned for in designing the auction.

There is no one design that is best in all situations. The optimal auction design needs to take into account the intended objectives, the types of assets or products being bought and sold, and characteristics of the likely participants.

### Objectives and constraints

Objectives for an auction usually include a subset of the following:

- Promote competition
- Encourage entry into a market
- Facilitate transactions that otherwise would not take place
- Establish arms-length market values
- Achieve economic efficiency—winning bidders are those who value the assets the most
- Generate optimal auction revenue
- Maximize price in a forward auction, minimize price in a reverse auction

Sometimes the objectives conflict and there are tradeoffs. “Constraints” that need to be taken into account when designing auctions include any legal, regulatory, policy, or institutional objectives or requirements that need to be considered in addition to the economic considerations listed above.

### Types of assets

The best auction design for achieving the objectives depends on the types of assets involved. Two key considerations are the extent to which “common value” vs. “private value” underlies the assets, and whether and how the assets are related in value for bidders.

#### *Common value vs. private value*

*Common value* means the value of the assets to bidders is correlated among the bidders. When bidders are uncertain about the value of the assets in this case, the “winner’s curse” problem arises. The bidder with the highest estimated value will tend to win, and depending on the auction design, will tend to over-pay for the asset in a forward auction (or to under-price in a reverse auction). Bidders take this into account by bidding conservatively low in a forward auction and conservatively high in a reverse auction. Consequently, the objectives of the auction are not likely to be fully achieved. Some auction designs are more effective than others at mitigating the winner’s curse.

*Private value* means the value of the assets to bidders is not correlated among bidders. A bidder may have unique existing assets that are complementary to the assets in the auction, so the value of the assets in the auction for this bidder may be independent of the value of the assets in the auction to other bidders.

In typical auctions the assets exhibit both common value and private value, so the key is to determine how important these value components are. If common value is important, then,

among other things, the auction design should provide for an effective price discovery process that reveals information to bidders in such a way that encourages them to bid their valuations rather than to bid conservatively for fear of outbidding the market.

#### *Assets related in value*

When multiple assets are auctioned the assets can be related in value in one or more ways: they can be substitutes, they can be complements, and/or they may be related indirectly through bidders' budget constraints. (The assets may be substitutes and/or complements from the auctioneer's perspective, but here we focus on the bidders' — i.e., sellers' — perspective.)

Two assets are substitutes for a seller if a price decrease for one causes the seller to be willing to sell the other asset at a reduced price. The assets may be perfect or imperfect substitutes. Two assets are complements for a seller if the seller is willing to sell the combination of the two at a lower total price than the sum of individual prices for the assets. The assets may exhibit strong or weak complementarities. Some assets may be substitutes for some bidders and complements for other bidders.

Even if assets for a bidder are neither substitutes nor complements, the assets are related in value indirectly if the bidder has a budget constraint.

To the extent assets are related in value, they should be auctioned simultaneously so that bidders can pursue price arbitrage opportunities among substitutable assets and preferred combinations of assets among complementary assets. Auctioning the assets independently, one by one, will lead to a failed auction or suboptimal results.

#### Characteristics of bidders

Along with the objectives of the auction and the types of assets, the characteristics of the types of likely bidders determine the appropriate auction design.

#### *Number of bidders*

Typically the objectives of an auction are more likely to be achieved the more interest there is from bidders in the auction. Interest is measured in terms of how many bidders participate and how much they are willing and able to bid on in the auction. If bidding interest is weak, some auction designs are better suited than others. For example, the use of one-shot sealed-bids may be appropriate in this case.

#### *Symmetry of bidders*

If there are strong asymmetries among bidders in terms of valuations, budgets, information advantages, sophistication, and so forth, some auction designs discourage participation by weaker bidders which can be detrimental to achieving auction success. When weaker bidders are encouraged to participate, even if they ultimately do not win, they force stronger bidders to bid more competitively and more consistent with their valuations.

### *Affiliation of bidders*

When a bidder is affiliated with the auctioneer or they have joint interests outside of the auction, the auction design needs to ensure that these bidders are not advantaged. Otherwise, non-affiliated bidders will be discouraged from participating and there may be challenges and delays to the process. Generally, a necessary condition is that a third party is appointed to develop and conduct the auction process. This promotes a fair, open, transparent, and objective auction.

### Other considerations for auction design

The auction design needs to mitigate any collusive behavior on the part of bidders. This includes effective information and communications protocols to limit what can be exchanged between bidders before and during the bidding process. Serious, credible penalties must be in place ahead of time to be applied to bidders that violate the auction rules.

In short, the best auction designs facilitate the ability and incentives of bidders to express their valuations for the assets in the auction. Bidders should be encouraged to devote their efforts to estimating valuations not to finding ways of taking advantage of loopholes in the auction. Winning bidders should not win because they are better at manipulating the auction. Winning bidders should win because no other bidders are willing and able to bid better prices for the auctioneer.

### What does this mean for the credit crisis?

The stated goals of the TARP primarily are to inject liquidity into credit markets by purchasing troubled assets (preferably through market mechanisms such as reverse auctions) and to minimize any potential negative impact on taxpayers, including selling the troubled assets once the market recovers and compensating taxpayers for any overpayment for the troubled assets.

### Liquidity

Defining which market to target for injecting liquidity is vital. If a range of assets is bid into a reverse auction by current holders of the assets without distinguishing (and pricing accordingly) differences among them (e.g., year of origination, maturity, coupon, likelihood of loan repayment), only the worst of the troubled assets will be purchased. And if uniform pricing is used without distinguishing the assets appropriately, all “winning” assets selected will be paid the same price so that the worst assets will earn inframarginal profit. This is counter to the objective of promoting liquidity in the more desirable troubled assets.

### Minimizing negative impacts on taxpayers

Some time after the Treasury purchases troubled assets via a reverse auction (or other mechanisms), it intends to re-sell the assets (perhaps through asset manager agents) when the housing sector and the economy have recovered and reverted to a “normal” state. For now, there is no way to detect a “normal” price for the troubled assets as there is no functioning market. Rather, the hope is that the reverse auctions will jump-start the market, and that as the purchases of the troubled assets inject liquidity into the marketplace, the market will start functioning.

Uncertainty about the prices at which the Treasury will be able to re-sell the troubled assets at a future date introduces the potential for a negative impact on taxpayers—the Treasury might purchase the assets at a price that is substantially higher than what it can recoup from the re-sale of the assets when the economy recovers at a future date.

However, it can be argued that some of the bidders might have a similar concern in the reverse auctions: since the “normal” market value of the troubled assets is unclear to the bidders, they might end up selling their assets at prices below that in a recovered market. This effect could be quite important for bidders who are liquidity-constrained only on the margin.

### Auction design and implementation issues

The objectives in relying on reverse auctions are clear: provide liquidity and minimize the potential negative impacts on taxpayers. As outlined above, besides the objectives, auction design is influenced by the type of assets being auctioned and the characteristics of the buyers. Which of these is pertinent in the current context, and how can auction design be used to get around the aspects idiosyncratic to the troubled asset markets? This is discussed next.

### Heterogeneity of troubled assets

The key challenge is that so many of the troubled assets are heterogeneous with nearly-unique attributes that affect their values. The value of a typical troubled asset is linked to the expected future cash flows from a wide variety of loans (e.g., home loans, credit card loans, and auto loans). As a result, loan-specific characteristics (e.g., origination year, fixed or adjustable rate, interest only, loan to value ratio, frequency of rate resets, and level of documentation) and borrower-specific characteristics (e.g., FICO score, debt-to-income ratio, and demographic characteristics) will distinguish one troubled asset from another, giving rise to a wide variety of troubled assets in terms of their value.

One way of getting around this is for the Treasury to buy \$700 billion of troubled assets with a total disregard for asset heterogeneity. But this will only enhance the downside risk for the taxpayers as sellers are likely to dispose off their least valuable assets. Thus, some standardization, pooling, or categorization across the assets is needed, regardless of whether a formal reverse auction or some other mechanism is used. Pooling or standardization of the heterogeneous troubled assets could be based on loan and/or borrower-specific characteristics. But this is not straightforward (except for relatively straightforward assets like mortgage pass-throughs) as it is non-trivial to map back the troubled assets to the loans on which they are based for the more complex troubled assets.

Heterogeneous products do raise a key auction design issue (distinct from the product design issue of collecting the vast variety of troubled assets into standardized pools). Bidders need to know that they are bidding in the context of some common set of bid selection criteria. Otherwise, effectively there will be individual one-on-one negotiation which is neither practical nor consistent with the objectives of timeliness and transparency that underlies the TARP. This is not an issue in a straightforward reverse auction where sellers submit a bid price, the buyer picks the

lowest bid price, and the auction concludes. The bid selection criterion is the lowest price bid. In TARP auctions, there could be several schemes to select winning bids.

One approach is for the auctioneer to establish a fixed “quantity” of assets that it will purchase along with a reservation price and select winning bids based on the lowest bid prices that do not exceed the reservation price. Alternatively, the auctioneer could establish a class of assets (for example, the year of origination of the underlying loans) for which it will purchase a fixed quantity, but within that class, leave it up to the auction to determine how much of each type of asset in the class to purchase based on price relationships among the assets established by the auctioneer—effectively allowing the auction to determine the mix of winning bids within the asset class. This bid selection criterion was used in auctions to buy back US Treasury securities in 2000-2002. The list of bonds that the Treasury intends to buy back along with the total amount to be purchased is announced by the US Treasury, leaving the bidders to determine the mix of winning bids.

### Common value and the associated winner’s curse

The troubled assets have a strong common value component in that their value is tied to general economic conditions, interest rates, and conditions in real estate markets in particular—which are uncertain and yet common to all participants. Of course there is a private value component too to the extent the heterogeneity of the assets provides uncorrelated value. Auctions can be designed to address the winner’s curse that follows from the strong common value component so that bidders do not need to bid artificially high prices.

For example, uniform pricing rather than paid-your-bid pricing could be used to mitigate the winner’s curse problem and encourages sellers to bid their true valuations. This argument formed the basis for a switch to uniform price auctions for US treasuries in the 1990s.

The reverse auction could be conducted in multiple rounds of bidding. The winner’s curse is mitigated via the price discovery that takes place at the end of each round from the release of information about other bidders’ valuations. This is not really a new innovation in financial markets. Rather, it is similar to the practice of many stock exchanges holding a pre-opening round that determines the prices at which trading should begin for the day.

Yet another alternative is linked to the fact that the common value component in these auctions arises from the unknown price of the troubled assets once the market recovers. Note that both the sellers and the buyer face this situation, so that both are subject to the winner’s curse: the taxpayers (Treasury) and the current holders of the troubled assets face the risk that the auction price could differ from the “normal” price at which assets will be sold in the future when the market recovers in either direction. A contingent pricing scheme could be made a part of the

reverse auction, whereby the taxpayers/Treasury and the sellers split the difference between the auction price and the resale price of the asset.<sup>4</sup>

### Troubled assets are related in value

The assets clearly are related in value. Current holders of the assets who would be selling into the reverse auction consider some of the assets substitutable and some of the assets complementary. This suggests the assets should be auctioned at the same time to the extent possible, rather than individually, one by one. Bidders would be able to price-arbitrage among substitutable assets and to pursue selling packages of complementary assets, leading to greater value realized and lower prices paid by the US Treasury. Simultaneously auctioning the assets would provide a more effective price discovery process, less risk, and more accurate market valuations.

### Bidders are asymmetric

The number of bidders is not a problem but asymmetry among them is a challenge. Asymmetry arises from differing prepayment probabilities of securities they hold and different abilities to map loan information into a price (asymmetries in bid preparation costs).

One way of handling informational asymmetries could be to introduce a distinction between competitive and non-competitive bids and allow only the less sophisticated bidders like thrifts to bid non-competitively. Non-competitive bids are allotted in full (the Treasury buys all the troubled assets) at the market clearing price in the competitive part of the auction. This is a common format to sell or buy back Treasury securities across the globe. The downside is that it makes the quantity of assets to be purchased in the competitive part of the auction uncertain. However, quantity uncertainty can be side-stepped by temporal separation of competitive and non-competitive bids and/or the release of this information in a multi-round format.

### Quantity of assets to be purchased cannot be fixed

Quantity does not enter the picture if a single object is being auctioned. But in the TARP auctions quantity plays a vital role. There is a wide variety of these assets, and the outstanding quantity of these assets is unknown to the Treasury. The \$700 billion has to be allocated among the heterogeneous assets (or their standardized version) so as to have a contestable auction in each class (supply by current holders exceeds the quantity that the Treasury agrees to purchase subject to the \$700 billion limit).

One way of addressing this is through a two-sided auction where bidders can determine whether they want to buy or sell in addition to submitting price-quantity pairs. Two-sided auctions are widely prevalent in the financial markets. Besides stock exchanges, rate resets for auction-rate securities are commonly done via two-sided auctions.

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<sup>4</sup>The emphasis in the TARP has been on the negative impacts of overpayment by the Treasury to holders of the troubled assets. However, bidders' incentives (especially the smaller, less sophisticated bidders) also need to be aligned with the risks associated with the resale price.

The difference from the one-sided reverse auction is that in addition to the Treasury, there will be other financial institutions, including sovereign wealth funds that could participate as buyers of the troubled assets. There is extensive press coverage about hedge funds, private equity and fund managers, and sovereign wealth funds willing to enter the market as buyers of troubled assets. As noted above, recently Lone Star purchased complex troubled assets from Merrill Lynch. The proposed one-sided reverse auctions in the TARP are a special case of the two-sided auctions in that the Treasury is the only buyer in the former.

### Concluding remarks

Regardless of how sound the underlying “real economy” is (as economists like to refer to the nation’s ability to produce and provide goods and services), eventually fundamental weaknesses in the “financial economy” will present a significant drag on the real economy. Throw in the heightened uncertainty in an election year in the third leg of the “economy”—the “political economy”—and we are experiencing rare dynamics.

Fundamentally, the US Treasury perceives the use of auctions as a means to create—or jump start—a market where there currently is no functioning market due to lack of confidence and lack of liquidity. By effectively pooling assets and by pooling participants, the Treasury hopes to provide an effective mechanism to encourage trade, to discover prices, and to instill confidence and liquidity.

Keep in mind that the Treasury is essentially proposing to act as a monopsonist through the use of reverse auctions. The presumption is that under current conditions there are no other buyers for the troubled assets—there needs to be a single buyer, the Treasury (ultimately the taxpayers). This puts the Treasury in position to dictate the terms for the disposition of the assets. Getting the auction design, rules, and implementation right, and demonstrating credibility and generating sufficient interest, will be keys to success. Direct and indirect market participants, as well as taxpayers, have an enormous—perhaps unprecedented—stake in well designed and implemented reverse auctions. Bidders participating in these auctions as well should conduct prudent due diligence and preparations to ensure they achieve their objectives.

### Our expertise and experience

CRA’s Finance and Auctions & Competitive Bidding Consulting Practices are well suited to help clients navigate through these challenging times.

CRA can assist bidders and the auction manager for US Treasury’s reverse auctions in several ways, including:

- Advising on the auction design and bidding rules and on the process for how the auctions are to be conducted
- Identifying improvements for future auctions, particularly as the auction process accommodates increasingly more complex assets
- Developing and implementing strategies, preparations, and actions to assist bidders in successful participation in the auctions

CRA International advises clients on auction and market design, implementation, participation, valuations, competitor assessments, bidder support and strategy, software and electronic trading platforms, regulatory and litigation support, and more. We have provided these services to clients in various industries including financial markets, commodities, energy and environment, telecommunications, transportation, natural resources, aerospace and defense, and health care.