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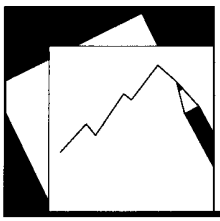

IMF Working Paper

Bank Resolution Costs, Depositor Preference, and Asset Encumbrance

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Monetary and Capital Markets

Bank Resolution Costs, Depositor Preference, and Asset Encumbrance

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Abstract

Depositor preference and collateralization of borrowing may reduce the cost of settling the conflicts among creditors that arises in case of resolution or bankruptcy. This net benefit, which may be capitalized into the value of the bank rather than affect creditors' expected returns, should result in lower overall funding costs and thus a lower probability of distress despite increasing encumbrance of the bank's balance sheet. The benefit is maximized when resolution is initiated early enough for preferred depositors to remain fully protected.

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"Bankruptcy is a situation in which existing claims are inconsistent" (Hart, 1995)

I. INTRODUCTION

The Modigliani-Miller theorem suggests that, leaving aside taxation effects, the composition of corporate financing has no substantive effects unless it influences the probability of bankruptcy or the costs of bankruptcy (Modigliani and Miller, 1963, Stieglitz, 1969). This result seems to be quite robust, and has spawned a huge literature on the possible asymmetries between borrowers and lenders that may affect the probability and costs of bankruptcy. Much of this literature focuses on a bank lending to enterprises, since the core of bank business relates to raising and allocating financing.

Here attention is directed toward a relatively neglected aspect, namely, the determinants and effects of possible conflict among claimants after the onset of bankruptcy or of bankruptcy-like procedures such as bank resolution. It is argued that this conflict may raise the costs of bankruptcy and thus, via the costs of funding, the probability of bankruptcy. These costs can be reduced by pre-assigning rights in case of bankruptcy through collateralization or the granting of preferred status to certain creditors, either by contract or by statute. However, these methods may generate their own costs and are limited in application, so some resolution costs are unavoidable. Conflict is especially likely to arise in the case of banks, which typically have multiple sources of financing, although the phenomena are not unique to that sector.

These issues are of immediate policy relevance in the aftermath of the global financial crisis, when the costs of dealing with problem banks has been highlighted; national and international authorities are debating how to increase the soundness of the financial system and economies more generally without harming growth and efficiency; and concerns persist about certain financial sector vulnerabilities. More specifically, many authorities are worried about possible excessive "asset encumbrance" of banks' balance sheets, that is, the possibility that such a high proportion of banks' assets are somehow pledged to various creditors that vulnerabilities are increased. At the same time, bank resolution procedures are being reformed with the hope of reducing costs and spill-overs. An element of this reform is the adaption of deposit guarantee schemes (DGS), including possibly the introduction of depositor preference; under depositor preference, depositors and thus, by subrogation, the DGS has a right to have claims paid out first when a bank is being resolved, and other claims such as those of unsecured creditors will be met only after those of the depositors have been satisfied.

The search for robust policies may be helped by the analysis presented here, which explicitly addresses the possibility of inconsistent, contested claims in the event of bankruptcy, and also allows for that possibility to be anticipated in the pricing and composition of funding and in the use of encumbrance. The analysis seeks to deepen understanding of why banking distress is so difficult to deal with, and of some indirect effects of possible policy responses. The argument is framed in terms of bank funding and the possible special status of depositors, but, *mutatis*

mutandis, it is relevant to financing mechanisms in general and the establishment of a ladder of rights of various creditors.

A single paper must necessarily concentrate on a few themes. Here the emphasis is on corporate and specifically bank solvency, rather than liquidity. A limited range of financial instruments and classes of claimants are considered. The legal and institutional interaction of depositor preference with the DGS is not directly addressed in the model.[2] Only a simple form of depositor preference is considered, and the complete ladder of prioritization is neglected.[3] For the purposes of this paper, "collateralized lending" can be taken to include a range of instruments, such as repurchase operations, covered bonds, and securitized loans where the issuer retains some exposure.[4] Likewise, "bankruptcy" includes not only formal bankruptcy proceedings and liquidation, but also less formal and less court-based procedures, such as loan restructurings and going-concern resolution. Time is compressed into one period when a bank obtains funding of various sorts, and a second period when its returns are distributed. This restriction precludes consideration of how various agents might react to funding and other surprises, but helps focus on solvency rather than liquidity concerns.

The next section provides background on related issues: the level of bankruptcy costs and their determinants; the functioning of depositor preference; and the current debate on asset encumbrance. Then a simple model of conflict among claimants is presented, which is applied in the following section in a model of the composition and cost of bank funding, where conflict costs are anticipated and, to an extent, preempted. The concluding section summarizes the findings, and points to issues for further research.

II. Background

A. Bankruptcy Costs

Bankruptcy proceedings and especially bank resolutions are often costly, complex, and time-consuming. Costs can be very high even if one ignores externalities such as spill-overs onto overall confidence in the financial system. The direct costs include those of the liquidator or administrator, and those of the authorities, such as the courts and, notably for financial institutions, the relevant government agencies. Indirect, but still closely connected, costs include those associated with the deterioration of assets and loss of earnings in the course of the

[2] An important practical issue is whether preferred status should be awarded to deposits in excess of the guarantee ceiling.

[3] Typically, for example, the receiver's administrative expenses and tax obligations are given highly preferred status. There may be different treatment also, for example, for residents and nonresidents. Yet, as will be documented, even where there are well-defined rules for allocating residual assets among creditor classes, bankruptcy costs can be high, in part because of the inconsistent of claims of creditors within each class.

[4] So-called "skin in the game."

proceedings, for example, because management has little time or incentive to oversee regular operations. For a bank, its borrowers' businesses may be affected by a lack of liquidity and financing for operations or new investment; loans to borrowers who cannot quickly find alternative sources of financing may become nonperforming, and preexisting problem loans may not be efficiently restructured. Costs may be borne by the bank's creditors, including its depositors, not only because their assets have become illiquid, but also because they have to engage in administrative proceedings, litigation, and lobbying efforts to establish the size and priority of their claims. These costs may compound one another: administrative delays will increase the cost of illiquidity and the deterioration of loan quality. Many of these costs are likely to be present, perhaps in diminished magnitude, in cases of less formal debt restructuring or going-concern rehabilitation.

The available empirical evidence confirms the connection between cost, complexity, and the time needed to complete proceedings. For nonfinancial firms in countries with relatively well-developed resolution frameworks, direct costs and loss of value totally 10 to 30 percent of gross assets seem to be typical, with larger losses occurring during economic downturns, and with a "tail" of very large losses (Warner, 1977; Ang, Chua and McConnell, 1982; Bris, Welch and Zhu , 2006; Schmieder and Schmieder, 2011). There may be some modest economies of scale, but larger firms are typically more complex, which characteristic adds substantially to costs and delay (Deis, Guffey and Moore, 1995). Evidence from U.S. bond defaults suggests that average losses tend to be about 60 percent of face value, with secured senior debt losing about 45 percent of its value in case of default (Altman and Kishore, 1996). In a typical high-income country, resolving the insolvency of a relatively straightforward business on average gives rise to direct costs of 9 percent of the estate, takes 1.7 years, and achieves a 70 percent recovery rate (World Bank, 2013); resolving insolvency is vastly more costly in other economies.

Cost levels observed in the resolution of banks are broadly similar or higher.[5] The experience of the U.S. Federal Deposit Insurance Corporation (FDIC) in resolving mostly smaller banks suggests that direct administrative costs typically amount to about 7 percent of pre-resolution assets, and losses on assets amount to about another 18 percent (Mason, 2000; Bennett and Unal, 2008). The FDIC has comprehensive legal powers and very extensive experience in bank resolutions, and macroeconomic conditions during the sample period were relatively benign, so its performance in this regard may be exceptionally strong.[6] These studies focus on the costs incurred by the FDIC; presumably due to lack of relevant data, they do not provide estimates of the costs borne by others.

[5] Banks typically have relatively few real assets that are easily realizable.

[6] The Korean Asset Management Corporation (KAMCO) purchased nonperforming loans (NPLs) with a face value of won 110 billion in the aftermath of the 1997 banking crisis. Its operating expenses amounted to about 20 percent of this stock, of which direct administrative and selling expenses made up 4.2 percentage points (He, 2006).

The experience in resolving Lehman Brothers is perhaps extreme but still illuminating. Between the start of bankruptcy proceedings in September 2008 and end–2012, the fees paid to the receivers and other administrators of the wind-up efforts reportedly amounted to US$2 billion (Sandler and Paulden, 2012), which is small relative to the nominal US$639 billion of assets with which Lehman Brothers entered bankruptcy.[7] [8] The average creditor is expected ultimately to receive 18 percent of the face value of claims in a process that is likely to take until 2016.

Much of the effort and complication of the Lehman Brothers case arose because of uncertainty over what was owed to whom. Reportedly, 67,000 payment demands for US$1.2 trillion were received. There were, for example, legal disputes pitting derivatives-holding claimants against bond-holding claimants, legal disputes over real estate investments, insolvency proceedings in 50 different jurisdictions, and 33,000 filings in the court docket.[9] Some legal issues thrown up by the case are still not settled at the time of writing (Fitzpatrick and Thomson, 2011). No estimate is available of the costs borne by the authorities in the United States and elsewhere, or of the administrative, legal and other costs borne by Lehman Brothers' creditors and other counterparties.[10] [11]

This evidence suggests that conflicts among claimants contribute importantly to bankruptcy costs and the length of the process. As emphasized by the FDIC (2011):

> In large, complex bankruptcy cases such as Lehman, a creditor may not receive any payment on his claim for a considerable period of time following the commencement of the bankruptcy case. One reason for this is that *it often takes a great deal of time to establish* both the size of the pool of assets available for general unsecured creditors and *the legitimate amounts of the claims held by such creditors. Litigation is typically needed to establish* both of *these numbers*, which can require years of discovery followed by trial, then more years of appeals and remands. (emphasis added)

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[7] In addition, several hundred employees were retained.

[8] Advising and administration in bankruptcy cases is a significant business (Ghorm, 2012).

[9] Lehman Brothers did not have deposit liabilities in the United States but its experience is still illustrative of the difficulty in establishing claims.

[10] Similar disputes affected the resolution of smaller and generally less complex financial institutions. In May 2012, Ally Financial Inc., which is mostly engaged in auto financing, agreed to give $750 million to its ResCap subsidiary to settle claims brought by bondholders and others (see http://www.bloomberg.com/news/2012-05-15/ally-pays-750-million-in-rescap-bankruptcy-to-avoid-the-noise-.html). At the time of writing, various creditors are reportedly still seeking compensation.

[11] Litigiousness is widespread. For example, the Irish government may be sued by various claimants over a planned bank debt restructuring deal ("Dublin faces lawsuit over IBRC liquidation," *Financial Times*, February 19, 2013).

The FDIC claims that losses could have been very much lower if Lehman Brothers had been resolved in the context of a resolution framework and under the aegis of an institution like the FDIC that is familiar with securing assets and sorting out claims.

Few academic studies have explored the implications of such conflicts among claimants for bankruptcy costs and optimal financial structures.[12] Welch (1997), in the paper perhaps mostly closely related to this one, suggests that banks would strongly contest priority in financial distress of a nonfinancial corporation if they were junior. The ex post stronger lobbyist/ litigant should be senior ex ante in order to reduce the total costs of an eventual contest. His model assumes that the composition of financing and the probability of bankruptcy are fixed, and thus cannot address stability concerns. Bris and Welch (2005) consider costly bargaining between the owners of a distressed firm and multiple creditors, who face a problem of free riding; the paper does not consider conflicts among creditors. Berglöf, Roland, and von Thadden (2010) emphasize the scope for strategic default and the borrower "playing off" one creditor against another; in their model, "having multiple creditors increases a firm's debt capacity while increasing its incentives to default strategically." Other papers that consider differences among creditors, but with an emphasis on informational asymmetries, include Winton (1995), Bolton and Scharfstein (1996), Longhofer and Santos (1999), and Bolton and Faure-Grimaud (2009).

B. Depositor Preference

Depositor preference is established by law in such countries as the United States, Australia, China, and Switzerland. The U.K. government has consulted on its introduction in that country, and in June 2013 the European Council agreed to introduce tiered depositor preference into the bank resolution framework for Europe.[13] Provisions for depositor preference differ mainly in the scope of the protection provided, and the connection to the DGS. In the United States, preference is awarded to all domestic depositors, and, through subrogation, the FDIC.[14] In Switzerland and Hong Kong, preferential treatment is limited to the insured amount. Under the Roman legal tradition, a detailed ladder of creditor status is established and cannot be abrogated by private side contracts. Some countries in effect have depositor preference as a matter of practice; in Israel, for example, depositors have always been protected despite the absence of a DGS and over the course of several banking crises in past decades.

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[12] Much of the literature on banking concentrates on matters related to asymmetric information, limited verification, monitoring costs, moral hazard, and adverse selection (Freixas and Rochet (2008) survey the main contributions). These approaches can explain rationing, collateralization, and many other observed phenomena, but they are not inconsistent with the approach taken here.

[13] See http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ecofin/137627.pdf and http://www.european-council.europa.eu/home-page/highlights/leaders-review-progress-in-strengthening-economic-and-monetary-union?lang=en .

[14] Marino and Bennett (1999) document the history of depositor preference in the United States.

Depositor preference is supported mainly by the argument that it enhances recoveries by depositors and the DGS; that was the express purpose of the introduction of depositor preference at the U.S. national level in 1993.[15] The U.K. government emphasized that, when the DGS is funded ex post by the banking system, depositor preference is meant to reduce contagion to other banks, which need to pay in levies to the DGS after a failure, or the liability that may be transferred to the government (U.K. Treasury, 2012). Non-insured depositors have less incentive to "run" from a perceived weak bank if they enjoy preferred status, while the non-preferred creditors have more incentive to devote resources to monitoring that bank and pressuring management to adopt a safer strategy (Financial Stability Board, 2011).[16]

In the context of a special bank resolution regime, and especially if "purchase and assumption" is a feasible resolution strategy, depositor preference with fairly wide coverage can be helpful: with such preference, a sound institution can assume deposits and purchase matching assets from the resolution agency without splitting deposits or facing challenge from other creditors whose interests may be hurt in the process.[17] When there is no depositor preference, the DGS is normally required to find a solution that ensures that other unsecured creditors are made no worse off than depositors, which can be difficult to achieve without delaying resolution and destroying more value.

Depositor preference has received criticism also (Hirschhorn and Zervos, 1990; Kaufman, 1997; Financial Stability Board, *op.cit*.). A common response is that depositor preference will either be undone by other creditors obtaining collateral and securitization, or result in a large increase in the cost of non-secured financing, which will undermine stability. The British Bankers' Association echoed such concerns in reaction to the government's proposals.[18] It is also possible that non-deposit creditors will "run" too readily if they face the prospect of depositors will receive preferential treatment in the event of resolution.[19]

The U.S. experience with depositor preference has been relatively intensely studied, in part because the FDIC—unlike, say, the authorities in Australia—has had to deal with the failure of numerous small and medium-sized banks. The overall finding is that the introduction of depositor preference had little systemic effect on resolution-related costs borne by the FDIC, or

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[15] Some individual states had had depositor protection already.

[16] The last point is related to the argument that providing a deposit guarantee, especially to large depositors and providers of wholesale bank funding, reduces the incentives for these agents to exercise market discipline (Demirgüç-Kunt and Huizinga, 2003 and Hovakimian, Kane, and Laeven. 2003).

[17] It is also then easier to net an individual's deposits against loans outstanding.

[18] Their comments are available at http://www.bba.org.uk/media/article/angela-knight-banking-reform-white-paper-needs-to-bring-certainty-in-key-ar .

[19] Marino and Bennett (1999) provide some relevant evidence from U.S. experience.

on bank funding costs; some studies suggest that costs were increased, but the impact of depositor preference is difficult to disentangle from other effects (Osterberg, 1996; Osterberg and Thornson, 1997 and 1999; Hirschhorn and Zervos, 1990). The absence of statistically significant or robust effects may in part reflect the circumstances of the FDIC, which, even before the introduction of depositor preference, was effective in maximizing recoveries based on its great expertise and status as a U.S. government agency. Data were apparently not available on the consequences of depositor protection on costs borne by others.

C. Asset Encumbrance

Potential concern over the encumbrance of banks' assets has increased in recent years in line with the increase in some European banks' reliance on collateralized refinancing from the European Central Bank (ECB); greater issuance of covered bonds rather than unsecured financing following the global financial crisis; possible regulatory measures such as the Basel III accord that favor secured funding in meeting liquidity or capitalization requirements; and the possible extension of preferred status to depositors and DGS (Bank of England, 2012; Barclays Capital, 2012; Juks, 2012).[20] Most of concerns mirror those expressed about depositor preference, but, as with depositor preference, there are counterbalancing arguments.

It is argued that the effect of encumbrance of reducing assets available to non-secured creditors (including the DGS) in event of resolution is itself worrisome. This argument seems to have been the main motivation behind the limits on banks' covered bond issuance in Canada and Australia (Office of the Superintendent of Financial Institutions, 2007, and Turner, 2011). Then, on the one hand, when encumbrance increases, unsecured creditors may demand a higher interest rate, which will make such financing less desirable. Yet, if prices for secured and unsecured financing can adjust and banks and their providers of funding can freely choose quantities, it does not seem problematic that unsecured creditors accept higher risk for higher return. Furthermore, bank stability depends on the overall cost of funding, not the cost of any one component; higher costs of unsecured funding may be more than offset by lower costs of secured funding. On the other hand, if the pricing of unsecured funding including insured deposits is not risk sensitive, then undue risk-shifting and moral hazard is possible. The issue here seems to be one of the pricing of deposit insurance and the distribution of gains and losses across sectors, rather than of overall welfare.

In a dynamic setting, asset encumbrance levels might be subject to self-fulfilling expectations and multiple equilibria (Haldane, 2012): if encumbrance is low, there will likely be ample residual assets in case of bankruptcy to share among claimants, so collateral is not very valuable. But if encumbrance is already high, a potential creditor must either demand an extremely high yield, or seek collateral for fear that loss given default for unsecured creditors

[20] Assets of non-banks are often highly encumbered: a household with a mortgage may in effect have encumbered all its assets except human capital. Insurance companies' assets are largely pledged to policy-holders.

will be very high. This argument has more force if creditors are very risk averse (as they may be especially if the borrowing bank is large and markets are stressed). However, if bankruptcy costs are strongly positively related to the level of residual assets, there is less incentives to obtain collateral when encumbrance is already high.

Asset encumbrance also affects banks' ability to obtain additional funding going forward, especially in difficult market conditions when non-secured funding may be tightly quantity constrained. A bank holding a large stock of eligible but unencumbered assets can perhaps obtain additional liquidity if needed, if necessary in the form of central bank refinancing, almost as if it held liquid assets initially. This argument suggests that holdings of unencumbered eligible assets should be included in measures of bank liquidity buffers and in related prudential requirements. However, the level of encumbrance may be more a symptom than a cause of a problem: if, say, the unsecured interbank market is disrupted and a bank uses its buffer of eligible assets to obtain funding, the bank thereby remains liquid. Its buffer is reduced and therefore it is more vulnerable to an additional shock, but the buffer needs to be usable to be of value.

III. Bankruptcy Costs and Claimants' Lobbying

We focus first on costly conflict resolution among creditors; the role of the borrowing bank—and collateralization—will be addressed later. It is assumed that the borrower has many creditors, as is plausible in the case of a bank with numerous depositors, bondholders, and interbank counterparts.

Suppose that the failed bank has residual assets of R, but total claims on the bank are S, $S > R$, made up of the claims s_i of $i = 1, \ldots, N$ creditors. Each claimant has a certain "lobbying" or "contest" technology $g_i(.)$, which captures its ability to use administrative procedures, litigation, lobbying, etc. to document and assert its claim. Specifically, suppose that the claimant can expend c_i on contending for its claim by various means, such that the greater is the claimant's effort relative to those of others and relative to its share of claims, the greater the proportion of the residual assets it will recover, but with diminishing marginal returns to effort (Hirshleifer, 1995). Thus, the net payoff for i is

$$g_i\left(\frac{c_i}{C}.\frac{S}{s_i}\right)\frac{s_i}{S}R - c_i,\ g_i' > 0,\ g_i'' < 0\ , \tag{1}$$

where $C = \sum_i c_i$. The claimant maximizes the net payoff by choosing c_i according to the first order condition for a maximum, where each claimant is small relative to the total and thus takes the total lobbying effort as fixed

$$g_i'\left(\frac{c_i}{C}.\frac{S}{s_i}\right)\frac{1}{C}R - 1 = 0\ ,$$

or

$$g_i'\left(\frac{c_i}{C}.\frac{S}{s_i}\right) = \frac{C}{R}. \tag{2}$$

Given that $g_i'' < 0$, the plausible result is obtained that the greater the residual assets, the more lobbying is undertaken; it is worth expending more effort when there is more to fight over.[21] Also, the more aggregate contending takes place, the more each claimant will contend.

In the symmetrical case, all claimants have the same technology and claims, so $c_i/C = s_i/S = 1/N$ and subscript *i* can be dropped.[22] Also, it will be assumed that $g(1) = 1$, so that everyone gets the same payoff if everyone expends the same amount on asserting their (equal) individual claims. Then total expenditure on contesting is proportional to the total residual assets:

$$C = g'(1)R\,, \tag{3}$$

and each claimant receives

$$\frac{R}{N}(g(1) - g'(1)) = \frac{R}{N}(1 - g'(1))\,. \tag{4}$$

Thus, even in the symmetrical case with "Nash" behavior, the contest over claims destroys some value.

The costliness of the bank resolution would be greater, if claimants' actions generated negative externalities that do not affect their individual marginal costs. For example, if one claimant takes legal action, others too (including the receiver) may have to take costly legal counsel, and moreover the resolution process may be further delayed, during which time the underlying assets may deteriorate further. The claimant taking the action does not normally care about the lobbying costs of others, and bears only a small part of the cost of delaying resolution. However, it is possible that private costs exceed social costs, insofar as the lobbying efforts transfer wealth from the claimants to their various agents and consultants.

It is straightforward to extend this contest over claims to the time dimension, explaining why bankruptcy proceedings often have the flavor of a drawn-out "war of attrition" (as in Alesina and Drazen, 1991, and surveyed in Drazen, 2000): lobbying and contesting efforts are delivered

[21] However, if claimants are risk averse, those who have most of their assets tied up in the failed bank may be willing to fight hardest when the residual assets are small. A form of moral hazard might prompt some to undertake a "gamble for resurrection." One could also envisage contest technology such that the contest is most intense at an intermediate level of residual assets; when there are ample residual assets, everyone might easily accept a small "haircut," and when no assets remain, the contest ends. The main results of the model would go through under such an alternative.

[22] The strongly asymmetric case is addressed in depth in Welch (1997). A bank may plausibly have one or a few major creditors, one of which might be the central bank or the deposit guarantee fund, but also many smaller creditors. Prudential regulations normally require banks to diversify assets and liabilities.

at a certain rate, and also costs accumulate over time as the residual assets deteriorate. Each claimant has an incentive to endure the losses in the hope that others will drop out first and leave a disproportionate share to the survivor.

IV. Optimal Collateralization and Asset Encumbrance

The model of endogenous bankruptcy costs can now be applied to the determination of the pricing of various funding instruments, and to the choice of the composition of funding. For the sake of clarity, the framework is kept as simple as possible; asymmetric information and moral hazard are ignored; there is no strategic, voluntary default by the bank; and intertemporal issues are assumed away.

A. Depositor Preference and Funding Costs

A relatively simple case arises where depositors enjoy their preferred status as a matter of law, and no resources need to be expended to establish this position.[23] The only alternative available to the bank is market-based funding without collateral; depositor preference is the only form of asset encumbrance.

Consider a bank with risky investments and a variety of funding sources. For now, all agents are considered to be price takers and risk neutral. The return on the bank's investment is $q+r$, where q is a fixed parameter and r is a random variable, which, for convenience, is taken to be uniformly distributed over the unit interval.[24] [25] The bank's total balance sheet size is normalized to unity, and its funding consists of d in deposits and $(1-d)$ in market-based financing. The deposits pay (one plus) interest i_d and enjoy preferred credit status, but the supply is fixed. For now, the important assumption is made that the bank always has enough assets to pay off the preferred depositors in full, that is, that $q–i_d d > 0$.[26] The remaining financing earns (one plus) interest i_m so long as the bank is solvent but is the residual claimant in case of default. The bank's operating profits are thus

$$\mathrm{q} + \mathrm{r} - \mathrm{i_d d} - \mathrm{i_m}(1 - \mathrm{d}).$$

[23] This case corresponds to how resolution through purchase and assumption is meant to work: should intervention be necessary, the DGS quickly sells preferred deposits and corresponding assets to a sound bank, and any contest over residual assets is left to other claimants.

[24] The model is broadly similar to that used in Hardy and Tieman (2008), adapted to focus on the issues of concern here.

[25] Use of a more general distribution function would leave results qualitatively unchanged.

[26] The book value of the assets encumbered by the obligation to preferred depositors may exceed the value of those deposits if realizing the assets in case of resolution is costly; in effect, a "haircut" needs to be applied. If it costs, say, one tenth of an asset's value to realize it and use it to meet a depositor's claim, then the committed assets amount to 10/9-th of the deposits.

For r below some break-even point, the bank becomes insolvent and is resolved. That break-even return r_b is given by

$$r_b = -\big(q - i_d d - i_m(1-d)\big)\,. \tag{5}$$

The interest rate i_m on market-based funding must be sufficient to ensure that investors are indifferent between lending to the bank and investing in a safe asset that yields i_s, that is, their reservation safe return. However, there are bankruptcy costs that depend on magnitude of residual assets, as suggested by the threat of conflict among creditors. Yet, the depositors do not need to enter into any conflict, because their priority status is conferred by statute. For tractability, the conflict-related bankruptcy costs are assumed to depend linearly on the assets remaining to be fought over in case of bankruptcy: [27]

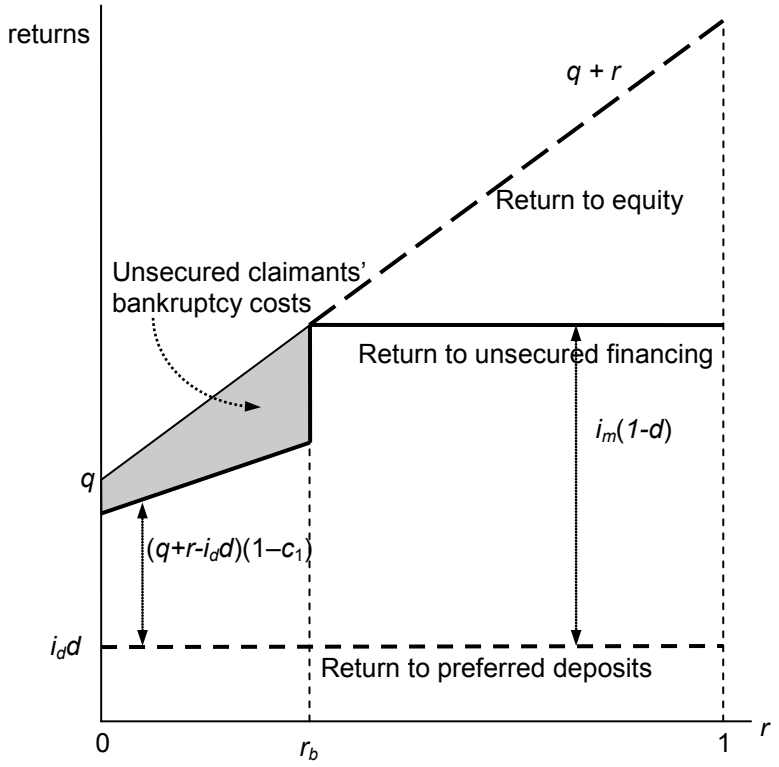
$$c_1(q + r - i_d d)\,.$$

It is assumed that $c_1 \in (0,1)$; if $c_1 > 1$, the net payoff $(1 - c_1)(q + r - i_d d)$ would be negative and presumably no contest would take place.

The structure of payoffs for different groups is illustrated below: the depositors with preferred status always receive $i_d d$, and equity owners receive the residual profits so long as bank returns are above the break-even point r_b . Unsecured financing is compensated at a fixed rate higher than the relevant risk-free rate so long as the bank is solvent, but becomes the residual claim when returns are low. Furthermore, the presence of variable bankruptcy costs reduces returns and creates a discontinuity in the relationship between the realization of r and what unsecured creditors receive. The shaded area in the figure represents expected bankruptcy costs.

[27] One could allow a fixed cost to enter the specification of bankruptcy costs, which would creates a range of low values of r, wherein unsecured claimants give up trying to recover assets because costs exceed any possible gain. Introducing this feature would not contribute to the main themes of this paper and add considerable algebraic complexity, because the range where lobbying is abandoned would depend on several of the other variables. Specifically, suppose that fixed costs are c_0. Then lobbying is no longer profitable when r falls below $c_0/(1 - c_1) - q + i_d d$.

Figure 1. Pay-Off Structure with Safe Deposits



The no-arbitrage condition determining the market rate of interest on unsecured funding is

$$i_s(1-d) = \int_{r_b}^{1} i_m(1-d)\mathrm{d}r + \int_{0}^{r_b}\big(q + r - i_d d - c_1(q + r - i_d d)\big)\mathrm{d}r \qquad (6)$$

or

$$i_s(1-d) = (1-r_b)i_m(1-d) + r_b(1-c_1)(q - i_d d) + \tfrac{1}{2}(1-c_1){r_b}^2 \,. \qquad (6')$$

Substituting i_m from this expression back into (5), the definition of r_b, yields a quadratic equation, which can be solved as[28]

[28] Note that, by assumption, $\big(q - i_d d - i_s(1-d)\big) < 0$; otherwise bankruptcy would not be possible. Formally there exists an alternative solution to the quadratic equation with a positive sign before the square root term. For some parameter values, that solution falls in the permissible range of [0, 1]. However, it is unstable in that, for example, an increase in q (c_0) would then increase (decrease) the probability of bankruptcy. Were equation (6) modified to incorporate risk aversion or a more general probability density function, multiple stable equilibria could be obtained for some parameter combinations and functional forms.

$$r_b = \frac{\left(1-c_1(q-i_d d)\right)-\sqrt{\left(1-c_1(q-i_d d)\right)^2+2(1+c_1)(q-i_d d-i_s(1-d))}}{1+c_1}. \quad (7)$$

The comparative statics confirm intuitions about certain relationships. For example, a higher minimum rate of return q lowers the break-even return r_b:

$$\frac{\partial r_b}{\partial q} = -\frac{1}{\sqrt{A}}(1 - c_1 r_b) < 0, \quad (8)$$

noting that $r_b \in [0,1]$, and where

$$A \equiv \left(1 - c_1(q - i_d d)\right)^2 + 2(1 + c_1)\left(q - i_d d - i_s(1 - d)\right). \quad (9)$$

The relationship between r_b and c_1, which is the marginal contribution of residual assets to bankruptcy costs, is positive: higher c_1 increases the level of bankruptcy costs for a given r_b, which can feed back into higher probability of bankruptcy through the level of i_m, the interest rate on market-based funding. Specifically,

$$\frac{\partial r_b}{\partial c_1} = \frac{\left((1+c_1)(q-i_d d)-\sqrt{A}\right)r_b-\left(q-i_d d-i_s(1-d)\right)}{(1+c_1)\sqrt{A}}$$

$$= \frac{1}{\sqrt{A}}\left(q - i_d d + \frac{1}{2}r_b\right)r_b > 0. \quad (10)$$

A higher proportion of financing in the form of preferred deposits can, in general, have an ambiguous effect, but will reduce r_b if reservation returns are similar across investor classes:

$$\frac{\partial r_b}{\partial d} = \frac{1}{\sqrt{A}}(i_d - i_s - c_1 i_d r_b). \quad (11)$$

The last term in brackets captures the value of additional preferred deposit funding in reducing bankruptcy costs: bankruptcy costs depend on the volume of residual assets that non-preferred creditors have to fight over. Hence, more preferred deposits reduce bankruptcy costs; there is a net benefit and not merely a redistribution of gains and losses. The difference in interest rates ($i_d - i_s$) has a direct effect on the break-even return: more deposit funding reduces the chance of bankruptcy if it is cheaper (on a risk-adjusted basis) than market funding. This interest rate differential can be interpreted as representing market segmentation and differences in tax, regulatory, and ratings treatment of deposits versus other funding sources. If there is no market segmentation, so $i_d = i_s$, or if $i_d < i_s$ (perhaps depositors have few alternative safe investments), then certainly $\partial r_b/\partial d < 0$; more preferred creditor-status funding reduces the probability of bankruptcy because expected bankruptcy costs are reduced, which effect reduces overall funding costs.

It can readily be shown that, in general, $\partial^2 r_b/\partial d\partial q > 0$, which implies that the break-even rate of return becomes less sensitive to the level of q, the higher is the level of d.[29] The level of q, which is the bank's minimum possible revenue, can be thought of as an indicator of market conditions; q would be low during a recession or in a structurally weak banking system. Since the probability of bankruptcy is greater in the face of such difficult market conditions, having more preferred deposit funding is then more likely to "pay off" in terms of lower realized bankruptcy costs; hence, market funding is significantly less expensive when d is higher, which advantage feeds back into a lower probability of bankruptcy.

The value of the bank to its owners is

$$V = \int_{r_b}^{1}\big(q + r - i_d d - i_m(1-d)\big)\mathrm{d}r = \frac{1}{2}(1-r_b)^2 \qquad (12)$$

where use is made of the definition of r_b (equation (5)). Therefore, the value of the bank is monotonically negatively related to the break-even yield and thus to the probability of bankruptcy. By construction, the depositors receive a fixed interest rate in all states, and other creditors receive a market yield such that the overall expected return equals their reservation return i_s, so neither group is affected by a change in the probability of default or bankruptcy costs. Hence, social welfare W is

$$W = V + i_d d + i_s(1-d)\,, \qquad (13)$$

which is likewise inversely related to the probability of bank failure. Owners and thus society benefit when there are higher base returns and lower bankruptcy costs. Assuming that depositors do not insist on a higher reservation yield than do providers of market funding, depositor preference generates a reduction in the break-even return and thus a net welfare gain. The recipients of this benefit are the owners of the bank, who enjoy lower funding costs and thus higher profits in the good states. Lower expected conflict costs from stronger depositor protection are capitalized into the value of the bank, and they are enjoyed in the form of higher profits in non-bankruptcy states. More formally, from (12) and (13),[30]

$$\begin{aligned}\frac{\partial W}{\partial d} &= \frac{\partial V}{\partial d} + i_d - i_s = -(1-r_b)\frac{\partial r_b}{\partial d} + i_d - i_s \\ &= -\frac{(1-r_b)}{\sqrt{A}}(i_d - i_s - c_1 i_d r_b) + i_d - i_s \\ &= \left(1 - \frac{(1-r_b)}{\sqrt{A}}\right)(i_d - i_s) + \frac{(1-r_b)}{\sqrt{A}} c_1 i_d r_b\,. \end{aligned} \qquad (14)$$

[29] The result may not hold if $i_d >> i_s$.

[30] Using equation (7), it is easy to show that $(1-\mathrm{r_b})/\sqrt{\mathrm{A}} > 1$.

In a more elaborate model one could incorporate some monopoly rents, the distribution of which may depend on funding composition, but it is difficult to have an intuition on the direction of effects. If suppliers of market funding are risk averse, there may be some shift in expected returns when *d* changes, but largely to offset changes in risk, leaving their expected utility unchanged (at least on the margin).

It has been assumed that funding costs fully reflect risks, but possibly this assumption does not hold because some investors are ill-informed or for other reasons.[31] At the extreme, one can assume that all interest rates on funding are invariant. Then equations (6) and hence (13) no longer hold, and the welfare function becomes

$$W = V + i_d d + \int_{r_b}^{1} i_m(1-d)dr + \int_{0}^{r_b}\big(q + r - i_d d - c_1(q + r - i_d d)\big)\mathrm{d}r$$

$$= V + i_d d + (1-r_b)i_m(1-d) + r_b(1-c_1)(q - i_d d) + \tfrac{1}{2}(1-c_1){r_b}^2. \qquad (15)$$

In this case

$$\frac{\partial W}{\partial d} = i_d - (1-r_b)i_m - r_b(1-c_1)i_d +$$

$$(-(1-r_b) - i_m(1-d) + (1-c_1)(q - i_d d) + (1-c_1)r_b)\frac{\partial r_b}{\partial d}$$

$$= -c_1(1-d)i_m(i_d - i_m) + c_1 i_d r_b \qquad (16)$$

since, under these assumptions, $\frac{\partial r_b}{\partial d} = i_d - i_m$, and using the definition (5). Total bankruptcy costs are still reduced because, on the one hand, some claimants are removed from the conflict, and on the other, fewer residual assets remain for others to contest and so they expend fewer resources on lobbying. There is no longer a gain from a reduced probability of default except insofar as i_d is less than i_m, which are assumed to be fixed. The benefit accrues in part to owners, in part to those who have gained preferred status (without lowering the interest rate they receive), and also in part to the remaining non-preferred creditors (who engage in less costly lobbying in case of default).

B. Funding Costs with Collateralization

Besides the preferred status of depositors conferred by statute, a bank may create preferred creditors by offering collateral, backed by sufficiently strong legal protections that this collateral can be seized without contest in the event that the bank fails. However, not all assets are readily suited to be used as collateral. Some, such as investment-grade securities held with a depository,

[31] There is formal evidence that deposit insurance reduces interest rates on deposits (Demirgüç-Kunt and Huizinga, 2003).

can be used immediately as "eligible assets." Others may have to be somehow "packaged," for example, by being included in the pool of assets underlying a covered bond or other security.[32] Some assets of a going-concern bank, such as deferred tax assets and goodwill, may not be usable as collateral in case of default, because they become valueless on a gone-concern basis.

Suppose then that the bank can obtain a share of financing *e* by offering collateral, for a yield of i_e, and with costs of collateralization $f(e), f' > 0, f'' > 0$. For now it is assumed that the collateral is of sufficient quality, and the quantity of collateralized borrowing is sufficiently small, that neither the lenders that hold collateral, nor preferred depositors face any risk.

The bank owners choose *e* to maximize

$$V = \int_{r_b}^{1} (q + r - i_d d - i_e e - i_m(1 - d - e) - f(e))\mathrm{d}r\,, \tag{17}$$

where now the break-even return is

$$r_b = -(q - i_d d - i_e e - i_m(1 - d - e) - f(e)). \tag{18}$$

Hence, again, $V = \frac{1}{2}(1 - r_b)^2$. It can readily be established, similarly to as before, that

$$r_b = \left(\frac{1}{1+c_1}\right)\left(\left(1 - c_1(q - i_d d - i_e e - f(e))\right) - \sqrt{\left(1 - c_1(q - i_d d - i_e e - f(e))\right)^2 + 2(1 + c_1)(q - i_d d - i_e e - i_s(1 - d - e) - f(e))}\right). \tag{19}$$

Then, the first order conditions for a maximum is

$$\frac{\mathrm{d}V}{\mathrm{d}e} = -(1 - r_b)\frac{\partial r_b}{\partial e} = 0. \tag{20}$$

According to equation (20), collateralized borrowing is chosen up to the point where it has no marginal effect on the break-even rate of return and thus on the probability of bankruptcy. Equation (20) can, using (19) and after substitution, be rearranged and simplified to show that the bank chooses *e* according to

$$f' = \frac{(1+c_1)(i_s - i_e) + c_1 i_e r_b}{1 + c_1(1 - r_b)}. \tag{21}$$

[32] One effect of the availability of collateralization or securitization is to increase banks' desire to hold assets that are relatively easy to package in this way, and reduce their willingness to provide other forms of financing, including perhaps loans to small and medium enterprises. Here it is assumed that each bank faces infinitely elastic demand for loans of different sorts.

The term in $(i_s - i_e)$ captures any (dis)advantage from collateralized borrowing due to market segmentation, perhaps because of differences in taxation or regulation; if certain classes of investors have different reservation safe rates or return, the bank should favor financing those with low-yield alternatives. More distinctive, however, is the term $c_1 i_e r_b$, which captures the benefits of using collateralization in reducing bankruptcy costs: those holding "bankruptcy remote" assets do not have to enter the contest for residual assets, and the remaining claimants have less to fight over. Thus, collateralized borrowing has an effect on bankruptcy costs similar to that of a law granting depositors (and thus the DGS) preferred status, but adds the costs of making assets eligible for use as collateral. Uncollateralized, non-preferred credits earn higher returns in good states and worse returns in bad, but collateralization yields a net benefit by reducing conflict costs.

Total differentiation can be applied to equation (21) to yield

$$\frac{\mathrm{d}e}{\mathrm{d}d} = \frac{c_1(f' + i_e)}{f'\left(1 + c_1(1 + r_b)\right)} \frac{\partial r_b}{\partial d}. \tag{22}$$

The first right-hand-side term is always positive; the numerator captures the direct effect on residual assets and thus on bankruptcy costs of a change in r_b associated with a change in e, and the denominator captures the effect working through higher marginal costs of collateralization. It has already been established from equation (11) that $\partial r_b / \partial d < 0$, unless depositors' reservation interest rate is markedly higher than that of market lenders. If that is the case, the bank has less incentive to offer collateral to its creditors; preferred deposits and collateralized borrowing are substitutes as far as the bank is concerned.

C. Limits of Preferred Depositor Status and Collateralized Borrowing

An important assumption has been that residual assets are always enough to meet claims of preferred depositors or collateralized loans. The cost of conflict over residual claims, and the connected legal uncertainty, may increase if secured creditors are unable to realize their claims fully, rapidly, and at minimal administrative and legal cost.[33] As affirmed by Hart (1995), bankruptcy always involves some conflict among claimants, and contracts are inevitably incomplete, so pre-assignment cannot cover all cases and some costs are unavoidable. Yet, the analysis may still be relevant.

The overall benefits of encumbering some assets may be reduced, insofar as the secured claims cease to be riskless. The amount of assets that can be given "bankruptcy remoteness" is

[33] Even if the failed bank has ample residual assets, legal uncertainty can arise if legislation is not well formulated or is absent. The advantage of a very strong legal framework is illustrated by the case of covered bonds, the bankruptcy remoteness of which is supported in many countries by dedicated legislation and legal precedent, such that covered bond holders have an uncontestable claim on both the issuing bank and the underlying assets. Nominal losses on German Pfandbrief are virtually unknown in the 250 years since their introduction.

inherently limited. In terms of the model including voluntary collateralization, full bankruptcy remoteness is achieved if preferred deposits and collateralized loans (with interest and after costs) need to make up a share of assets less than the minimum return on the portfolio:

$$q > i_d d + i_e e + f(e).$$

Since this funding may be relatively long-term, the parameter q needs to represent a floor under possible returns at any point in the cycle, that is, an extreme value.[34] Experience from the recent global crisis, and experience from past banking crises from across the world, suggests that this floor may in some cases be surprisingly low, depending on the bank's business model, the macroeconomic circumstances, and the regulatory and supervisory framework.

One implication of this discussion is that the supervisory authorities should take the composition of funding into account when deciding on intervention measures.[35] If remedial action is mandated at an early stage, the interests of secured creditors, including depositors, may be unaffected, and therefore they are likely to be supportive; lobbying and other forms of contest will be restricted to other creditors (and borrowers and equity holders). Also, the scope for collateralization will be expanded if prompt intervention precludes the occurrence of such severe losses that collateralized claims cannot be met.[36]

Suppose instead that, if the bank's returns are very bad, then preferred depositors and creditors with collateral have to engage in contending *pari passu* with other creditors (the condition is that, when returns are realized, $q + r < i_d d + i_e e - f(e)$. There will be many more contestants, albeit for relatively few residual assets, and perhaps large bankruptcy costs.[37] But there is still a range of returns where the bank needs to be restructured and only the non-secured claims have to enter the contest (when $i_d d + i_e e + i_m(1 - d - e) - f(e) > q + r > i_d d + i_e e - f(e)$), so bankruptcy costs are reduced by the institution of collateralization. Ex ante, there is still a net gain.

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[34] The "haircut" on collateral needed to ensure that collateralized loans can always be repaid is $\left(1 - q - i_d d - f(e)\right)$.

[35] The U.S. "prompt corrective action" framework is based mainly on capitalization levels.

[36] Early intervention may increase the parameter q.

[37] The "conflict technology" may be complex; possibly, a small number of claimants, each with a relatively large share of claims, might very fight intensely, or it could be that the DGS can internalize conflict and allocate residual claims relatively easily, perhaps assisted by financing from government and the ability to impose higher premia on surviving banks.

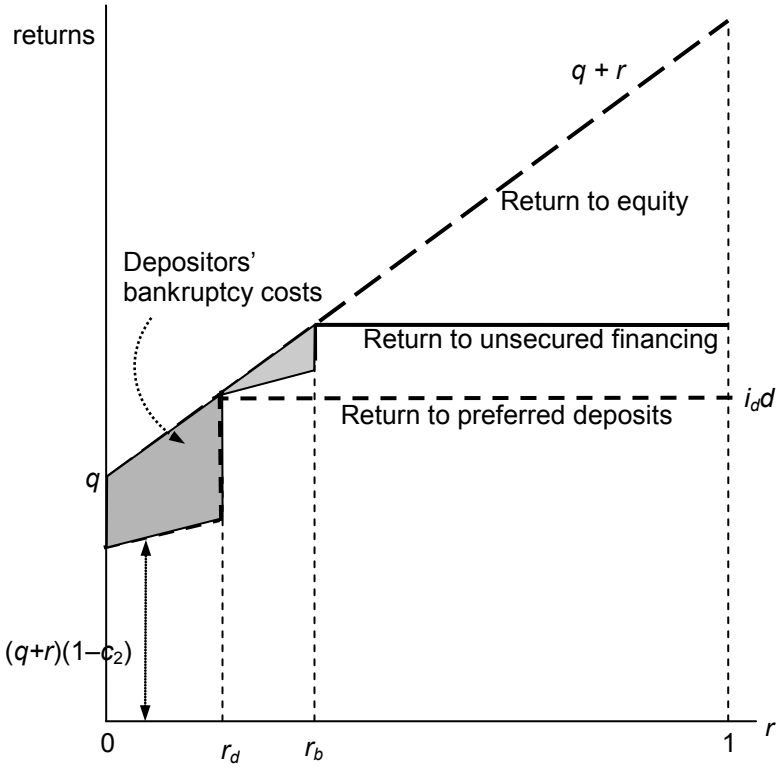
The net gain may be greater if, as may be plausible in some legal systems, the non-secured claimants drop out when secured claims are not met in full. Then the conflict will arise among the holders of collateral and preferred depositors (or their successor, the DGS). In consequence, total expenditure on lobbying/contending could be lower than if all claimants were involved. There will, however, be an effect on the cost of unsecured borrowing, as those claimants will anticipate the bankruptcy costs incurred by preferred depositors.

To refine these points, consider a case with depositor preference but—for the sake of simplicity—no collateralization, and where there may not be sufficient residual assets to meet the claims of depositors. Thus, there is some non-negative rate of return

$$r_d = -q + i_d d, \tag{23}$$

below which claims of preferred depositors cannot be met in full and the depositors engage in lobbying/contending among themselves, giving rise to marginal bankruptcy costs of c_2; other claimants drop out. The modified pay-off structure is illustrated below.

Figure 2. Pay-Off Structure with Risky Deposits



Again for the sake of simplicity, it is assumed that depositors are risk neutral and have the same reservation interest rate i_s as do other claimants. The non-arbitrage conditions (analogous to equation (6)) for depositors and unsecured financing are, respectively,

$$i_s d = \int_{r_d}^{1} i_d \mathrm{d}r + \int_{0}^{r_d} \big(q + r) - c_2(q + r)\big)\mathrm{d}r \tag{24}$$

and

$$i_s(1 - d) = \int_{r_b}^{1} i_m(1 - d)\mathrm{d}r + \int_{r_d}^{r_b} \big(q + r - i_d d - c_1(q + r - i_d d)\big)\mathrm{d}r. \tag{25}$$

Using (23) and (24), it is easy to establish that the break-even yield for depositors is

$$r_d = \frac{1-c_2 q-\sqrt{(1-c_2 q)^2+2(1+c_2)(q-i_s d)}}{1+c_2}, \tag{26}$$

which is analogous to (7) and allows one to show that

$$\frac{\partial r_d}{\partial d} = \frac{i_s}{\sqrt{(1-c_2 q)^2+2(1+c_2)(q-i_s d)}} > 0. \tag{27}$$

Unsurprisingly, increasing the quantity of deposits increases the probability that residual assets will be insufficient to meet all these claims.

As to the break-even rate r_b, below which unsecured claims cannot be met in full, one can derive using (6), (23), (24), and (25) and the implicit function theorem that

$$\frac{\mathrm{d}r_b}{\mathrm{d}d} = \frac{-i_s}{\sqrt{(1-c_1 r_d)^2+2(1+c_1)(r_d-i_s(1-d))}} + \frac{\partial r_b}{\partial r_d}\frac{\partial r_d}{\partial d} \tag{28}$$

$$= \frac{i_s\big(c_2 i_d d-c_1 i_m(1-d)\big)}{\sqrt{\big(1-c_1(q-i_d d)\big)^2+2(1+c_1)\Big(q-i_d d-i_s(1-d)+\frac{1}{2}r_d^2(1-c_1)\Big)}\sqrt{(1-c_2 q)^2+2(1+c_2)(q-i_s d)}} \tag{28′}$$

the sign of which is ambiguous. The first term in parentheses in the numerator of (28′) captures the effect of bankruptcy costs incurred by preferred depositors when they are affected, but it is offset by the second term, which captures the effect of higher d to reduce bankruptcy costs incurred by unsecured creditors. If the former effect predominates, that is, when the share of preferred deposits is high or their marginal bankruptcy costs are elevated while bankruptcy remoteness cannot be assured, extending preferred status is detrimental to stability.

The optimal choice of d—which minimizes the probability of failure and expected bankruptcy costs—is given implicitly by

$$\frac{c_1 i_m}{c_2 i_d+c_1 i_m}.$$

Intuitively, when unsecured creditors give rise to high bankruptcy costs, it is best to grant preferred status to a relatively large share of possible claimants, and vice versa when preferred depositors may give rise to high costs should they be provoked into lobbying/contending.

V. Conclusions and Next Steps

Bank resolution, like bankruptcy and debt restructuring generally, inherently involves a great deal of negotiation and uncertainty; these are situations in which contracts are far from complete. Experience from many sectors, most notably the financial sector, suggest that the attendant conflicts among claimants can add substantially to costs and delays in resolution.

The prospective costs attached to such conflicts, which should depend on the magnitude of residual assets, can influence the optimal composition and conditions of financing, and, in particular, motivate the introduction of provisions that make some claims "bankruptcy remote." Bankruptcy remoteness can be achieved through statute and policy, as when depositors enjoy preferred status as a matter of law, or through private agreements, as when banks issue covered bonds backed by a pool of high-quality assets. The asset encumbrance that results from either mechanism can be desirable insofar as it reduces bankruptcy costs, and, through lower overall funding costs, lowers the probability of distress. This substantive effect from the composition of financing is not due to asymmetric information or related mechanisms, but to the gain from containing conflict resolution costs.

In the first instance, the gain should be capitalized into the value of the bank, which enjoys an overall reduction in funding costs. The extension of preferred status to some creditors (including a DGS) need not make them better off. Nor need non-secured borrowers be disadvantaged in expectational terms: they earn more when the bank survives but bear larger net losses in case of resolution (though they spend less contending for their claims). Granting preferred status to (some) depositors need not provoke increased collateralization of other credits: from the point of view of the borrowing bank, collateralization and statutory depositor preference are near substitutes, with the difference that collateralization can be increased at the bank's initiative, albeit at an increasing marginal cost. However, the achievement of full benefits and their distribution will depend on pricing being risk-sensitive; the probability of distress might not be reduced if those that benefit from collateralization demand an interest rate that ignores the reduction in LGD that collateralization should achieve.

For these measures to be valuable, a high degree of legal certainty of their implementation must be achieved, and it is important that the resolution process starts when the borrowing bank still has enough residual assets that preferred or collateralized claims can be met. If, ex post, these conditions are not met, conflict may be intensified. Hence, bank stability might be enhanced by limiting total asset encumbrance (preferred deposits plus collateralized borrowing) to below the likely minimum level of residual assets. Authorities that are willing and able to take early corrective action, and therefore rarely have to deal with banks left with scant residual assets, can be more sanguine about asset encumbrance.

The analysis presented here lead on to other questions of practical relevance, which may be addressed in further research using an extension of the framework. Some of these questions include the following:

- What systematic evidence might be examined to determine whether and how bankruptcy costs depend on the intensity of conflict over residual assets? Some anecdotal evidence indicates that bankruptcy proceedings and bank resolutions are characterized by intensive lobbying in various forms, which considerably inflate the costs to all concerned. There is also some statistical evidence that bankruptcy costs and delays are related to the complexity of the affected corporation, and complexity is plausibly connected to the number of interest groups and thus expenditure on lobbying. But it would be worthwhile to investigate also who bears costs and receives benefits ex ante, as measured, for example, by the reaction of market prices to relevant regulatory innovations.

- Why is information on bank asset encumbrance not more readily available? Appropriate pricing of both collateralized and non-collateralized borrowing depends on making good estimates of probability of failure and of loss given default facing different creditors, and thus of the degree of outstanding asset encumbrance. Yet it is difficult to obtain current or detailed, bank-by-bank information: one may use published accounts to quantify a bank's deposit base—if deposits enjoy preferential status—and the volume of covered bonds that it has issued, but typically one cannot know the volume of assets pledged in the interbank market, to the central bank, in liquidity swap and derivative deals, etc. Presumably a bank in a weak position is afraid to reveal that fact and face a "squeeze" on its position. However, there seem to be incentives for strong banks to disclose information, and thus to force others to reveal more.[38] To some extent this occurs: many banks repaid as early as possible financing from the ECB's Long-Term Refinancing Operation, presumably to demonstrate their strength. If banks do not volunteer much information on encumbrance, there could be grounds for imposing greater transparency through regulation, but national authorities have traditionally reserved the right to provide central bank refinancing on a confidential basis.[39]

- What are the implications for funding behavior and stability of heterogeneity among creditors in their litigating/lobbying ability and incentives? Welch (1997) has initiated a discussion of the question, with a focus on a non-financial corporate facing a dominant bank

[38] Such "pooling" versus "separating" is displayed in various aspects of banks financing behavior (see Hardy and Tieman (2008) and Hardy (2012) for applications).

[39] The European Systemic Risk Board recently issued recommendations to enhance prudential oversight of asset encumbrance and related market transparency, but explicitly prohibits the revelation of data on assets encumbered to central banks (see "Recommendations of European Systemic Risk Board of 20 December 2012 on funding of credit institutions (ESRB/2012/2), available at http://www.esrb.europa.eu/pub/pdf/recommendations/2012/ESRB_2011_2.en.pdf?e622821b9c3171124f1d85f3a1b4d40e).

creditor, but the situation of banks, with many retail and wholesale counterparties, may be rather different. The interests of those most effective in lobbying may not coincide with those of society or the prudential regulator. One advantage of depositor preference is that it protects the interests of a large number of creditors with a substantial portion of claims for whom, however, it is individually relatively expensive to defend those claims in case of resolution; the weak atomistic depositors are molded into one dominant creditor. In this connection, differences in lobbying ability could account for aspects of market segmentation: those with low costs might specialize in the holding of certain instruments, and those with high costs (or funding constraints) might want to concentrate on holding secured, bankruptcy-remote assets.[40]

- In what ways would statutory bail-in of unsecured creditors be symmetric to the granting depositors preferred status, and in what ways would contingent capital ("CoCos") be symmetric to collateralized credit?[41] In all cases, one category of claimant is assigned a special status in case of bankruptcy or resolution—some are assigned an especially weak position, others an especially strong one. The incentives for, and ability of the different claimants to lobby for larger compensation is therefore affected. For example, those clearly subject to a statutory bail-in would not devote resources to contesting claims with those in a clearly superior position, and thus bankruptcy costs could be reduced. Holders of bail-in-able securities or CoCos would presumably demand higher yields to compensate for this risk, which in itself may increase risk of distress, but there could be some net benefit.

The framework would need to be extended to analyze how different forms of asset encumbrance might affect bank liquidity risk, taking into account the availability of other liquidity buffers and interaction with solvency risk. Indeed, liquidity and solvency risk are deeply connected, especially for banks. Furthermore, illiquidity, like bankruptcy, is "a situation in which existing claims are inconsistent," and so suited to an analysis based on costly resolution of conflict, rather than the application of predetermined rules and contracts.

[40] The lack of such relatively safe investment vehicles may be a contributing factor to low savings by poorer households and some developing countries.

[41] Rutledge et al (2012) provides a starting point for the current debate on bail-ins.

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