

# CRS Report for Congress

## Auction Basics: Background for Assessing Proposed Treasury Purchases of Mortgage- Backed Securities

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## Summary

To address the turmoil in financial markets, the Emergency Economic Stabilization Act (EESA; H.R. 1424, P.L. 110-343), enacted on October 3, 2008, authorizes purchases of “troubled assets.” The act passed the Senate on October 1, 2008, passed the House on October 3, 2008, and was signed into law the same day.

The Administration proposed using reverse Dutch auctions to purchase troubled assets — primarily mortgage-related securities from financial institutions. In reverse Dutch auctions, a buyer purchases multiple objects from private parties at a price set by the last accepted bid. The government has used reverse auctions since the Revolutionary War. Designing efficient reverse Dutch auctions may present some tradeoffs between enhancing competition among bidders and overpaying for assets relative to their quality. Careful auction design, however, can help minimize these problems.

Auctions are especially useful for selling assets whose value to potential owners is unknown to the seller. Reverse auctions are useful when a buyer does not know what value sellers place on assets. Auction results could clarify the market value of troubled assets. The price discovery properties of auctions could stimulate trading by reducing private traders’ uncertainty about the value of troubled assets.

A reverse auction program essentially swaps Treasury securities for troubled mortgage-backed securities. If Treasury securities are exchanged for troubled assets at prices close to those assets’ current market prices, costs to the taxpayer would be minimized. Financial institutions, however, may gain some liquidity, but might not receive much additional capital. Some economists have argued that other means of injecting capital into the financial sector, such as purchases of preferred stock or capital injections balanced by equity warrants (i.e., options to claim an equity stake), might be a better strategy. Since passage of EESA, the U.S. Treasury has been working to design methods to inject capital into firms and restore market liquidity.

The heterogeneity of troubled assets may present challenges to the Treasury auction program. The reverse Dutch auctions would need to be adapted to buy highly diverse and relatively small-volume securities, in a way that minimizes risks of trading manipulation. Reverse Dutch auctions may be vulnerable to adverse selection, meaning that the average credit quality of *submitted* assets of a given type may be systematically worse than the average credit quality of *all* assets of that type. Auction mechanisms might be designed that could mitigate these problems.

Recent academic research in auction theory and in experimental economics has examined how various types of auctions work. Auctions may capture higher revenues for governments and can often allocate scarce resources more efficiently than traditional methods of selling or purchasing. Different policy problems, however, call for different types of auctions. Government economists involved in designing reverse auctions to buy troubled assets have drawn upon academic research and internal Treasury research. This report will be updated as events warrant.

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# Auction Basics: Background for Assessing Treasury Purchases of Mortgage-Backed Securities

To address the turmoil in financial markets, Congress passed and the President signed the Emergency Economic Stabilization Act (EESA; H.R. 1424, P.L. 110-343) on October 3, 2008. The act authorizes the Secretary of Treasury “to restore liquidity and stability to the financial system of the United States” (Sec. 2) by purchasing or insuring “troubled assets.” The Secretary will design the mechanism for purchasing the troubled assets and methods for pricing and valuing these assets. The act broadly defines troubled assets as (1) mortgages and any securities based on such mortgages whose purchase the Secretary determines will promote financial market stability, and (2) any other financial instrument whose purchase the Secretary and the Federal Reserve Board Chairman determines will promote financial market stability.

The act authorizes Secretary Paulson to use \$700 billion to enhance liquidity and to inject capital into financial markets by purchasing (1) mortgages and pools of mortgages, (2) preferred stock in ailing financial institutions, and (3) troubled mortgage-backed securities (MBSs).<sup>1</sup> The Secretary has indicated that reverse auctions will be used to purchase mortgage-backed securities from troubled financial institutions. A well-designed auction could help determine the price and value of these assets in an efficient manner.

The act establishes a Congressional Oversight Panel to review the current state of financial markets, the regulatory system, and the administration of the Troubled Asset Relief Program (TARP) by the Secretary. This report provides Congress with information on the uses, design, and functions of auctions. It reviews some common types of auctions used by the federal government and some of the complexities of auction design that the Secretary will have to deal with in the TARP.

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<sup>1</sup> MBSs are debt obligations representing claims to the cash flows (principal and interest) from pools of mortgages primarily on residential property. The main use of MBSs is to transform relatively illiquid financial assets (mortgages owned by mortgage originators) into liquid and tradable capital market instruments. Given the problems with the housing market and subprime mortgages, it is difficult to know the true value of MBSs. Consequently, MBSs have become illiquid.

## Dutch Auctions and Reverse Dutch Auctions

The Administration has proposed using reverse auctions to purchase mortgage-related securities from financial institutions, which are similar to the multiple-unit Dutch auctions that the Treasury uses to sell government securities. In a reverse auction, a buyer accepts bids from multiple potential sellers. In reverse multi-unit Dutch auctions, a buyer (e.g., the U.S. Treasury) buys a given number of units from private parties (e.g., financial institutions) at a price set by the last accepted bid.<sup>2</sup> **Figure 1** below contains a hypothetical example of a reverse Dutch auction.

Auctions provide a means of selling objects whose value to potential owners is unknown to the seller. Many different auction mechanisms are in common use. A large research literature in economic theory and experimental economics examines how different types of auctions work. On the one hand, well-designed auctions can provide an expeditious and efficient method for selling or acquiring objects. On the other hand, poorly designed auctions have caused governments to forego large amounts of revenue. Moreover, poorly designed auctions may increase the likelihood that valuable resources are allocated to buyers who value those resources less than others — a source of inefficiency.<sup>3</sup> In particular, auctions suitable for some applications may be unsuited for other applications.

The American government has used reverse auctions since Robert Morris, who headed the Treasury Department, used them to procure supplies for troops in the Revolutionary War.<sup>4</sup> In recent decades, the Treasury Department has used auctions to sell federal securities.<sup>5</sup> Over time, the federal government has gained valuable experience in conducting and designing auctions, which has reduced costs and increased revenues compared to other methods.

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<sup>2</sup> Dutch auctions usually refer to falling-price auctions, which are described in more detail below. The reverse multi-unit sealed-bid auction outlined by the Treasury is strategically equivalent to a certain falling-price multi-unit auction, which is why the former is usually called a Dutch auction.

<sup>3</sup> Paul Klemperer, “Using and Abusing Economic Theory — Lessons from Auction Design,” *Journal of the European Economic Association*, 2003, available at [<http://www.paulklemperer.org/>]. In some situations, auction designers may face a tradeoff between maximizing expected seller revenue and maximizing the likelihood that resources are allocated to those who value them the most.

<sup>4</sup> Robert E. Wright, *One Nation Under Debt: Hamilton, Jefferson, and the History of What We Owe*, (New York: McGraw-Hill, 2008), p. 61.

<sup>5</sup> Various federal agencies have used different auction mechanisms for many years. The Department of Interior has run auctions to distribute Outer Continental Shelf (OCS) oil and gas leases since 1954. Since 1994, the Federal Communications Commission has used complex auction mechanisms to license slices of electromagnetic spectrum for use in wireless communications.

### Figure 1. A Hypothetical Reverse Dutch Auction

Suppose a government agency wished to purchase 1,000 desktop computers of a given specification. Potential sellers would submit sealed bids with a price and a number of units. The agency would then sort bids by price in ascending order. The agency would accept bids, starting with the lower price, and continuing until units offered in bids reached 1,000. Hypothetical bids are shown below.

#### Bids for a Hypothetical Government Procurement Reverse Auction

Hypothetical Firm	Bid Price (Per Unit)	Number of Units
Hang-10 IT	\$450	400
Crash Computers	\$470	500
Macrohard Inc.	\$510	200
HAL Systems	\$525	300

The agency would accept the bid from Hang-10 IT and buy 400 units because it had the lowest bid price, although Hang-10 IT's bid price (\$450) would not be the purchase price. The agency would also accept Crash Computers' bid for 500 units, because its bid price was the second lowest. Finally, the agency would buy 100 computers from Macrohard Inc. to reach the total of 1,000 computers. Because Macrohard was the last successful bidder, all computers would be bought at a unit price of \$510. HAL Systems would sell no computers to the agency.

Some may wonder why the government agency would not force firms to sell computers at their bid prices, which might seem to save the agency money. Such a strategy would probably be unsuccessful in saving money because firms would change their bidding strategies if they knew that they would have to sell at their bid prices. In particular, sellers would tend to shade their bids upwards, which might *raise* costs to the agency.

Specific rules and operation details for reverse Dutch auctions used by governments and private firms have varied. Some central banks use multiple-price or pay-your-bid auctions to sell securities, others use uniform-price auctions, and some have used both. Differences between multiple-price and uniform price auctions are discussed in more detail

Current U.S. Treasury auctions, which use a multi-unit Dutch auction mechanism to sell securities, have apparently provided a starting point for Administration proposals to buy "troubled assets" via reverse Dutch auctions. Because the reverse Dutch auction process would, in approximate mirror fashion, resemble Treasury auctions of government securities to primary dealers, key market participants could quickly familiarize themselves with new bidding procedures. Those administering Treasury reverse auctions, however, recognize that differences between Treasury securities and troubled assets have consequences for auction design.<sup>6</sup> Designing reverse Dutch auctions may present some tradeoffs between enhancing competition among bidders and overpaying for assets relative to their quality. Careful auction design, however, can help minimize these problems.

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<sup>6</sup> Discussion with government official, Sept. 26, 2008.

In the Dutch auction mechanism used to sell U.S. Treasury securities, all successful buyers pay the same price; in other words, it is a *uniform-price* mechanism. Uniform-price mechanisms, according to some experts, may encourage more aggressive bidding, which raises expected revenues.<sup>7</sup>

While details of the Treasury reverse Dutch auctions remain unspecified, the U.S. Treasury would probably announce that it wished to buy a given amount of mortgage-related securities (MBSs) of specific types or issues for a given auction. Bidders would then list securities they wish to sell and specify prices. The Treasury would then buy the securities listed at the lowest prices until the specified amount was reached. The price offered by the last successful bidder would then be paid to all successful bidders.

## **Quality Differences of Troubled Assets Presents Challenges for Auctions**

The diversity or heterogeneity of troubled assets may present challenges to the Treasury auction program. The mortgage-backed securitization process was intended to create marketable assets with credit characteristics that could be readily assessed by credit agencies and buyers. Credit rating agencies claimed that the rating process sorted asset-backed securities and other assets into categories with essentially homogenous profiles. All assets of a specific type receiving a given rating were supposed to embody essentially similar risk characteristics.

Confidence in the credit rating process has deteriorated over the past two years, however. Credit rating agencies, according to the Securities and Exchange Commission (SEC), struggled to keep up with more complex types of securities and had difficulty assessing risks embedded in subprime mortgage-backed assets. In addition, according to the SEC, none of the rating agencies examined had specific written procedures for rating residential MBSs and collateralized debt obligations.<sup>8</sup> Thus, some buyers may doubt that credit ratings represent a true gauge of asset quality. Tightened market liquidity in capital markets since August 2007 may stem in part from potential buyers' uncertainty about the credit quality of MBSs and other assets. Buyers may worry that sellers could have incentives to sell assets with difficult-to-detect risks before assets without such hidden hazards.

Similar problems may occur with reverse Dutch auctions used to buy troubled assets. A typical Treasury auction sells a large volume of identical government securities whose characteristics are well understood. The reverse Dutch auctions used by the Treasury would need to be adapted to buy highly diverse and relatively small-volume securities, whose characteristics may not be well understood by many

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<sup>7</sup> The U.S. Treasury has run multiple-price (in which buyers pay their bids) and uniform-price auctions in the past. In particular, multiple-price auctions may be more susceptible to the winners' curse, which may cause bidders to shade their bids downwards. The winners' curse and other issues relating to differences between multiple-price and uniform-price auctions are discussed below.

<sup>8</sup> U.S. Securities and Exchange Commission, *Summary Report of Issues Identified in the Commission Staff's Examinations of Select Credit Rating Agencies*, July 2008.

buyers. A typical mortgage-backed security issue, while enormous relative to a single housing mortgage, is small when compared to the size of a typical Treasury security issue, and individual tranches (slices) of MBSs are smaller still.<sup>9</sup> Different MBSs and related structured finance assets are very diverse, although their structures and pricing follow some general principles.<sup>10</sup> Thus, selling Treasury securities is like selling commodity steel; buying mortgage-backed securities is like buying used cars.

If the Treasury were to run a large number of narrowly defined reverse auctions, it would be more difficult to prevent certain types of market manipulation.<sup>11</sup> For example, a bidder who gains control of a large proportion of an issue might exert influence on auction outcomes. But, if a wider variety of securities or assets were allowed in the same auction, which would sharpen competition, sellers may have an incentive to submit bids for those assets with hidden flaws.

Reverse Dutch auctions may therefore be vulnerable to adverse selection, meaning that the average credit quality of *submitted* assets of a given type may be systematically worse than the average credit quality of *all* assets of that type. In addition, if assets submitted to an auction were on average worse than other assets of a given type, then auction prices might be biased downwards. Some empirical research has found that adverse selection problems can lower prices on eBay auctions.<sup>12</sup> If reverse auctions for troubled assets generated downwardly biased prices, that could affect valuations of assets held by other firms through mark-to-market accounting requirements. Thus, a downward bias in auction prices due to adverse selection could affect the market value or even solvency of some firms, whether or not they participated in auctions.

Moreover, managing a portfolio bought via reverse Dutch auctions susceptible to adverse selection could present financial risks to the federal government. While adverse selection could push prices down (relative to prices appropriate for the average of *all* assets of a given category), the quality of assets accepted by the

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<sup>9</sup> Most Treasury issues are generally sized in the tens of billions of dollars range, although cash management and other concerns may lead to smaller issues (U.S. Department of Treasury, *Treasury Bulletin*, various issues). Structured product issues (i.e., asset- or mortgage-backed securities, or collateralized default obligations (CDOs)) are generally sized in the hundreds of millions of dollars range, and are often divided into a half dozen or so tranches. Tranche comes from the French verb *tranchez* meaning to slice or to carve.

<sup>10</sup> The Bond Market Association and American Securitization Forum note that “(e)ach product sector is distinct based on issuers, investors, origination, servicing and collateral management, trading and pricing systems, and type and volume of available information. These differences lead to distinct pricing and valuation conventions, liquidity levels and risk exposures and sensitivities.” *An Analysis and Description of Pricing and Information Sources in the Securitized and Structured Finance Markets*, Oct. 2006, p. 1, available at [[http://www.miacanalytics.com/fs/AboutMIAC/PR/Pricing-Information\\_Sources\\_Study\\_1006.pdf](http://www.miacanalytics.com/fs/AboutMIAC/PR/Pricing-Information_Sources_Study_1006.pdf)].

<sup>11</sup> Manipulation in auctions is discussed below.

<sup>12</sup> Sanjeev Dewan and Vernon Hsu, “Adverse Selection in Electronic Markets: Evidence from Online Stamp Auctions,” *Journal of Industrial Economics*, vol. 52, no. 4, pp. 497-516, Dec. 2004.



Treasury through the reverse auction mechanism could also be lower (relative to average quality of *all* assets of a given category). To the extent that Treasury overpays for assets relative to their quality due to adverse selection, costs to the taxpayer rise. Whether this effect presents a significant financial risk to the taxpayer is difficult to determine before the reverse Dutch auctions have been running for some time.

Auction mechanisms, however, might be designed that could mitigate these adverse selection problems.<sup>13</sup> Analysts close to government auction design discussions have outlined a design in which several similar securities could be listed for an auction.<sup>14</sup> Price offsets or “handicaps” could be applied relative to a benchmark security. For instance, an auction might encompass a specified set of MBSs, underwritten by the same investment bank in the same month. Bids offering a specific MBS issue with a higher average default rate on the underlying mortgages would be reduced by an offset calculated using a financial asset pricing model.

Other auction mechanisms might also mitigate these problems. For example, a firm could be required to let the government select an asset randomly from all of its holdings of a specific type of asset if its bid were successful. Or participating firms could be required to post a performance bond that could be used to compensate the government if a firm’s assets sold in auctions turned out to be systematically worse than average.<sup>15</sup> Charles Plott, a pioneer in auction design, has designed and tested a reverse Dutch auction that was able to mitigate adverse selection concerns in another context.<sup>16</sup>

**Adverse Selection and Firms’ Asset Holdings.** Uncertainty about the composition of firms’ holdings could be an additional source of adverse selection in the administration of the Troubled Asset Relief Program. Some claim that financial institutions have avoided offering to sell large amounts of subprime and other troubled assets out of a concern for the institution’s reputation. Other market participants might infer that a would-be seller has a large inventory of subprime and other troubled assets and thus may be a risky counterparty.<sup>17</sup> That inference could adversely affect a potential seller’s stock price and its ability to raise capital, thus providing a reason for firms to hold troubled assets. In other words, some firms may worry that attempting to sell troubled assets may damage its reputation, market value,

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<sup>13</sup> Justin Lahart, “Economists Look at Ways to Structure Auctions,” *Wall Street Journal*, Sept. 25, 2008.

<sup>14</sup> Discussion with government official, Sept. 26, 2008.

<sup>15</sup> Matthew O. Jackson and Hugo F. Sonnenschein, “Overcoming Incentive Constraints by Linking Decisions,” *Econometrica*, vol. 75, no. 1, Jan. 2007, pp. 241-257.

<sup>16</sup> Charles Plott and P.J. Brewer, “A Decentralized, Smart Market Solution to a Class of Back-Haul Transportation Problems: Concept and Experimental Test Beds,” *Interfaces*, vol. 32, no. 5, pp. 13-36, 2002.

<sup>17</sup> Jonathan Carmel, “Pitfalls of the Paulson Plan,” *Economists’ Voice*, vol. 5, no. 5, Oct. 2, 2008, available at [<http://www.bepress.com/ev/vol5/iss5/art14>].

and ability to trade. However, many view the former investment bank Merrill Lynch's sale of troubled assets as a sound strategic move.<sup>18</sup>

**Reputational Issues and Participation.** If financial markets were to associate participation in the Troubled Asset Relief Program (TARP), including bidding in Treasury reverse auctions, with financial weakness, then firms might be less willing to participate. Reputational issues, in the view of many financial experts, have discouraged some firms from participating in certain federal government or Federal Reserve programs. For example, in recent years some have viewed firms using the Federal Reserve's discount window as "desperate."<sup>19</sup> The Federal Reserve Term Auction Facility (TAF), in the view of some, was designed to provide liquidity to firms while avoiding the stigma that some might perceive to be associated with the discount window.<sup>20</sup> U.S. Treasury, however, has stressed that TARP is "not targeted at failing firms," but instead is designed to attract broad participation among financial institutions.<sup>21</sup>

The effectiveness of the reverse auction asset purchase program could be reduced if reputational issues caused some firms to forego participation in TARP. Factors that reduce the number of active bidders in an auction can decrease expected revenues and can dampen competition among bidders. The choice of how auction results are released and how much detail is disclosed may affect firms' willingness to submit bids. For example, if firms believe that market analysts can observe or infer from announced auction results that the firm holds large inventories of troubled assets, then that firm may become reluctant to participate in the auction. Designing Treasury reverse auctions for troubled assets and associated announcements of results to avoid any such possible reputational effects may enhance firms' willingness to participate.

## Sequencing Issues

The order or sequencing in which reverse securities auctions take place may affect the results of auctions. First, the initial reverse auctions might be a learning process for both bidders and the U.S. Treasury. This might imply that smaller, simpler auctions should precede larger and more complex auctions. In the past, new

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<sup>18</sup> Merrill Lynch, "Merrill Lynch Announces Substantial Sale of U.S. ABS CDOs, Exposure Reduction of \$11.1 Billion," Press release, July 28, 2008, available at [[http://www.ml.com/index.asp?id=7695\\_7696\\_8149\\_88278\\_101366\\_103431](http://www.ml.com/index.asp?id=7695_7696_8149_88278_101366_103431)].

<sup>19</sup> Allan Sloan, "The Fed's Thaw," *Washington Post*, Dec. 25, 2007, p. D1.

<sup>20</sup> The Term Auction Facility was created in December 2007. For details, see the Federal Reserve Bank's TAF webpage, available at [<http://www.federalreserve.gov/monetarypolicy/taf.htm>].

<sup>21</sup> Neel Kashkari, Assistant Treasury Secretary for International Economics and Development, "SIFMA Conference Call," Sept. 28, 2008, available at [<http://www.youtube.com/watch?v=uXmFADm61Rc>]. On Oct. 6, 2008, Mr. Kashkari was named Interim Assistant Secretary of the Treasury for Financial Stability and will oversee TARP. U.S. Treasury, Press release hp-1184, Oct. 6, 2008, "Kashkari Appointed Interim Assistant Secretary for Financial Stability, available at [<http://www.treas.gov/press/releases/hp1184.htm>].

auction designs have sometimes presented unanticipated operational problems or unforeseen strategic vulnerabilities. Careful design and testing of auction mechanisms, however, can minimize such problems. Second, if the Treasury interventions in financial markets do start to unfreeze credit markets as intended, then asset prices will change. Bidders' anticipation that asset prices will rise after the initial auctions (or because of other types of government intervention) could induce bidders to submit fewer assets in earlier auctions. Third, sequencing may raise operational issues because of the large number of asset types, and because of the intrinsic complexity of some mortgage-related securities.

## Will Auctions Unlock Credit Markets?

The September 20, 2008, Treasury proposal suggested that reverse auctions would play a central role in restoring liquidity to credit markets. It argued that auctions could help stabilize asset and credit markets in two ways. First, firms with illiquid assets would sell them at prices determined by a competitive process, which would supply firms with liquid proceeds of those sales. Second, auction results could provide pricing benchmarks that might stimulate trading in other assets. Some believe that this could improve liquidity conditions in credit markets; others, however, are skeptical.<sup>22</sup>

The reverse auction program essentially swaps Treasury securities for troubled mortgage-backed securities. If the prices at which Treasury securities are exchanged for troubled assets are close to current market prices for those assets, then financial institutions may gain liquidity, but might not receive much additional capital.

What prices the "troubled" mortgage-related assets will sell at is, therefore, a key question. Merrill Lynch, for example, sold a large stake of senior mortgage-related collateralized default obligations (CDOs) to Lone Star Funds, a private capital fund, for about 22 cents on the dollar.<sup>23</sup> If other assets sold at Treasury reverse auctions at prices reflecting similar discounts, the solvency of some financial institutions might be put in doubt.

Some commentators, however, have suggested that Treasury might believe that such assets are underpriced in current conditions.<sup>24</sup> Assets might be underpriced, relative to fundamental factors, because of the rapid deleveraging of financial

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<sup>22</sup> Paul Krugman claims that Treasury Secretary Paulson has "never been able to explain clearly why buying up bad mortgage assets at market prices will solve the credit crunch." "Bailout Narratives," *New York Times* blog, Oct. 1, 2008, available at [<http://krugman.blogs.nytimes.com/>].

<sup>23</sup> Merrill Lynch, "Merrill Lynch Announces Substantial Sale of U.S. ABS CDOs, Exposure Reduction of \$11.1 Billion," Press release, July 28, 2008, available at [[http://www.ml.com/index.asp?id=7695\\_7696\\_8149\\_88278\\_101366\\_103431](http://www.ml.com/index.asp?id=7695_7696_8149_88278_101366_103431)].

<sup>24</sup> Paul Krugman, "A \$700 Billion Slap in the Face," *New York Times* blog, September 24, 2008, available at [<http://krugman.blogs.nytimes.com/2008/09/24/a-700-billion-slap-in-the-face/>].

institutions, which increased the supply of assets and the demand for liquidity.<sup>25</sup> As the price of liquidity rises, measured as the cost of overnight interbank borrowing relative to comparable Treasury rates, highly leveraged financial institutions may come under additional pressure to sell assets. Thus, deleveraging and falling asset prices may create a self-reinforcing spiral. To the extent that buying assets via a reverse auction process might strengthen the link between assets and their underlying values, more normal market conditions might be restored. But others argue that the low prices of “troubled” assets reflect their intrinsic value, and that previous prices were above those justified by fundamentals.<sup>26</sup>

Federal Reserve Chairman Ben Bernanke spoke of “hold to maturity” valuations of assets, which would seem to imply that prices above current market levels might be paid.<sup>27</sup> While paying above-market prices for assets would inject capital into financial institutions, it would also increase the costs and risks to taxpayers. How auctions could be designed to ensure “hold to maturity” valuations of assets is unclear. One economist with knowledge of auction design discussions has said that reverse auctions would be designed in a hard-nosed manner to minimize taxpayer costs. But, if current asset prices accurately reflect fundamental value and if the Treasury reverse auctions are run efficiently, comparatively little capital would be injected into the financial sector. While this would minimize costs and risks to taxpayers, such an auction program might provide limited support for financial institutions.

Some economists have argued that other means of injecting capital into the financial sector, such as purchases of preferred stock or capital injections balanced by equity warrants (i.e., options to claim an equity stake), might be a better strategy.<sup>28</sup> On October 8, 2008, the U.S. Treasury emphasized that EESA gives it authority to directly inject capital into firms, and is developing strategies to do so.<sup>29</sup>

Asset purchases and direct capital injections may have different implications for affected firms. Proceeds of asset purchases would presumably be counted as trading profits, which firms can use without restriction. Capital injections, however,

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<sup>25</sup> Leverage is the value of a firm’s assets relative to its debts. Deleveraging typically means selling assets or restructuring positions to reduce debt levels.

<sup>26</sup> Nikki Kahn “Away from Wall Street, Economists Question Basis of Paulson’s Plan,” *Washington Post*, Sept. 26, 2008.

<sup>27</sup> Testimony of Federal Reserve Chairman Ben Bernanke, in U.S. Congress, Senate Committee on Banking, Housing, and Urban Affairs, *Turmoil in U.S. Credit Markets: Recent Actions Regarding Government Sponsored Entities, Investment Banks and Other Financial Institutions*, 110<sup>th</sup> Congress, 2<sup>nd</sup> sess., Sept. 23, 2008.

<sup>28</sup> Nikki Kahn “Away from Wall Street, Economists Question Basis of Paulson’s Plan,” *Washington Post*, Sept. 26, 2008; Paul Krugman, “A \$700 Billion Slap in the Face,” *New York Times* blog, September 24, 2008.

<sup>29</sup> Secretary Paulson, in an Oct. 8, 2008, press statement, mentioned capital injections before he mentioned asset purchases. Henry Paulson, Secretary of the U.S. Treasury, Press release hp1189, Oct. 8, 2008; Edmund L. Andrews and Mark Landler, “U.S. May Take Ownership Stake in Banks,” *New York Times*, Oct. 8, 2008, p. A1.

generally provide firms with financial resources that are subject to restrictions. For example, capital injections might provide the U.S. Treasury with the right to demand management changes or equity warrants. Treasury purchases of preferred equity shares would probably commit firms to make regular, specified payments back to the Treasury. Proceeds from asset purchases, however, might be available for dividends, executive compensation, reducing debt, or other purposes.

## **Costs and Risks to Taxpayers**

Federal interventions to restore more normal conditions to financial markets would provide substantial benefits to those connected to the financial sector, either directly or indirectly. Of course, some may receive greater benefits than others from a resuscitation of the financial sector. A large-scale federal intervention could impose substantial costs and risks on taxpayers and federal program beneficiaries, although the scale and nature of those costs and risks may depend on how interventions are structured and administered.

If Treasury reverse auctions were conducted in a hard-nosed and efficient manner, direct costs to taxpayers and beneficiaries could be minimized. Furthermore, the federal government might well eventually sell assets for more than their purchase price. Such auctions, however, might supply little extra capital to the financial sector, and thus may fail to achieve a normalization of market conditions. Other measures, such as debt/equity swaps, purchases of preferred stock, or trading stock warrants for capital injections, might present the taxpayer with greater financial risks, but might also be better suited to addressing current financial conditions.

## **Auction Design**

Auctions in recent years have been used to address a wide range of policy issues. Auctions may capture higher revenues for governments and can allocate scarce resources more efficiently than traditional methods. Different policy issues, however, may require different types of auctions to achieve reasonable results. To provide a basis for evaluating the reverse auction mechanisms that may be used in TARP, this section discusses potential problems that may arise in using auctions, and how those problems can be minimized by careful design of auction mechanisms.

### **Single-Unit Auctions**

The most common auction mechanisms used to sell single items are the first-price sealed-bid auction, the English or ascending-price open-bid auction, and the Dutch or descending-price auction. In the first-price sealed-bid auction, bidders submit bids to the seller, who then selects the highest bid when selling an item or the lowest bid when buying an item. In the English or ascending-price auction, bidders announce prices that must exceed previous prices by a set amount. The last bidder to remain receives the object at her last announced price. In flower markets in Amsterdam and other trading centers in the Netherlands, bidders watch a price clock that starts at a high price and descends at a constant rate. The first bidder to press a

button buys the lot of flowers at the price indicated on the price clock.<sup>30</sup> Similar descending-price mechanisms are called Dutch auctions.<sup>31</sup>

**Why Are Treasury Auctions Called Dutch Auctions?** Treasury auctions for government securities, which use sealed-bid rules, are often described as “Dutch” auctions even though they do not use a descending-price mechanism as in flower auctions. Treasury securities auctions, however, are strategically equivalent to a particular descending-price (Dutch) auction. An auction mechanism is strategically equivalent to another auction mechanism when bidders’ incentives, the identity of the winner, and the final sale price are the same for both. Some auction rules, however, may be operationally easier to carry out. For example, bidders can mail in responses for a sealed-bid auction, while English auctions require bidders (or their agents) to gather in the same place.

A descending-price (Dutch) auction, under certain conditions, is strategically equivalent to a sealed-bid, first-price auction. A rational bidder calculates what the item for sale is worth to her.<sup>32</sup> If a bidder bid her value, however, she would make zero gain in a first-price auction because the price paid would exactly match the item’s value to her. A rational bidder therefore shades her bid downwards, trading off a larger gain (value minus price paid if she wins the auction) against the possibility that she would lose the item by lowering her bid.<sup>33</sup> The same calculation applies to both the sealed-bid, first-price auction and to the descending-price auction, so the two auctions may be considered strategically equivalent. An English (ascending-bid) is strategically equivalent to a second-price sealed-bid auction when bidders know what the object up for auction is worth to them.<sup>34</sup>

### **Imperfect Information: Common Values and the Winner’s Curse.**

When bidders have imperfect information about the value of an item, an English or ascending-bid auction may force better-informed bidders to reveal valuable information to less well informed bidders.<sup>35</sup> For example, the value of an antique

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<sup>30</sup> For details, see [\[http://www.flora.nl/en/AboutFloraHolland/Auctioning/Pages/default.aspx\]](http://www.flora.nl/en/AboutFloraHolland/Auctioning/Pages/default.aspx).

<sup>31</sup> Falling-price auctions were invented to avoid Napoleonic-era taxes on rising-price auctions.

<sup>32</sup> “Rational” here only means that a bidder has internally consistent preferences and is self-interested, so that the bidder can compute bids that best achieve her ends.

<sup>33</sup> Bidders here are assumed to keep the object and cannot resell it. In technical terms, values are private and independent. When values are linked or common, results can differ.

<sup>34</sup> When the value of objects are linked, such as when an auctioned object will be resold, some of these equivalences may not hold. For example, in an English auction among wholesalers, bidders may learn about an object’s resale value in retail markets through the bids of others. In that case, the equivalence of an English auction to a second-price sealed-bid auction would not hold.

<sup>35</sup> For example, in eBay auctions, informed bidders often use “sniping” strategies, in which bids are submitted seconds before the auction closes. This prevents less informed bidders from gleaning information from the bidding behavior of an informed bidder. For details, see (continued...)

may depend on who made it, how rare it is, and on who owned it before. A knowledgeable bidder, who may know more about an item's value, will attempt to use bidding strategies that conceal private information.

The value to bidders of some auctioned items may be linked. For example, the value one energy company places on an Offshore Continental Shelf (OCS) lease that would allow exploration and extraction of oil and gas will correlate to the value other energy companies place on the same lease. Different companies might have strengths and weaknesses in exploration and extraction techniques, so the value of the lease will not be the same to each company. Any company that got the lease, however, would sell oil and gas on the same world markets. Auctions that sell items whose value to bidders is correlated are called common-value auctions.

Bidders in a common-value auction may have different indications of an item's value. For example, many energy companies may have private information about the geological structures of areas covered by an OCS lease. A company holding an OCS lease in a nearby area that had run seismic tests might have more precise information about those geological structures, and thus would have a more precise estimate of the value of the OCS lease up for auction.

When bidders have imperfect signals of value, bidders with overly optimistic signals are likely to win auctions. Such bidders, however, will suffer losses because the true value of the item is less than their optimistic estimate. This is the winner's curse: such auction winners would have been better off losing. Sophisticated bidders in common-value auctions shade their bids downward to account for the winner's curse. Sophisticated auction designers release as much information as possible about an item's value so that revenues are not reduced by bidders who shade their bids downwards.<sup>36</sup> That is, bidders with better information bid more aggressively.

**Revenue Equivalence.** Certain auction mechanisms, as noted above, are functionally equivalent to certain other auctions run using different rules. The auctions discussed above (Dutch, English, first-price and second-price sealed bid) in theory deliver the same profits to bidders and the same revenues to sellers. Moreover, any (independent private value) auction that awards the item to the highest bidder and attracts the same pool of participants also in theory provides the same profits to bidders and the same revenues to sellers.<sup>37</sup> This result, known as the Revenue Equivalence Theorem, implies that to affect expected revenues requires changing who participates in an auction. For example, minimum bid rules can raise expected revenue, but may lower an auction's economic efficiency. Experimental

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<sup>35</sup> (...continued)  
[<http://www.esnipe.com>].

<sup>36</sup> John H. Kagel and Dan Levin, *Common Value Auctions and the Winner's Curse*, (Princeton, 2002).

<sup>37</sup> This result assumes that bidders are risk-neutral when values are uncertain. Auction revenues will not in general be equivalent when bidders are risk-averse. Elmar Wolfstetter, *Topics in Microeconomics: Industrial Organization, Auctions, and Incentives*, (Cambridge, 1999), pp. 186-188; For a more detailed discussion, see Paul Milgrom, *Putting Auction Theory to Work*, (Cambridge, 2004), ch. 3.

research has found that some expected auction equivalences hold, while others do not.<sup>38</sup> Experimental testing of revenue equivalence of auction mechanisms is an active research area.

## Multiple-Unit Auctions

Auctions in which multiple units are sold simultaneously are more complex than single-unit auctions. Computing optimal bidding strategies in multiple-unit auctions may be complex and difficult. Designing multiple-unit auctions so that government revenue is maximized and so that scarce resources are likely to be assigned to those who value them the most can be challenging. The federal government, however, has successfully used complex multi-unit auctions to allocate electromagnetic spectrum for wireless communication and related uses.

**Manipulation and Demand-Reduction Strategies.** Bidders in some situations can benefit by strategically withdrawing bids on some items in order to lower prices on other items.<sup>39</sup> The logic of this strategy is analogous to standard monopoly or oligopoly pricing models. A monopolist or a firm with some market power can raise profits by reducing output below the level that would prevail in a competitive market. Just as entry by new competitors can reduce the market power of existing firms, auction designs that encourage many bidders to participate can limit the effect of demand-reduction strategies.

**Complementarities.** Auctions that sell complementary goods can be extraordinarily complex.<sup>40</sup> Items are considered complements when groups of items are more valuable than the sum of individual items. For example, take-off rights from a specific airport that a government might auction off will be more valuable if the airline can obtain landing rights at a different airport. Federal Communications Commission auctions of electromagnetic spectrum involve complementarities because a license in one geographic area may be more valuable to a telecommunications firm that holds a license in an adjacent area.

Complementarities among troubled assets may complicate current reverse auctions implemented as part of TARP. For instance, some assets backed by sub-prime loans were often linked to collateralized default obligations (CDOs), which provided something akin to insurance to investors holding those assets. In that case, the asset backed by a pool of sub-prime loans and the associated CDO would share a strong complementarity, which could affect behavior in a reverse auction.

**Dutch Auctions with Multiple Units.** The U.S. Treasury, as noted above, uses a multi-unit Dutch auction mechanism to sell government securities to primary

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<sup>38</sup> David Lucking-Reiley, "Using Field Experiments to Test Equivalence Between Auction Formats: Magic on the Internet," *American Economic Review*, vol. 89, no. 5, pp. 1063-1080.

<sup>39</sup> Lawrence M. Ausubel and Peter Cramton, "Demand Reduction and Inefficiency in Multi-Unit Auctions," Univ. of Maryland working paper, July 27, 2002, available at [<http://www.cramton.umd.edu/papers1995-1999/98wp-demand-reduction.pdf>].

<sup>40</sup> Paul Milgrom, *Putting Auction Theory to Work*, (Cambridge, 2004), ch. 5.



dealers. The federal government and some corporations have used reverse Dutch auctions for some procurements. Treasury auction mechanisms can, under certain circumstances, be vulnerable to manipulations related to the demand-reduction strategies discussed above.<sup>41</sup> The U.S. Treasury and many entities that use auctions, however, have developed methods designed to detect or mitigate manipulation strategies.

**Uniform-Price vs. Individual Price Auctions.** In some multiple-unit auctions, such as Dutch auctions, all successful bidders pay the same price. Such auctions are called uniform-price auctions. In other auctions, such as first-price auctions, in which successful bidders pay their bids, different bidders pay different prices for identical items. Such auctions are often called discriminatory or multiple-price auctions. A 2002 International Monetary Fund report found that 10 of 18 advanced industrial countries surveyed used uniform-price auctions, and 15 of 18 used multiple-price auctions.<sup>42</sup> The U.S. Treasury claims that a uniform-price auction raises slightly more revenue than a multiple-price auction because it reduces winner's curse risks.<sup>43</sup>

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<sup>41</sup> Yongdong Shi and Xianfeng Jiang, "Manipulation in the Treasury Auction Market," working paper, July 26, 2004, available at [<http://ssrn.com/abstract=575441>].

<sup>42</sup> International Monetary Fund, "Guidelines for Public Debt Management," Aug. 4, 2003, Table 1.2, available at [<http://www.imf.org/external/pubs/ft/pdm/eng/guide/080403.htm>].

<sup>43</sup> Paul F. Malvey and Christine M. Archibald, *Uniform-Price Auctions: Update of the Treasury Experience*, U.S. Treasury Study, Oct. 1998.