Subsidizing Price Discovery

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Abstract

In the wake of the 2007-2008 financial crisis, a policy called the Public-Private Investment Program for Legacy Assets (PPIP) was introduced to promote price discovery and restore liquidity in the markets for a variety of asset-backed securities. Under this program, private investors who were interested in purchasing these securities from financially distressed banks were issued non-recourse loans from the FDIC in order to finance a fraction of the purchase price. This program effectively targets two frictions that are often cited as sources of market "freezes." First, given the put-option associated with non-recourse loans, this program helps mitigate the problem of *adverse selection*. Second, by allowing investors to leverage their investment up to a certain ratio, this program helps to relax liquidity constraints, thus easing the scope of *cash-in-the-market pricing*. In this paper, we construct an environment that incorporates both of these two frictions, and use it to formally analyze PPIP, paying particular attention to the optimal leverage ratio. We find that the relationship between information production and this leverage ratio is non-monotonic: few signals are produced when it is too small, while the information content of signals is diminished when it is too large. We characterize the optimal, *interior* leverage ratio.

*The views expressed here are those of the authors and do not necessarily reflect the views of the Federal Reserve Bank of Philadelphia or the Federal Reserve System.

1 Extended Abstract

The collapse of trade in the market for various types of asset-backed securities was a central feature of the financial crisis of 2007–2008. In particular, both prices and the volume of trade for assets such as collateralized debt obligations and credit default swaps fell precipitously, inflicting significant damage on the balance sheets of major financial institutions. Unable to sell these assets and raise new capital, these financial institutions could not make loans, which in turn made it difficult for consumers to buy new homes and cars, and for firms to finance new investment. This, in turn, led to a further decrease in asset prices and a decline in economic growth. Given the danger of this downward spiral, it is not surprising that one of the most important questions to emerge from this crisis is: what causes markets to "freeze" and what is the optimal form of intervention to "unfreeze" a market?

While there are potentially many reasons for a market to suddenly seize up, perhaps the two most popular explanations are *adverse selection* and *cash-in-the-market pricing*. The first of these explanations rests on the assumption that sellers have assets of heterogeneous quality, and they have private information about the quality of their asset. As is well known since (at least) Akerlof (1970), the combination of these two ingredients can produce a "lemons market," where prices fall until only the lowest quality assets are traded. The second explanation rests on the assumption that buyers need liquid assets to make a purchase, and that the supply of these assets is inelastic during a financial crisis (see, e.g., Allen and Gale, 2005). According to this theory, a sudden decrease in prices and trade is caused by a binding budget constraint: though buyers would like to purchase assets at the market price, they cannot acquire the liquidity to do so. This causes prices to fall further, damaging the balance sheets of other market participants, and thus reducing their ability to raise liquid funds.

Though adverse selection and cash-in-the-market pricing have been viewed (and studied) as two separate explanations for frozen markets, it is possible that the root of the recent financial crisis was, in fact, the *combination* of the two. After all, it's hard to imagine that there weren't "sophisticated" financial institutions with teams of analysts that could evaluate

the assets being sold by financial institution X and eliminate at least some of the asymmetric information. It's also hard to imagine that there weren't "deep pocket" financial institutions with enough liquid assets to capitalize on the under-pricing of financial institution X's assets. However, it is *not* hard to imagine that those financial institutions with the expertise to evaluate these assets were precisely the ones who were liquidity constrained, while those with sufficient liquid wealth to enter the market were precisely the institutions who were not sophisticated enough to differentiate high- from low-quality assets.

In this situation, the challenge that faces a benevolent government is to incentivize sophisticated financial institutions to produce information about the assets for sale, so that eventually financial institutions with deep pockets would be sufficiently informed to re-enter the market and restore liquidity. However, there are several reasons why these sophisticated institutions may be unwilling or unable to participate in the marketplace for these assets. First, even if they are able to acquire some information about the assets for sale, the residual uncertainty may still be sufficiently large to discourage them from trading; that is, the "lemons problem" may be present even for sophisticated financial institutions. Second, if there are positive externalities associated with restoring liquidity in these markets, the private benefit to sophisticated financial institutions from trading (and producing information) will typically be less than the social benefit, leading to a classic under-production of information. Last, even if these sophisticated financial institutions want to engage in trade, they may be unable if they are liquidity constrained.

In order to confront these frictions, the government introduced the Public-Private Investment Program for Legacy Assets (PPIP) in March of 2009 in an attempt to restore trade in the markets for a variety of asset-backed securities. Under this program, the FDIC would issue *non-recourse* loans to private investors (up to a maximum debt-to-equity ratio of 6-to-1) to assist in buying legacy assets from distressed financial institutions, while the Treasury would provide the investor with half of the equity funding.[1] For example, if a pool

[1] A "non-recourse" loan is one in which the asset purchased by the buyer serves as collateral; if the buyer defaults, the lender can seize this asset, but the buyer is not liable for any additional debts. The assets eligible for these non-recourse loans included non-agency residential mortgage-backed securities, commercial mortgage-backed securities, and other asset-backed securities.

of residential mortgages was purchased for a price of \$84, the private investor would put up \$ 6 of his own equity, the Treasury would contribute an additional \$ 6 in equity, and the FDIC would provide a non-recourse loan of \$ 72.[2] After the purchase, the private investor would share in half of the profits should the asset appreciate, while its down-side risk would be only the initial equity offering of \$ 6.

At its core, this program would seem to address both of the crucial underlying frictions outlined above. On the one hand, the ability to borrow over 90% of the purchase price clearly relaxes the borrowing constraints of private investors, thus easing the scope for cash-in-the-market pricing to cause fire sales. On the other hand, given the nature of non-recourse loans, this program also subsidizes a buyer's purchase through a *put option*: since the buyer can always default on his loan if the asset turns out to be low quality, in which case he only incurs a fraction of the total loss, the government is essentially insuring the investor's downside risk. However, to the best of our knowledge, there has been no theoretical analysis of this program's ability to achieve price discovery and restore trade in these markets, nor is there is an analytical framework to deduce, for example, the *optimal* leverage ratio that the government should specify.

In this paper, we construct an environment in which both adverse selection and cash-in-the-market pricing frictions are present, and use it to analyze the effects of a program modeled after the PPIP. The specific model we consider is as follows. There is a single asset for sale (to start) which may be high or low quality, and a set of "sophisticated" investors who receive a private, noisy signal about the quality of the asset. If they receive a good signal, they may be willing to trade at a high price, but there are liquidity constraints that may render them unable to pay such a price. On the other hand, there are outside investors who are not sophisticated, but they have deep pockets; in particular, the initial lemons problem for these buyers is sufficiently strong to keep them out of the market.

We introduce a government policy which offers buyers a non-recourse loan for a certain fraction of the purchase price of the asset; if they receive a low quality asset they will optimally choose to default on this loan, while they will pay it back if they receive a high

[2]This is the example provided by the Treasury department itself.

quality asset. We solve for equilibrium bidding strategies by (sophisticated) buyers, along with the subsequent expected transaction prices. We then suppose that there are *other* assets for sale. To the extent that the qualities of these assets are correlated with that of the initial asset, trade by sophisticated investors can generate valuable information for the outside investors. In particular, we identify conditions under which the policy intervention generates a sufficient amount of information to draw outside investors back into the market for these assets.

Our main substantive result is that the relationship between the maximum leverage ratio and the amount of information produced is non-monotonic. When the leverage ratio is very low, sophisticated investors will typically be unable to purchase the asset even when they receive very positive signals, and thus little information is produced on average. Alternatively, when the allowed leverage ratio is too high, so investors are essentially unconstrained, the "winner's curse" problem inherent in the market for lemons becomes exacerbated, which reduces the investors' incentive to take risks, thereby suppressing the generation of socially valuable trading information. The leverage ratio should be set to optimally balance these two opposing forces. This suggests that, even if one ignores the cost of this program, a larger subsidy (in the form of a higher allowable leverage ratio) does *not* necessarily lead to a more liquid market.