Depositor Preference, Bail-in, and Deposit Insurance Pricing and Design

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Abstract

This paper considers how current developments in depositor preference and resolution arrangements affect deposit insurance scheme design and pricing and argues that they substantially reduce the merits of the conventional view that *ex ante* risk based premiums are desirable. Depositor preference arrangements can, in many circumstances, reduce the "fair value" of deposit insurance and the risk to the insurance fund to virtually zero, because other subordinated bank stakeholders are, effectively, providing the insurance. Banks might be expected to incur the cost of some depositors being protected through higher returns demanded by subordinated stakeholders, and explicit fees for deposit insurance would then involve unwarranted duplicate costs. However, if implicit guarantees are believed to exist banks would not face such costs. The appropriate approach is then to charge fees for those implicit guarantees based on total liabilities, such as to finance a "resolution fund", rather than fees on insured deposits above the fair value (of zero) for the explicit insurance.

KEYWORDS: Deposit Insurance, Bail-in, Implicit Guarantees, Depositor Preference, Option Pricing, Resolution Funds.

JEL Categories: G21, G28

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Introduction

It is the conventional wisdom that: (a) an explicit, limited, well designed, deposit insurance scheme (DIS) should be a feature of financial system design; and (b) one component of good design is the charging of risk adjusted premiums to banks covered by the scheme. There is also a widespread perception that *ex ante* premiums should be charged to member banks, which is reflected in practice. "Among FSB member jurisdictions with an explicit DIS, a considerable number (16) have built up an ex-ante fund …. in response to a growing trend in funding patterns around the world" (FSB, 2012).

But there is less evidence in the academic or policy literature on the merits of *ex ante* rather than *ex post* funding. Demirgüç-Kunt, Kane, and Laeven (2006) spell out six core principles which include limited coverage, a design which prevents taxpayer loss (except in extreme circumstances), and appropriate risk-based pricing, but do not explicitly include charging *ex ante* premiums in those principles. The IMF (2013) argues for risk related premiums, but notes strengths and weaknesses of *ex ante* versus *ex post* scheme funding. IADI (2014) present principles of deposit insurance design which, while endorsing adequate scheme funding arrangements and reduction of moral hazard, do not specifically endorse either *ex ante* premiums or risk based premiums. Nevertheless, the FSB (2012) suggests that there "may be merits to the broader adoption of *ex-ante* funding arrangements, and IADI should consider whether a pre-funded DIS needs to be more explicitly advocated in its guidance". That, of course, requires some methodology for determining appropriate fees, and most researchers turn automatically to using some variant of the "fair pricing" option approach introduced by Merton (1974).

The thesis of this paper is that changes in depositor preference and resolution arrangements underway internationally significantly weaken (if not destroy) the case for charging *ex ante* deposit insurance premiums calculated using "fair pricing" techniques, and that deposit insurance design needs to take into account the nature of preference arrangements. (Depositor preference, discussed in detail in Section 1 involves all, or some (eg insured), depositors being given seniority over other creditors (such as bond holders) in the event of bank insolvency.) Legislated preference for domestic depositors also creates complications for deposit insurance design and the choice of type of presence (branch or subsidiary) for foreign banks.[1]

Notably the Financial Stability Board thematic review of deposit insurance (FSB, 2012) did not consider depositor preference, even though the "treatment of depositors in the creditor hierarchy can have a profound impact on the costs incurred by the deposit insurer and the failure resolution regime more generally" (IADI, 2014). Relevant to this, IADI's November 2014 revision of core principles IADI (2014), includes principle 16.2 which proposes that the "deposit insurer has at least the same creditor rights or status as a depositor in the treatment in law of the estate of the failed bank". As shown later, this is not the case in a number of jurisdictions, but in an increasing number of cases the deposit insurer ranks ahead of uninsured depositors.

[1] In September 2012, the UK Financial Services Authority released a consultation paper (FSA, 2012) suggesting that banks from non-EEA countries with national depositor preference would be required to adopt a subsidiary rather than branch presence in the UK to protect UK depositors with those banks. At April 2015, the timetable for implementation had yet to be announced.

Particularly in those latter cases, the "fair value" of official explicit deposit insurance approaches zero, rendering the conventional wisdom for ex ante risk based premiums invalid. But, if perceptions of "bail-out" remain amongst uninsured bank depositors and creditors, there is a case for levies based on total liabilities, which can be used for a "resolution fund". Such levies can be calculated using a methodology which can be found in Merton (1974), but which is different to the "fair pricing" technique also articulated there, and which has influenced most subsequent research.

The argument can be stated briefly as follows. First, depositor preference and bail-in debt requirements mean that, under reasonable assumptions, the "fair price", reflecting the value of taxpayer / insurance fund guarantees to insured depositors is extremely close to (if not equal to) zero. [2] (The exception is if the proportion of insured deposits in total bank liabilities is very high.) Second, uninsured depositors and other creditors should, in these circumstances, demand appropriate risk-based returns for the "insurance" they provide, via subordination, to "insured" depositors.[3] Such market discipline would overcome the moral hazard concerns associated with having no explicit deposit insurance fee. Third, however, if this form of market discipline does not operate due to perceptions of implicit government guarantees[4], a fee reflecting the value of those implicit guarantees is appropriate (on grounds of both moral hazard prevention and competitive neutrality). Such fees could be used for a "resolution fund" such as exists in some jurisdictions, enabling regulators to arrange takeovers of troubled institutions, or use of other mechanisms, which, by their nature, provide protection to other creditors as well as insured depositors.

While an option pricing approach could be used to calculate the appropriate size of fee for implicit guarantees, it is unrelated to determination of a "fair premium" for explicitly guaranteed deposits. That latter approach calculates the break-even fee for an insurer given that an insurance scheme is in place and insured deposit liabilities are provided to the bank at the risk free rate (despite the bank having a non-zero risk of failure – which would otherwise create losses for those depositors).[5] Merton (1974) notes that the value to the bank of the existence (or introduction) of an insurance scheme is instead the reduction in the cost of deposit liabilities from a required return which included a default risk premium, to the risk free rate.[6] This is the appropriate approach to use in calculating the value of implicit guarantees provided – albeit it difficult to implement in practice because of problems in identifying what would be the required rate of return on deposits (and other liabilities) in the counterfactual situation of no implicit guarantees.

Identifying the value of implicit guarantees thus involves determining the difference between the total cost of non-equity funding in the absence of such implicit guarantees relative to the cost in

[2] This conclusion is strengthened in situations where the deposit insurer has "super-priority" over uninsured depositors – as is the case in Australia.

[3] Fitch Ratings, for example noted that the introduction of depositor preference in Europe could raise the effective asset encumbrance ratio, from the perspective of unsecured creditors, from 28 to 72 per cent with significant implications for recovery rates in the case of insolvency. http://www.reuters.com/article/2013/05/29/fitch-bank-depositor-preference-still-ke-idUSFit65964420130529

[4] Schich, Bijlsma and Mocking (2014) note from a study of European banks that "Implicit guarantees persist however and their value continues to be significant" despite some decline in the last few years associated with developments in bank regulation and resolution arrangements.

[5] Some authors (Chan et al, 1992) have challenged the possibility of a deposit insurer determining a "fair" insurance premium under circumstances of asymmetric information about bank risk-taking,

[6] Whether the ultimate beneficiaries are bank borrowers, shareholders or depositors depends, *inter alia*, on the nature of competition.

their presence. It will be shown subsequently that this is independent of the composition of liabilities between deposits accorded explicit insurance and/or preferred (seniority) status and other liabilities, and thus should be based on total liabilities, but dependent *inter alia* on perceptions of the likelihood of the guarantees being real. To the extent that systemically important banks (SIBS) or other large banks are perceived to be too big to fail (TBTF) and thus subject to implicit guarantees that do not apply with as much certainty to smaller institutions, the size of fee should reflect this difference.

The following section outlines the increasing international role and types of depositor preference arrangements, including their interrelationship with "bail in" requirements. This is followed in Section 2 by an illustrative analysis of how such depositor preference arrangements affect the "fair pricing" of explicit deposit insurance schemes, where insured deposits only account for a fraction of bank liabilities. Section 3 turns to a consideration of the interrelationship between explicit and implicit guarantees and the potential case for risk related levies calculated on the size of all non-equity liabilities rather than on insured deposits. Because current global regulatory initiatives are largely aimed at removing (or reducing the value of) implicit guarantees through "bail in" debt requirements, Section 4 considers the implications of "bail-in" for bank levies discussed in Section 3. Section 5 concludes.

1. Depositor Preference

Depositor preference, which gives depositors seniority over most other creditors in a bank insolvency, has existed for decades in a small number of countries (such as Australia and the USA). It has now come under consideration, and introduction, in a number of other countries as a measure to increase financial stability, and has been recommended for consideration in a number of recent country FSAPs conducted by the IMF. Much of the recent focus of depositor preference discussion has been on clarifying bank resolution arrangements, particularly for ensuring that retail (or other) depositors do not get caught up in bail-in situations.[7] But, of course, such changes to creditor priority arrangements can be expected to have consequences for required returns of affected creditors, increasing them for less preferred relative to more preferred creditors.[8] Such changes also, *ceteris paribus*, reduce the likelihood that in an insolvency preferred creditors such as insured depositors, and thus the deposit insurance fund, will suffer losses, and need to be taken into account when considering how to calculate "fairly priced" deposit insurance.

Table 1 depicts a simplified balance sheet for a bank, highlighting that there are typically a number of different categories of providers of funds including insured depositors, uninsured depositors, other creditors and shareholders.[9] Preference arrangements among these stakeholders differ across

[7] One country which has explicitly eschewed this route is New Zealand, whose Open Bank Resolution approach involves bail-in, by way of haircut, applied pro rata to all unsecured bank creditors including depositors.
[8] Many commentators have expressed concerns that depositor preference will increase incentives of less preferred stakeholders to "run".
[9] In practice, there will be other liabilities in insolvency such as unpaid employee entitlements, tax liabilities etc which, depending upon national legislation, may rank ahead of insured deposits or the insurer in liquidation.

nations. The simplified balance sheet also ignores distinctions between deposits of residents and non-residents and between which there may be different preference arrangements. It is possible to categorise depositor preference regimes (where at least some depositors have priority over other unsecured creditors) as (a) insured deposit preference only (b) general deposit preference (c) tiered deposit preference.

Table 1: Simplified Bank Balance Sheet

Assets	A	Insured Deposits	D_i
		Uninsured Deposits	D_u
		Other Creditors	C
		Equity	E

At one extreme is the tiered deposit preference arrangement found in Australia. Depositors have preference above other creditors. In insolvency the deposit insurer (APRA) pays out insured deposits and then has priority over all other creditors (including uninsured depositors) in liquidation. Thus, insured depositors effectively have "super priority". If the insurer instead ranked equally with all other depositors and creditors after paying out insured deposits, the system would correspond to case (a) – insured depositor preference only. (But from the perspective of the insurer it would be equivalent to no depositor preference). This corresponds to the case of Switzerland and Hong Kong where, insured deposits have preference, but uninsured deposits do not, (Turner, 2011, Hardy, 2014). If the insurer ranked equally with uninsured depositors who ranked ahead of other creditors, the system would correspond to case (b) of general deposit preference. This corresponds to the case of the USA where, since 1993, depositors have had preference over other creditors, but where the FDIC does not have preference over uninsured depositors in liquidation.

At the other extreme are many countries where creditors and depositors have equal preference, although there may be specific categories of subordinated debtholders (and increasingly holders of debt which can be "bailed in"). The FSB (2012) notes that 13 of its 21 members provide some form of depositor preference. Table 2 provides relevant information for G20 countries as at end 2011 and subsequent developments.

Table 2: G20 Depositor Preference Regimes 2011 and subsequent developments

Depositor Preference Regime	**No Depositor Preference Regime**
Argentina	Brazil (introduction recommended by IMF FSAP 2012)
Australia	Canada (introduction recommended by IMF FSAP 2014)
China	Germany (introduced following BRRD 2014/59/EU)
France	Italy(introduced following BRRD 2014/59/EU)
India	Japan
Indonesia	Saudi Arabia
Mexico	South Africa

Russia	South Korea
Switzerland	UK (introduced following BRRD 2014/59/EU)
Turkey	
US	

Source: Clifford Chance (2011), and updating by author

Recently, there has been substantial interest in, and action on, introduction of depositor preference in a number of countries. For example, the Vickers Report (Vickers, 2011) in the UK recommended this in conjunction with proposals for "ring-fencing" of retail banking. Subsequently the Financial Services (Banking Reform) Act 2013 introduced (from end 2014) preferential status for deposits protected by the Financial Services Compensation Scheme (FSCS) with the scheme inheriting that status for any claims it pays out. Subsequent legislation[10] meant that unprotected retail and SME deposits would rank next and above other unsecured claims from March 2015.

Arrangements announced by the EU (2013) and implemented in the Bank Recovery and Resolution Directive (BRRD 2014/59/EU) create a similar situation from the start of 2015 for EU countries. Essentially, retail (and SME) depositors[11] have preference over other depositors and creditors, and the deposit insurance scheme (which would pay out covered retail deposits) has preference over all other creditors (including uncovered retail depositors). Table 3 provides some examples of how preference arrangements affect the situation of the deposit insurer.[12]

Table 3: Depositor Preference and Insurance arrangements: International examples

Australia – general depositor preference but insurer has preference after payouts
UK /EU (from 2015) – tiered depositor preference, with insurer inheriting priority
USA – general depositor preference, FDIC inherits position of insured depositors it has paid-out
Malaysia – general depositor preference, deposit insurer inherits position of depositors it has paid out
Singapore – general depositor preference, deposit insurer ranks above non-bank depositors
Indonesia – tiered depositor preference via insurer ranking ahead of other depositors
India – general (but capped) depositor preference, insurer has no preference
Canada – no depositor, nor insurer, preference
Hong Kong – insured depositor (and insurer by subrogation) preference
Switzerland - insured depositor (and insurer by subrogation) preference

Sources: ASIFMA (2013), national regulator web sites

More generally, and complicating preference arrangements have been the growth of various forms of collateralised borrowing by banks, including repurchase agreements and covered bond issuance. For ease of exposition, these complications are ignored in the following discussion which examines

[10] Directive 2014/59/EU (the Bank Recovery and Resolution Directive), and the Banks and Building Societies (Depositor Preference and Priorities) Order 2014 (SI 2014/3486)

[11] This includes deposits in overseas branches which would have otherwise been eligible.

[12] China has local depositor preference and announced in December 2014 the forthcoming introduction of a deposit insurance scheme, but details on preference status of the insurer are not readily available.

the consequences of various levels of depositor preference in the typical situation where deposit insurance only applies to a subset of deposits (such as retail deposits below some "capped" level). Also ignored are the consequences of "domestic depositor preference" which while important are less relevant to the principal message of this paper.

2. The valuation of deposit insurance and depositor preference

Merton (1974) introduced the notion of considering deposit insurance using option pricing concepts, and his method of estimating a "fair price" for provision of deposit insurance has influenced subsequent research and practice.[13] A range of different option pricing models involving variants upon and extensions to his original model can be found in the literature.[14] Notably, however, Merton's distinction between the fair price for insurance, once a scheme has been introduced, and the value to the banks involved of the introduction of a deposit insurance scheme has been largely neglected in the subsequent literature. Fegatelli (2010) is one of the few papers to have drawn upon this distinction, albeit with a primary focus upon determinants of moral hazard. Pennacchi (2006) also provides an analysis of the difference between what he terms the "market value" of the insurance and the "actuarially fair value", where the former relates to the value to the bank from introduction of the scheme, and the latter to the value once insurance is in place and depositors no longer demand a risk premium in deposit interest rates. We return to this issue of the market value of deposit insurance in section 3 where the role of implicit guarantees is considered, but first examine the implications of depositor preference arrangements for the conventional "fair pricing" approach.

We consider a range of cases of depositor preference arrangements and the effect on "fair pricing". The key feature of all these cases is that the bank has some mix of insured depositors, uninsured depositors, and other creditors, and that insolvency occurs when its assets are insufficient to meet the sum of those liabilities. It is possible that insolvency could occur, but that there are sufficient assets to meet insured (and perhaps uninsured) deposit obligations, with those possibilities increasing as the relative importance of other creditors (and uninsured depositors) in the bank funding mix increases. The exposition is, for simplicity, graphical with algebra relegated to the appendix, and (for simplicity) a one year horizon is assumed. Compared to Table 1 which shows book value balance sheet amounts as (D_i, D_u and C) the option pricing approach focuses upon promised repayments (B_i, B_u, B_c respectively) where, for example, $D_i = B_i e^{-r}$.

Case 1. No Depositor Preference

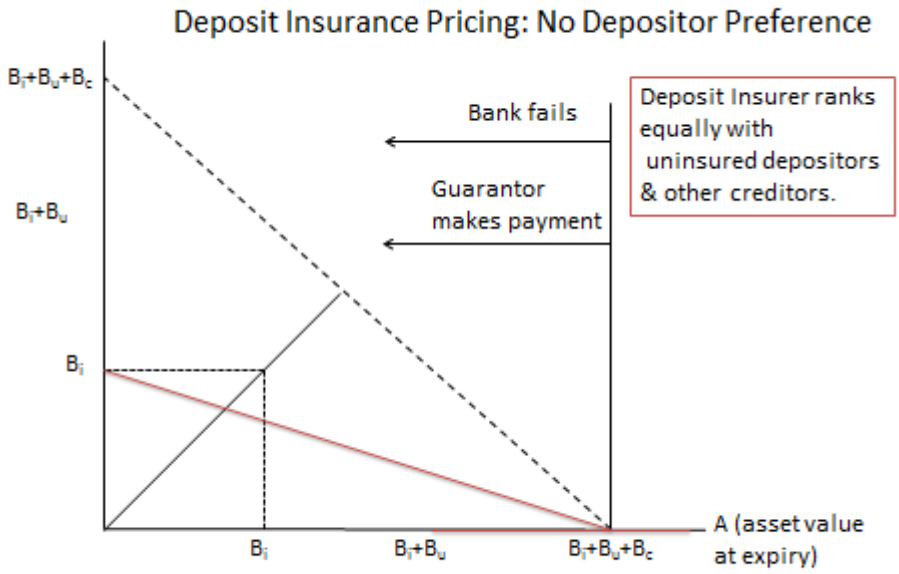
Consider first, as a benchmark, the case of no depositor preference. Total promised bank payments to liability holders (insured and uninsured depositors and other creditors) are $B_i + B_u + B_c$. Should the bank fail ($A < B_i + B_u + B_c$), the insurer pays out insured depositors the amount B_i and ranks equally

[13] Merton estimated the value of the guarantee given by the government, assuming a scheme is in operation, as the value of the put option with a strike price of B and current deposit amount $D = Be^{-rT}$ where the entire non-equity funding of the bank is by insured deposits (D).The formula for calculating the value of this put option is well known and shown in Appendix 1.

[14] See, for example, Marcus and Shaked (1984), Ronn and Verma (1986), Pennacchi (1987), Gropp and Versala (2004). Even though national deposit insurers may not use such explicit option pricing models in determining premiums, risk based pricing approaches typically reflect similar considerations and aim to (a) achieve appropriate compensation for the insurance scheme (or taxpayers) for the value of insurance provided, and (b) reduce the incidence of moral hazard.

with other depositors and creditors as a claimant on bank assets, recouping a pro rata share of those assets.[15] The payout is thus $B_i - (B_i /(B_i + B_u + B_c))A$. As Figure 1 illustrates this payout function for the deposit insurer is the proportion $(B_i /(B_i + B_u + B_c))$ of a put option over the bank's assets with a strike price of $(B_i + B_u + B_c)$. The fair price for this insurance can be readily calculated (at least in principle) as $(B_i /(B_i + B_u + B_c)).P(A_0, , (B_i + B_u + B_c), \sigma_A, r_f, T)$, where P is the value of a put option with strike price $(B_i + B_u + B_c)$ over bank assets with current value A_0 and volatility σ_A.

Figure 1: Deposit Insurance Pricing: No Depositor Preference



Case 2. Deposit Insurance: General Depositor Preference

In this case of partial coverage, some proportion "x" of total depositors' funds is covered by insurance, and all have preference in liquidation over other creditors (with the deposit insurer inheriting the position of the insured depositors following payout to them). This could involve either (a) a certain class of depositors (eg households and/or amounts under some capped level) being the only deposits to which the insurance scheme applies, or (b) some proportion of each depositors' funds being covered by the insurance scheme. The payout of the insurer in each approach is the same. In approach (a) the insurer payout is $G_i = - B_i + xA$. In approach (b) the insurer payout is $G_d = - x(B_i+B_u) + xA$. Because $B_i = x(B_i+B_u)$ these amounts are equal. Moreover, it is readily shown (see Appendix 1) that if depositor preference applies (and all depositors have equal preference), the fair value *per dollar of insured deposits* is independent of the proportion of deposits guaranteed. (The payout by the insurer is x per cent of the payout which would occur if, instead, all deposits were covered, and the premium is applied to the x per cent of deposits which are insured).

While, as shown in appendix 1, the "fair" price is the same in each approach, the practical consequences of each in terms of enhancing stability are potentially quite different. As shown from the British experience in the global financial crisis, partial insurance (90 per cent in that case) did not

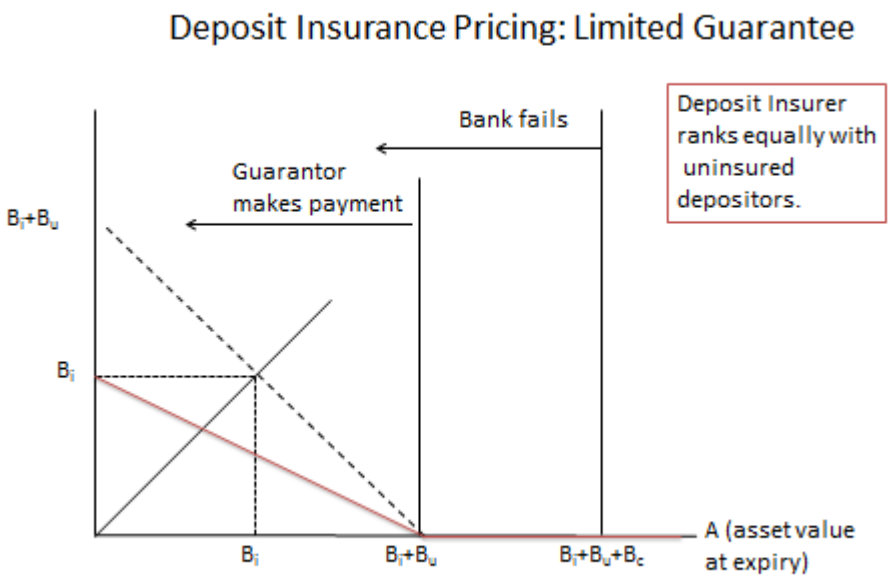
[15] In practice, some schemes may only guarantee the principal amount (D_i).

prevent insured depositors from "running" on troubled banks. While 100 per cent coverage of some depositors should prevent that group from running, this does not provide disincentives for other depositors to run – and preference arrangements might be expected to adversely affect such incentives.

Figure 2 demonstrates the situation when there is depositor preference and limited deposit insurance, and other creditors, and where the deposit insurer ranks equally with uninsured depositors (and ahead of other claimants) in liquidation of the bank. If the bank's assets (A) are less than total claims of insured depositors (B_i), uninsured depositors (B_u) and other creditors (B_c), (ie $A < B_i + B_u + B_c$), the bank fails. But it is only if assets are less than $B_i + B_u$ that the insurer will make a net payout (payouts to insured depositors less recoveries in liquidation). Were it the case that all depositors were insured the insurer payout would be the dotted line, which is the payout of a put option with strike at $B_i + B_u$. However, where only x percentage of deposits are insured the payout is the solid line, representing x per cent of a put option. The "fair price" of the deposit insurance would thus be calculated as x per cent of a put option with a strike price equal to total deposits. The fair price for this insurance can be readily calculated (at least in principle) as $(B_i /(B_i + B_u)).P(A_0, , (B_i + B_u), \sigma_A, r_f, T)$.

Compared to the situation where there was no depositor preference, where the payout would be a proportion of a put option with strike price equal to all claims ($B_i + B_u + B_c$), the value of the insurance is reduced – and increasingly so as the use of non-deposit funding by the bank is increased.

Figure 2: Deposit Insurance Pricing under Depositor Preference

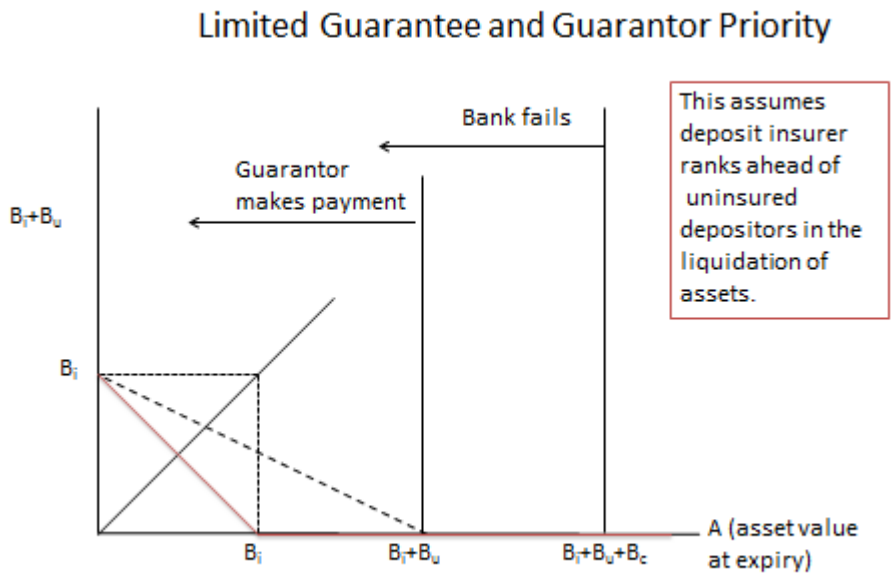


Case3: Deposit Insurance: Tiered Depositor Preference

An alternative depositor preference structure is that found, for example, in Australia. All depositors have priority over other creditors[16], but in the event of insolvency the provider of insurance (APRA) ranks ahead of all other creditors including uninsured depositors in claiming recovery for amounts paid out from the bank assets. This is equivalent to insured depositors having preference over all other creditors (including uninsured depositors) and the insurer inheriting their position upon making payment to them.

Figure 3 shows the consequences of this structure for estimating the fair value of deposit insurance. If the bank fails, the insurer pays out the insured deposits B_i and stands first in priority for recovery of that amount from the bank's assets. If the assets exceed B_i in value, the insurer gets full recovery and has a zero net payout. If assets are less than B_i the net payout is $(B_i - A)$. This represents the payoff on a put option with a strike price of B_i the value of insured deposits, ie $P(A_0, B_i, \sigma_A, r_f, T)$.

Figure 3: Deposit Insurance and Tiered Depositor Preference



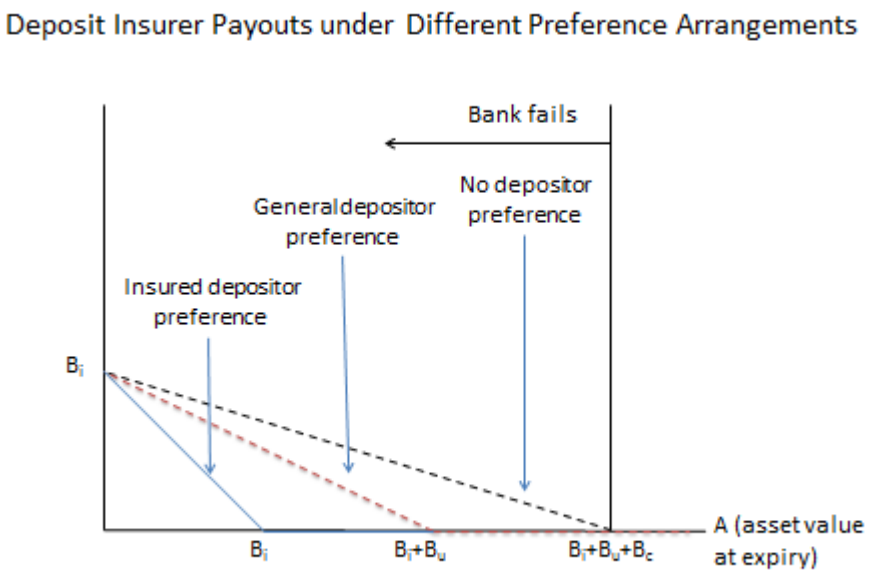
Empirical Relevance

Figure 4 summarizes the results of the previous analysis in terms of the differences in insurer payouts under different preference arrangements following bank failure. It is clear that, *ceteris paribus,* the payouts are lowest under tiered preference, and that payouts under general depositor preference are less than in the case of no depositor preference, although several caveats are in order. First, differential preference arrangements may lead to different asset value outcomes at the

[16] Some specific items such as unpaid employee entitlements rank ahead of depositors, while covered bond holders have prior claim over assets in the cover pool, but rank behind depositors as unsecured creditors should cover pool assets be insufficient to meet obligations.

assumed expiry date under the option formulation. This could occur in practice because of uninsured depositor and creditor responses to perceived changes in risk leading to runs and asset fire sales. Second, different preference arrangements can be expected to affect required returns. For example, depositor preference can be expected to increase required returns of other creditors. Within the option framework used here, the assumed promised repayment (of B_c) would be associated with a lower value of funds currently provided and thus lower current asset levels. The assumption that the same level of initial assets can be used in calculating the "fair value" of deposit insurance would then need to be amended (but the effects of this are, at best, of second order importance).

Figure 4: Insurer Payouts under Alternative Preference Arrangements



As Figure 4 illustrates, the consequences of insured depositor "super preference" (or tiered preference) on the "fair value" of insurance depends on the proportion of insured deposits to total assets. The effects of differences in depositor preference arrangements are dramatic. To illustrate, we first use the same basic parameters as used for illustration by Merton (1974). This involves setting deposits/assets at either 0.95 or 0.90, $\sigma^2 = 0.006$, T=1. Assuming that all deposits are insured Merton calculates a fair value of deposit insurance of $1.20 per $100 of deposits when deposits/assets = 0.95 and $0.32 per $100 of deposits when the deposit/assets =0.90.

Table 4 shows the consequences of alternative assumptions regarding the relative size of insured deposits versus other funding and different assumptions regarding depositor preference. Case (a) corresponds to Merton's deposit/assets = 0.95 case, and the fair value of $1.02 is 80/95 of Merton's $1.20 estimate, for no or general depositor preference, reflecting the fact that this is the proportion of deposits assumed insured in this example. (Since there are no other creditors, there is no difference between no and general depositor preference in this case). Note the marked reduction in the fair value of insurance in the case of tiered depositor preference. Intuitively, this reflects the fact that there needs to be approximately a three standard deviation fall in the value of assets before the insurer is required to make any payout.

Cases (b) and (c) illustrate how the introduction of other creditors who are subordinated to depositors also has a marked effect on the fair value of insurance under general depositor preference. The reason is that, from the insurer's perspective, under depositor preference, an increase in other creditors is the same as an increase in equity. Case (d) illustrates how a reduction in the proportion of insured deposits also has a significant effect on the fair value, reducing it to less than half a basis point in this example under general depositor preference and to effectively zero under tiered depositor preference.

Table 4: Depositor Preference and Deposit Insurance "Fair Value" Examples[a]

	Cases			
Funding Mix	(a)	(b)	(c)	(d)
Insured Deposit (Di)% of assets (BV)	0.8	0.8	0.8	0.7
Uninsured Deposit (Du)% of assets (BV)	0.15	0.1	0.05	0.1
Other Creditors (C)% of assets (BV)	0	0.05	0.1	0.15
Equity % of assets (BV)	0.05	0.05	0.05	0.05
Depositor Preference Assumptions	*Fair Value per $100 of insured deposits*			
No depositor preference	$1.02	$1.02	$1.02	$0.89
General Depositor Preference	$1.02	$0.29	$0.05	$0.004
Tiered Depositor Preference	$0.005	$0.005	$0.005	$0

(a) Calculations are based on an adaptation of the Ronn and Verma (1986) model which allows for depositor preference (as outlined in the appendix). An annual dividend of 0.2 per cent of assets and $\sigma^2 = 0.006$ is assumed and the time horizon assumed is to be one year.

It should be stressed that the examples used in Table 3 based on Merton's illustrations are extremely conservative and understate the effect of depositor preference. The assumptions of equity/assets = 0.05 and volatility of assets of σ =7.7 per cent p.a. imply that bank failure will occur if there is a one standard deviation decline in the value of assets. That has a risk-neutral probability of over 25 per cent p.a.!

For a more realistic example, consider the case of Australia. Insured deposits of the major banks are around 30 per cent of total (book value) assets, and there is tiered depositor preference. Uninsured deposits are approximately 30 per cent of assets (book value) and allowing for a (relatively typical) market/book value of equity of 2 (such that the market value of assets is 5 per cent greater than book value), the fair price of insurance with no depositor preference would be $0.11 per $100 of insured deposits. But under general depositor preference, the fair value falls to a very, very, small fraction of a basis point per $100 of insured deposits and is infinitesimal under tiered preference. Even for the case of building societies and credit unions which have quite different balance sheet structures, fair pricing is insignificantly different from zero under tiered depositor preference. Assuming insured deposits are 75 per cent of the value of assets (and book and market value of assets equal), uninsured deposits are 10 per cent and equity is 10 per cent, the fair value is $0.0002 per $100 of insured deposits. (Under general depositor preference, the value would be $0.05 per $100).[17]

[17] These calculations otherwise use the same parameters as in Table 3.

Table 5 provides information relevant to assessing the effect of different international depositor preference regimes on the "fair value" of deposit insurance. It shows that insured deposits generally are a minority of total deposits, and that insured deposits are in most cases below 50 per cent of assets. In such cases, tiered depositor preference (where insured deposits and the insurance fund rank above other depositors) would require substantial falls in asset value (over 50 per cent) before the insurance fund would suffer losses (from not recouping payouts to insured depositors from the remaining bank assets). Even where the proportion of insured deposits is higher, the existence of non-depositor creditors (and equity buffers) reduces the insurer risk – even where only general depositor preference applies. Notably, major countries where the insured deposits/assets ratio is high and there is not tiered preference are Japan and the USA.

Table 5: Deposit Insurance Coverage and Depositor Preference Internationally: 2010

Country	Coverage level USD, 2010	% of Deposit Value Covered	Bank Assets / Bank Deposits**	Covered Deposits / Bank Assets	Depositor Preference*
Argentina	7545	29	1.2	25	Yes (general)
Australia	1010300	61	1.3	46	Yes (tiered)
Brazil	42000	22	1.7	13	No
Canada[(a)]	100000	35	1.2	29	No
France	136920	67	1.6	41	Yes (tiered)
Germany	136920	n.a.	1.1	n.a.	Yes (tiered)
Hong Kong	64000	20	0.7	29	Yes (insured only)
India	2240	33	1.0	32	Yes (general)
Indonesia	235294	61	0.9	66	Yes (tiered)
Italy	136920	31	1.7	18	Yes (tiered)
Japan	122775	71	0.9	83	No
Korea	43902	27	1.6	17	No
Mexico	146606	58	1.4	43	Yes
Netherlands	136920	48	1.7	29	No
Russia	23064	32	1.2	26	Yes (general)
Singapore	38835	19	1.0	19	Yes (tiered)
Spain	136920	47	1.5	32	Yes (tiered)
Switzerland	96830	24	1.3	19	Yes (insured only)
Turkey	32341	25	1.3	19	Yes (tiered)
UK	133068	n.a.	n.a.	n.a.	Yes (tiered)
USA	250000	79	0.8	103	Yes (general)

**As at mid 2015; ** calculated from WB SFD Database as (Deposit Money Bank Assets/GDP)/(Bank Assets/GDP), (a) Canadian figures for deposits/asset are for 2008*

Source: FSB (2012), Clifford Chance (2013), ASIFMA (2013), World Bank Financial Structure and Development Database 2013, updating by author

3. Implicit Guarantees, Deposit Insurance and Bank Levies

The preceding section has argued that under tiered depositor preference arrangements, and with moderate use of non-deposit funding by banks, the "fair value" of explicit insurance approaches zero. The reason is that the likelihood of the insurer facing a net payout after recoveries from remaining bank assets approaches zero due to preference arrangements. It is, effectively, the less preferred stakeholders who are providing the insurance to insured depositors. It would be expected that this would be reflected in their required rates of return on funds provided to the bank. If this were the case, charging a fee for explicit insurance would amount to imposing an unwarranted duplicate cost.

However, that argument assumes that non-preferred stakeholders do, in fact, adjust required returns to reflect their subordinated position. During the GFC, many governments provided a range of support measures to banks, potentially creating (or reinforcing) the perspective that implicit guarantees exist, independent of, and with wider coverage than, any explicit scheme. Subsequently there has been increased interest in "depositor preference" arrangements and in resolution arrangements involving "bail-in" securities and higher total loss absorbing capacity (TLAC). Both arrangements aim to increase the role of market discipline by subordinating other bank creditors to depositors and increasing the proportion of bank funding from such subordinated creditors.

To the extent that there are perceptions of government implicit guarantees for bank creditors through expectations of bail-outs of distressed banks, the upward adjustment of required returns of non-preferred stakeholders may not occur. In those circumstances, the government incurs a cost – but it is unrelated to the "fair value" of explicit deposit insurance. Rather, it reflects the reduction in the cost of funds to the bank arising from, and providing a valuation of the implicit cost to the government, from the implicit guarantees.

Merton (1974) addresses a similar issue in the context of assessing the value to a bank from the introduction of explicit deposit insurance, but (since he assumes only insured deposit and equity funding) his analysis translates directly to the case of implicit guarantees (insurance) over all liabilities. He argues that value to the bank of insurance is determined by the reduction in the interest rate it must pay to raise funds. If prior to the scheme introduction there was a positive risk premium in funding costs, the benefit to the bank is the removal of that risk premium due to liabilities now being regarded as risk free. Merton writes this gain as:

$$G = B\, e^{-rT} - Be^{-rfT},$$

where B is the amount promised to creditors at time T, r is the pre-guarantee interest rate, and rf is the risk free rate paid to creditors after the scheme is in operation.[18] This reflects the effective replacement of the bank by the government as the creditors' ultimate counterparty.

The value to the bank of insurance is the amount G above plus any excess of the put option "fair value" over fees charged for the insurance. The cost to the government is the option fair value (less fees charged) plus the effect of its potential obligations from the existence of the scheme on its

[18] Unfortunately Merton (1974) uses the same term G for both concepts of the value of deposit insurance discussed in that paper.

credit rating and cost of its own debt raisings. This latter component may, of course, be zero, if uninsured banks had zero default risk or providers of funds misguidedly assumed zero default risk. But otherwise, the higher amount of funds which banks can raise for a promised future repayment of B reflects the additional component.[19]

Figure 6 illustrates the argument in an option pricing framework (using a more convenient notation and assuming a one period situation, ie T=1). Without the existence of guarantees, to raise the amount of funding D, the bank promises D(1+R) and in conjunction with own equity E invests in loans and other assets with current value V_0 (V_0 = D+E). After the introduction of the guarantee, the amount promised to raise D is D(1+r_f), with D+E = V_0. The terminal date value of the bank equity prior to the guarantee is given by the call option payoff relationship with the strike at D(1+R). After the guarantee it is the call option payoff relationship with the strike at D(1+r_f). If it is assumed that fees are levied equal to the fair value of the put option provided, the value to the bank from the introduction of insurance/guarantees is the difference in the intrinsic value of those two call options.[20] This corresponds to G as defined earlier – although in Merton's terminology it would be expressed as reflecting the effect of being able to raise a larger amount of funds for the same promised payment as the cause of the increase in the intrinsic value of the option.

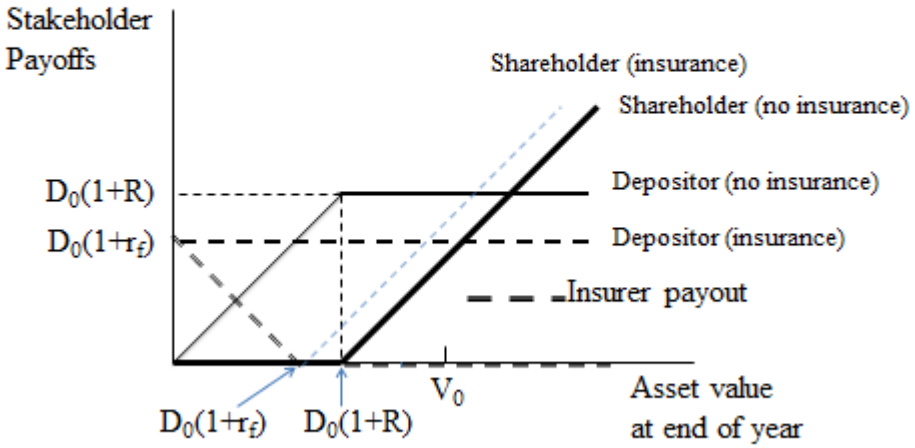
This analysis is simply reflective of the benefit to a bank from being able to raise funds at a lower promised interest rate, in this example at the risk free rate (r_f) rather than the higher rate R. But because the bank is unable to offer, without government assistance, a risk free claim, this additional value to it arises from the introduction of the guarantee scheme and consequent reduction in deposit interest rate required to be paid. The conventional calculation of the fair value of deposit insurance which calculates the cost of writing a put option conditional on the deposit interest rate being the risk free rate of interest does not capture this effect. To do so, the value of deposit insurance (or implicit guarantees) provided to the bank would need to be calculated as a put option with the higher strike price of D(1+R) rather than D(1+r_f).

To the extent that the time premium is the same for both options, the value of the implicit (or explicit) subsidy can be calculated as the reduction in bank funding costs – reflected as the interest differential multiplied by the funding base. This is the approach taken by Schich et al (2014) who examine the funding cost benefit from credit ratings uplifts due to perceived government support.

[19] Fegatelli (2010) argues that it is not deposit insurance per se that gives rise to moral hazard, but rather limited liability, and that the existence of implicit guarantees may reduce the cost to government from introduction of a scheme.

[20] This assumes, for simplicity of exposition, that the time premium in the option value would be the same in both cases.

Figure 5: Insurance Scheme Introduction Value to Banks



Very few researchers have pursued the question of what is the value of introduction of a deposit insurance scheme to the banks involved – with most focusing instead on the "fair value" concept. One exception is Pennacchi (2006) who addresses this issue (and interrelationship with risk based capital requirements). He focuses on the difference between the "market value" of the insurance (reflected in the reduced interest cost for deposits) and the "actuarially fair" value which is considered in most pricing models. Neither Merton nor Pennacchi, however, consider the implications for pricing of depositor preference or subordination of other creditors (including uninsured depositors) to depositors and/or the deposit insurer.

What is the practical import of this argument? There may be an argument for deposit insurance premiums above the "fair value" if deposit interest rates are reduced because of the existence of the scheme. However, it may be that banks were able to raise funds at the risk free rate anyway. That could reflect either that: their activities are risk free - in which case the fair value will be zero; depositor misconceptions of actual risk; the existence of implicit guarantees; or preference arrangements which mean that the risk to "insured" depositors was zero.

But more generally, it would be inappropriate to charge higher explicit deposit insurance fees related to the amount of insured deposits as a mechanism for obtaining compensation for the value of implicit guarantees. There is no necessary correspondence between them. Indeed, the value of implicit guarantees is unrelated to the proportion of total liabilities which are covered by explicit insurance, since, under realistic assumptions with depositor preference, there is no net cost to the insurer from the protection of insured deposits. Rather the cost of implicit guarantees is the cost of bailing out other uninsured creditors as part of the resolution arrangements for the bank.

Hüpkes (2011) notes that a number of jurisdictions have established resolution funds including the Orderly Liquidation Fund established in the US under the Dodd-Frank Act, the Swedish Stability Fund, and notes an EU recommendation for each nation to establish a resolution fund. Subsequently[21] the EU has established a Single Resolution Fund, to be funded by (risk related) levies on banks and credit institutions based on total liabilities less own funds and covered deposits – where the latter are generally subject to levies under national deposit guarantee schemes. The aggregate consequence is levies on the total liabilities less own funds.

It might be argued that recent global regulatory developments, such as increased capital requirements have reduced the value of implicit guarantees. And while they arguably have, it would appear that implicit guarantees remain of value. Schich, Bijlsma, and Mocking (2014) estimate that significant funding cost advantages of around 132 basis points existed in Europe in 2014 as measured by the effect of credit rating uplifts for banks associated with perceived sovereign support.

4. Bail-in requirements and deposit insurance pricing

While the G20 has not finalized details of bail-in debt requirements for large internationally active banks, and those standards do not necessarily apply to smaller domestic banks, it appears possible that such standards will become commonplace. Bail-in securities are already part of the Basel 3 Tier 2 capital requirements. One consequence of these changes is that there is another layer of bank creditors subordinated to insured (and other) depositors, with obvious, if hard to quantify, implications for the value of explicit deposit insurance guarantees.

The complications in assessing the impact of bail-in debt for deposit insurance pricing lie in assessing its impact on probability of bank failure (and consequent activation of explicit deposit insurance schemes) and the likely cost to the scheme in that event. Triggers for write down or conversion into equity generally involve some element of regulatory discretion, and while bail in debt is generally described as "gone concern" loss absorbing capital, bail in could lead to continuation of the recapitalised entity with no claim on the deposit insurance fund for actual payouts to depositors. There is no experience to date to indicate the political willingness to enforce bail-in terms, but if used to enable continuity of the bank (under new owners and management) this would reduce the likelihood of regulatory agencies requiring funds to facilitate an exit of a failing banks by way of an assisted takeover.

Assuming that bail in will occur when capital is still positive, the effect of introduction of such liabilities is to further reduce the fair value of explicit deposit insurance, through reducing either the bank probability of default or loss given default for insured depositors. Bail-in adds another layer to the nature of preference arrangements.

The more substantive effect lies in the potential effect on market discipline and thus moral hazard. Arguably, holders of such debt will take into account the risk associated with such debt and price their subordinated status into required returns. If bail in is credible, there is less of a case for fees for implicit guarantees, and moral hazard associated with explicit insurance of some deposits is accordingly reduced.

[21] Regulation (EU) No 806/2014

Conclusion

The case for ex ante risk related fees for deposit insurance is considerably weakened by depositor preference arrangements and also by requirements for bail in debt. In the event of bank failure it is lower ranked creditors who effectively provide insurance to insured depositors by absorbing losses. In the resolution process, the explicit insurer only suffers losses if the fall in asset values exceeds the value of subordinated claims. Moreover, if insured depositors have effective priority over uninsured depositors, such as through the deposit insurer having a priority claim on bank assets in regard to amounts paid out, the insurer's expected loss, and thus fair premium, is further reduced. For many situations, the fair value is insignificantly different from zero.

Of course, one complication with fair value estimates is that they are based on an estimate of asset values which is assumed to be valid. In practice, many failed banks, discovered by regulators to have negative equity, have until that time reported positive equity. Credible bail in of debt with a trigger of 5.125 risk weighted capital ratio arguably should reduce this likelihood, by causing reassessment of the bank viability and resolution at that time.

This complication raises the important question of how preference arrangements affect the monitoring and disciplining incentives of various stakeholders including the prudential regulator / deposit insurer (Page and Santos, 2003). This paper has not considered this important issue, but focused instead on how preference arrangements affect the appropriate pricing of explicit deposit insurance. It has argued that preference arrangements including introduction of "bail-in" requirements have significant implications for deposit insurance pricing, including challenging the conventional wisdom that ex ante risk based pricing schemes are generally appropriate.[22] Provided that insured, preferenced, deposits are not the dominant form of bank financing, market discipline by other creditors should work to prevent moral hazard. To the extent that it does not, because of perceptions of implicit guarantees, governments need to find alternative ways of preventing excessive risk-taking – but ex ante risk-based fees for explicit deposit insurance, calculated in the conventional manner, are not the relevant solution to that problem.

Finally, an important conclusion from the analysis of this paper is that regulators should consider carefully the nature of depositor preference arrangements and how they interact with the operation of explicit deposit insurance schemes. Providing insured depositors with preference over all others, and having the scheme inherit this status, dramatically reduces the potential cost to the insurer (to close to zero) and logically suggests that no fees would generally be charged for such explicit insurance provided to a limited set of depositors. By transferring the cost of bank failure to uninsured depositors and creditors, preference arrangements should increase market discipline and reduce moral hazard, with the bank "paying for" explicit insurance via higher returns demander by these stakeholders. If this does not occur, it is likely to be the result of implicit guarantees which, if unable to be removed, warrant explicit levies linked to the funding cost advantages received by such banks.

[22] One common argument for ex ante schemes is to provide a fund for potential use by the insurer to subsidize exit of a troubled institution by way of assisted merger. But this is effectively a bail-out of unsecured creditors and uninsured depositors, such that the natural base to use for levies to create such a fund is total liabilities, not insured deposits.

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APPENDIX 1: Deposit Insurance and Depositor Preference Analytics

Merton (1974) provided the essential framework for an options based analysis of deposit insurance for the case of all liabilities taking the form of insured deposits. Amount B is promised to depositors for payment at time T. $D = Be^{-rT}$ is the current market value of deposits if there is a guarantee, where r is the risk free rate. Letting A represent the current market value of the bank assets (funded by

insured deposits and equity) the value of the guarantee given over risky deposits promising the risk free rate is

$$G(T) = Be^{-rT}N(x_2) - AN(x_1), \text{ where}$$

$$x_1 = \{\log(B/A)-(r+\sigma^2/2)T\}/\sigma\sqrt{T}; \quad x_2 = x_1 + \sigma\sqrt{T}$$

Letting g = G(T)/D be the value of the guarantee per dollar of (insured) deposits, and substituting $De^{rT} = B$ in x_1 gives:

$$g = N(h_2) - (1/d)N(h_1), \text{ where}$$

$$d = D/A$$

$$h_1 = \{\log(d) - \sigma^2T/2\}/ \sigma \sqrt{T}; \; h_2 = h_1 + \sigma \sqrt{T},$$

Merton provides illustrative calculations showing for example that for d = 0.95, T=1, $\sigma^2 = 0.006$, g = 0.01209 ($1.20 per $100), while for d =0.90, g falls to $0.32 per $100)

Depositor Preference and Limited Deposit Insurance

To estimate the fair value of insurance, it is necessary to amend the Merton model to allow for both insured and uninsured depositors and other creditors and assumptions regarding priority of depositors over other creditors. Let

- r,ρ, and μ represent the interest rates promised to insured depositors, uninsured depositors, and other creditors respectively
- $B^i = D^i e^{rT}$, $B^u = D^u e^{\rho T}$, $B^c = Ce^{\mu T}$ amounts promised

Case (a) No Depositor Preference

In this situation the payout by the deposit insurer is given by

- Payout $= \text{Max}[0, B_i - \frac{\text{B}_\text{i}}{\text{B}_\text{i}+\text{B}_\text{u}+\text{B}_c}\text{A}] = \frac{\text{B}_\text{i}}{\text{B}_\text{i}+\text{B}_\text{u}+B_c}\text{Max}[0, \text{B}_\text{i} + \text{B}_\text{u} + B_c - \text{A}]$
  - Guarantor pays B_i and receives pro rata share of bank assets with uninsured depositors and other creditors

  Payout is a proportion (share of insured deposits in total non-equity funding) of a put option on bank assets with strike equal to total non-equity funding payment promises ($B = \text{B}_\text{i} + \text{B}_\text{u} + B_c$)

Hence, adapting Merton's notation

$$g = (D_i/(D_i+D_u+C))(N(h_2) - (1/d)N(h_1)), \text{ where}$$

$$d = (D_i+D_u+C)/A$$

$h_1 = \{\log(d) - \sigma^2T/2\}/ \sigma \sqrt{T}; \; h_2 = h_1 + \sigma \sqrt{T}$

Case (b) General Depositor Preference

- Payout =$\text{Max}[0, B_i - \frac{\text{B}_\text{i}}{\text{B}_\text{i}+\text{B}_\text{u}}\text{A}] = \frac{\text{B}_\text{i}}{\text{B}_\text{i}+\text{B}_\text{u}}\text{Max}[0, \text{B}_\text{i} + \text{B}_\text{u} - \text{A}]$

  - Guarantor pays B_i and receives pro rata share of bank assets with uninsured depositors

- Note: bank could fail ($A<B^i+B^u+B^c$) but $A>B^i+B^u$ and no payout

Payout is proportion of put option on bank assets with strike equal to total deposits

- $G = \frac{B_i}{B_i+B_u}P; g = \frac{G}{D_i} = \frac{e^{rT}}{B_i+B_u}P \quad ;$
- $P = (B_i + B_u)\, e^{-rT}N(d_2) - AN(d_1)$
- $d_1 = \frac{\ln(\frac{B_i+B_u}{A}) - (r+\frac{1}{2}\sigma^2)T \;\;)}{\sigma\sqrt{T}}$ and $d_2 = d_1 + \sigma\sqrt{T}$
- $g = N(h_2) - \frac{N(h_1)}{d}; h_1 = \frac{\ln(d) - \frac{1}{2}\sigma^2 T \;\;)}{\sigma\sqrt{T}}; h_2 = h_1 + \sigma\sqrt{T}$
- $d = \frac{(B_i+B_u)\, e^{-rT}}{A} = \frac{D_i+D_u\, e^{(\rho-r)T}}{A}$

$d = \frac{D}{A}$ if ρ = r (ie uninsured deposits pay risk free rate)

Case (c) *Deposit Insurance Pricing with Insured Depositor Priority*

- $G = P; g = \frac{G}{D_i} = \frac{e^{rT}}{B_i}P \quad ;$
- $P = (B_i)\, e^{-rT}N(d_2) - AN(d_1)$
- $d_1 = \frac{\ln(\frac{B_i}{A}) - (r+\frac{1}{2}\sigma^2 T_i)}{\sigma\sqrt{T}}$ and $d_2 = d_1 + \sigma\sqrt{T}$
- $g = N(h_2) - \frac{N(h_1)}{d}; h_1 = \frac{\ln(d) - \frac{1}{2}\sigma^2 T_i)}{\sigma\sqrt{T}}; h_2 = h_1 + \sigma\sqrt{T}$
- $d = \frac{(B_i)\, e^{-rT}}{A} = \frac{D_i}{A}$