Re-examining the Case for Government Deposit Insurance*

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I. Introduction

This paper re-examines the rationale behind deposit insurance. Perhaps the most influential analysis of deposit insurance is of Diamond and Dybvig (DD) [3] who presented a model of a banking system which enabled depositors to invest in production while still remaining liquid, but which was subject to damaging "bank runs" if too many of them wanted to withdraw while production was still in progress. They went on to show how deposit insurance could eliminate these runs, and they argued that the government would have a natural advantage in providing this insurance principally because of its power to tax. This paper re-evaluates the role of deposit insurance in preventing bank runs, and in so doing re-assesses the DD argument that deposit insurance should be provided by the government. This is done by extending the DD framework to include share-capital, and I suggest that the pledge of share-capital to cover the bank's liabilities could help prevent bank runs at least as well as deposit insurance, and probably better. We require only that investors have an adequate inducement to pledge their capital, a credible means of pledging it, and a legal system that would enforce the contracts they make with depositors—conditions that all appear to be relatively inocuous. The banking system is then capable of protecting itself against the problems posed by runs, and deposit insurance is unnecessary.

II. The Diamond-Dybvig Model

The DD model has three periods ($T = 0, 1, 2$) and a production technology that yields 1 unit of output for each unit deposited in period 0 and withdrawn in period 1, and $R > 1$ units of output for each period 0 deposit withdrawn in period 2. This technology captures the idea that early withdrawals interrupt the production process. The decision whether to withdraw in period 1 or period 2 is made in period 1. There is a continuum of consumer-agents of measure one. They are identical in period 0, but are revealed to be of one of two types in period 1. Type 1 agents derive utility only from period 1 consumption, and type 2 agents derive utility only from period 2 consumption. All agents can privately store consumption goods at no cost, and no storage is publicly observed. Type 1 consumers will therefore withdraw their deposits and consume them in period 1; type 2

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consumers will consume in period 2 any deposits they withdraw in that period and anything they might carry over from the previous period. If we let c_T be goods received in period T, then the utility functions of type 1 and type 2 agents are assumed to be respectively $u(c_1)$ and $\rho u(c_1 + c_2)$, where $1 \geq \rho > R^{-1}$ and $u : R_{++} \rightarrow R$ is twice continuously differentiable, increasing, strictly concave, and satisfies the conditions

$$u'(0) = \infty, \quad u'(\infty) = 0, \quad -cu''(c)/u'(c) > 1. \tag{1}$$

Each agent is given an endowment of 1 unit in period 0, and nothing else. If agents' types are publicly observable in period 1, DD show that it is possible to design an optimal insurance contract for period 0 that enables agents to insure against the unlucky event of turning out to be a type 1 consumer. Letting c_{ij} be the consumption in period i of a type j consumer, and using asterisks to refer to optimal consumption bundles, they show that this contract satisfies[1]

$$\begin{aligned} c_{12}^* = c_{21}^* = 0, \quad u'(c_{11}^*) = \rho R u'(c_{22}^*), \\ t c_{11}^* + [(1-t)c_{22}^*/R] = 1 \end{aligned} \tag{2}$$

where t is the proportion of type 1 agents. They also show[2] that $c_{11}^* > 1$ and $c_{22}^* < R$, so this contract improves on the "autarky" outcome where $c_{11} = 1$ and $c_{22} = R$. One should also note that the optimal outcome satisfies the "self-selection" constraint that no agent has an incentive to misrepresent his type.[3]

The problem is to implement this contract when agents' types are not publicly observable. DD suggest that agents might be able to implement the optimal contract by establishing a bank which would take in deposits and invest them in the production process, but promise depositors a reasonable return if they withdraw their deposits in period 1. They therefore suppose that banks offer a demand deposit contract that promises to pay $r_1 > 1$ for each deposit withdrawn in period 1 provided that the bank still has assets to liquidate. The bank is assumed to serve demands for withdrawals sequentially in random order until it runs out of assets. If it has any assets left, they are liquidated in period 2 and divided pro rata among remaining deposit holders. It is important to stress that the bank makes no distinction between depositors and shareholders, and we shall return to this point later.

DD find that the demand deposit contract can support the optimal insurance contract as a Nash equilibrium, but unfortunately the equilibrium is not unique, and there exists an alternative bank run equilibrium in which all the bank's assets are liquidated in period 1. This equilibrium occurs when type 2 depositors "panic" and withdraw their deposits because they anticipate that the bank will run out of assets. It is a worse outcome for both types of agent than the initial autarky equilibrium because certain returns of 1 and R for each type are replaced by uncertain returns for both of mean unity. As DD explain, "Bank runs ruin the risk-sharing between agents and take a toll on the efficiency of production because all production is interrupted at $T = 1$ when

1. See DD [3, 406–7]. The first condition comes from noting that type 1 (2) households derive no utility from period 2 (1) consumption, so the optimum would rule out that sort of consumption. The second indicates that marginal utility is in line with marginal productivity, and the third is the resource constraint.

2. These follow from equations (2), $\rho R > 1$ and DD footnote 3. Note also that $\rho R > 1$ implies that $c_{22}^* > c_{11}^*$ (since $u'(c_{11}^*) = \rho R u'(c_{22}^*)$).

3. Type 1 agents have no incentive to represent themselves as type 2 agents because $c_{11}^* > 1$ and $c_{12}^* = 0$. Type 2 agents have no incentive to misrepresent themselves because $c_{22}^* > c_{11}^*$.

it is optimal for some to continue until $T = 2$" [3, 409]. DD then suggest that a government deposit guarantee could eliminate the incentive to participate in a run, and that we can think of this guarantee as a system of deposit insurance.[4]

III. Investor Capital as an Alternative to Government Guarantee

We shall now outline an alternative way in which depositors could be protected against bank runs.[5] Suppose we introduce another agent—an investor—who derives utility from second-period consumption and is endowed with K units of capital.[6] He has the option of establishing a bank which would invest his K units of capital and the deposits it takes in the production process, and would commit itself to pay r_1 for deposits withdrawn in period 1, and r_2 for deposits withdrawn in period 2. If the bank is established, let us also suppose that it promises to pay depositors the optimal consumption bundles for each type of deposit, i.e., that

$$r_1 = c_{11}^*, \quad r_2 = c_{22}^*. \tag{3}$$

Depositors would therefore obtain returns at least as good as they could obtain if they set up their own bank along DD lines, and we can conclude that they would deposit their capital in the new bank in preference to that of DD.

The question then is whether the investor would agree to set up the bank in the first place. Let E be the value of the bank when it is wound up after all deposits have been repaid. Assuming that type 2 investors do not withdraw in the first period, it can readily be seen that

$$E = KR + [t + (1 - t)R] - [tr_1 + (1 - t)r_2]. \tag{4}$$

The first term is the return on the investor's own capital, the second is the return on its deposits, and the third is (the negative of its) its deposit liabilities. Note that $\partial E/\partial t < 0$ and E reaches its highest and lowest values respectively for $t = 0$ and $t = 1$. For $t = 0$ the value of E is $(1 + K)R - r_2 > KR$ and for $t = 1$, E is $KR + (1 - r_1) < KR$. If $t = [R - r_2]/[r_1 - 1 + R - r_2]$ the investor's return would be KR—the same as it would have been had he invested directly in the production process instead of setting up a bank. This value of t is the "break even" level, and he makes a profit (loss) if t is less (greater) than this level. Assuming that he expects depositors

4. Strictly speaking, we should not be talking of deposit insurance at all. As Kane [9, 31] points out,

> technically deposit insurance is misnamed. Rather than insuring deposits against a particular set of hazards, it places the credit standing of one of three federal agencies behind the deposit liabilities of an insured institution. . . . A guarantee differs from insurance in that it is contingent on the nonfulfillment of designated provisions of a financial contract.

5. It is in any case far from obvious that we ought to try to prevent bank runs anyway. Kaufman [10] argues very persuasively that runs are more a symptom of weakness than a cause of it, and that the threat of runs provides a useful discipline against managements that engage in excessive risk-taking. These considerations suggest that deposit insurance might actually destabilize the banking system by removing an important check to risk-taking behavior. In addition to this, recent work suggests that the "contagiousness" of bank runs has at the very least been grossly overrated (Benston et al. [2, 53–60, 66], Kaufman [10], Rolnick and Weber [13; 14]). This "new view" of bank runs can be used to provide additional reasons against government deposit insurance to those advanced here.

6. If one likes, one can think of all agents being identical to start off with, but they then get hit by two consecutive shocks. The first divides them into (potential) equity-holders and (potential) depositors, and the second divides depositors into their two types.

to satisfy the self-selection constraint—we shall see below that this constraint would be satisfied, so the investor would rationally expect it to be—then our investor will invest in the bank if he expects t to be in a range sufficiently less than the break even level to compensate him for the risks, inconvenience and so on he would take on by setting up the bank.

In the DD model, the possibility of bank runs arises because depositors would be aware that they would suffer capital losses if sufficiently many others withdrew their deposits. The prospect of these losses arises in turn because the bank has insufficient capital to redeem all its deposits in the first period at the rate of r_1 per deposit. If the bank had sufficient capital to meet this liability, however, the public would have no reason to fear capital losses and therefore no reason to participate in runs. To provide such an assurance, the bank's capital would have to cover its liabilities in the "worst case scenario" when everyone withdraws in period one. A sufficient condition to rule out runs is therefore

$$K \geq r_1 - 1 \tag{5}$$

noting that $(r_1 - 1)$ is the loss the bank makes on deposits withdrawn in period 1. If this condition holds, then no type 2 depositor would withdraw in period 1. The self-selection constraint would therefore be satisfied and there would be no bank runs.[7] Runs arose in the DD model precisely because the zero value of K meant that this condition could not hold.[8]

IV. Deposit Insurance and Share Capital

Our extension of the DD model indicates that the introduction of investors willing to pledge their capital can eliminate bank runs without any apparent need for state intervention to guarantee the liabilities of the banking system. The advantage of this kind of bank over the mutual fund bank is that it allows the functions of shareholders and depositors to be separated, and thereby allows mutually beneficial trades to take place among a heterogeneous population that cannot take place with a mutual fund bank: those willing to accept risks and forego liquidity would become shareholders, and those who were more risk-averse or who wanted to remain liquid would become depositors. These considerations perhaps explain why the shareholder bank is historically so common and the mutual fund bank relatively rare.

Our example also sheds some light on deposit insurance itself. Indeed, one could think of it as a model of deposit insurance if one interprets the "shareholders" as outside deposit insurers. This is because it allows for no analytical difference between formal deposit insurance and the kind of insurance provided by share capitalists. However, one might have thought that shareholder-capitalists would normally be better placed to exercise control over bank management

7. The idea that bank capital might discourage runs is not new (Bhattacharya and Gale [1] mention it in passing, and George Kaufman has emphasized it in his work), but previous formal models have not given it the major role that analysis presented here suggests it ought to have.

8. In my model, banks might be "fully collateralized," but they do not interrupt the process of "liquidity creation" by which the banking system "converts" illiquid or non-marketable assets into liquid or marketable liabilities. My banks are to be distinguished from 100% reserve banks which are also fully collateralized, but which cannot create liquidity because of the reserve requirement. The difference arises because my banks make use of additional resources besides those put up by depositors. These resources enable my banks to create liquidity while remaining fully collateralized. The absence of such resources under 100% reserve banking is what prevents those banks creating liquidity. For more on 100% reserve banking and liquidity creation, see Diamond and Dybvig [4].

than outside insurers. Compared to external insurers, shareholder-capitalists would also have a natural advantage in providing a guarantee because they could "internalize" the moral hazard problems that might otherwise arise with separate shareholders and insurers. This kind of "deposit insurance" therefore avoids one of the main difficulties encountered by more formal systems of deposit insurance, and perhaps explains why private systems of deposit insurance do not tend to arise spontaneously when banks are of the share-capital variety.[9]

V. Private Guarantees for Depositors

For private investors to invest in a bank they would need to have sufficient capital to pledge, an adequate inducement to pledge it, and an appropriate means of pledging it. There would also need to be a legal system that enforces any insurance contracts that private agents make among themselves. The first condition is perhaps not unreasonable (see the next section), and I have already suggested that potential investors would be willing to invest provided they did not expect too many early withdrawals. There are a number of ways in which they could provide depositors with some sort of reassurance. One way is simply to maintain an adequate publicly observable "cushion" of equity-capital in the bank. Creditors of the bank could then observe its capital ratio and they would have little reason to run if this ratio was high enough.[10] Before the days of deposit insurance it appears that bank creditors did look at factors like these in judging banks' safety. George Kaufman [10, 15–6] notes that there is

> evidence that depositors and noteholders in the United States cared about the financial condition of their banks and carefully scrutinized bank balance sheets. Arthur Rolnick and his colleagues at the Federal Reserve Bank of Minneapolis have shown that this clearly happened before the Civil War. Thomas Huertas and his colleagues at Citicorp have demonstrated the importance of bank capital to depositors by noting that Citibank in its earlier days prospered in periods of general financial distress by maintaining higher than average capital ratios and providing depositors with a relatively safe haven. Lastly, an analysis of balance sheets suggests that banks took . . . less interest rate risk before the establishment of the FDIC.

Banks might also maintain an adequate capital cushion by issuing subordinated debt that would be automatically converted into equity when a bank's net worth fell to a level that was considered to threaten depositors' confidence. As Litan [11, 302] writes,

> this could provide for an automatic recapitalization of the bank in the event that the bank "failed" (that is, in the event its equity capital were exhausted). In effect, mandatory convertible subordinated debt would provide a parachute that would ensure a soft landing for the payments system . . . The covenants on the debt that trigger the mandatory conversion into equity would be the ripcord.[11]

9. A possible counter-argument that needs to be considered is that share-capital banks might still want external deposit insurance to reassure depositors who might be uncertain of the bank's capital value and be consequently skeptical of the shareholder guarantee. While this might lead banks to buy deposit insurance, as we note in the next section there are other ways in which banks can provide credible assurances about their "capital backing." In any case, as Gorton and Haubrich [8] show, the existence of a market to price bank-specific risk should provide depositors with a clear signal of the bank's net worth.

10. It is sometimes suggested that banks would tend to hold insufficient capital. It is not clear why they would. Shareholders have much to lose from bank runs, and so might be expected to encourage their managements to take measures to protect the bank against them. Nor does capital appear to share the nonexcludability or nonrivalness characteristics of a "public good."

11. For more on the possible advantages of subordinated debt covenants, see Benston et al. [2, 192–5].

In addition, private investors might also want to reassure depositors by assuming liability for the bank beyond the extent of their equity investments. In the U.S., for instance, it was customary until the 1930s for bank shareholders to be "doubly liable" for their investments[12], and there is some evidence that this extended liability did reassure bank creditors [2, 61; 10, 13–14]. It would have done so by increasing shareholders' incentive to monitor managements and decreasing their willingness to go along with "shoot for the moon" strategies once a bank's net worth became negative [2, 242–43].[13]

VI. Government or Private Deposit Insurance?

The earlier discussion suggested that there are other ways in which banks could reassure their creditors besides deposit insurance, but does not rule out a possible complementary role for deposit insurance as well. If there is to be deposit insurance, we need to investigate whether it should be provided by the government or the private sector. DD support a government system on the grounds that "the government may have a natural advantage in providing deposit insurance" because private companies that have no power to tax would have to "hold reserves to make their promise credible" [3, 416].[14] As noted earlier, however, it is a question of pledging capital in a credible manner rather than holding reserves as such, and private investors can pledge their capital in any of a number of ways. For instance, they could simply bond their personal property in the same way that Lloyd's "names" do at present. All that we would then require is that the property pledged be marketable and that there exist a legal system that enforces such commitments. The "power to tax" is irrelevant.[15]

In any case, the argument that private agents have insufficient reserves (or rather, resources) undermines *all* schemes for deposit insurance, and not just private ones. In the final analysis, the government relies on the private sector to finance its liabilities through taxation, but the government can only tax resources that the private sector already has. If private agents have the resources to meet the government's deposit insurance liabilities, they presumably have sufficient reserves to meet deposit insurance liabilities of their own,[16] and there is no obvious reason why they could

12. Double liability for the shareholders of national banks and some state banks was repealed in 1933 for new shares and in 1937 for old shares [2, 78]. Double liability persisted for remaining shareholders until the 1950s [15, 689].

13. The potential usefulness of extended liability is argued by Benston et al. [2, 61, 242–3], while Woodward [15, 689] argues that it would be a "bad idea" because of the difficulties of "chasing" the shareholders of failed banks. This argument amounts to a claim that it would be difficult to enforce extended liability arrangements, but those who enter into such commitments could presumably "bond" their property with the appropriate legal authorities.

14. They acknowledge that this would not prevent private companies from offering deposit insurance, and suggest that "the deposit guarantees could be made by a private organization with some authority to tax or create money to pay deposit insurance claims, although we would usually think of such an organization as being a branch of government" [3, 413]. They therefore conclude that there might be a "small competitive fringe of commercially insured deposits, limited by the amount of private collateral" [3, 413].

15. A related argument that has to be considered is that the government may have an advantage in timing because of its monopoly over the currency supply. When it issues more of an inconvertible currency, no "law of reflux" operates to return any "excess" notes to the issuer, and so they tend to drive up the price level. There is a long tradition in monetary economics which maintains that these note issues are disruptive and (therefore) undesirable. Friedman [5] has also suggested that inconvertible currencies have considerable resource costs. On the other hand, if the government issues convertible currency or any other form of debt, it must persuade other agents to hold those liabilities willingly. In that case, the government is no different from other agents which can also issue debt, but which can do so only if other people are willing to hold it.

16. One must also bear in mind that a state-run deposit insurance system might accumulate a larger liability than a private one. As Benston et al. [2], Kane [9] and Kaufman [10] have noted, the U.S. deposit insurance agencies have

not provide deposit insurance themselves. The private sector already provides many other forms of insurance quite successfully, after all, and when we bear in mind that we cannot even be sure that we want deposit insurance in the first place, and that it has an very unsatisfactory track record anyway, the argument for government deposit insurance would appear to be very weak indeed.[17]

VII. Conclusions and Implications

The model presented in this paper can be considered as a counter-example to the DD model which provides the standard theoretical justification for government deposit insurance. A role for government deposit insurance can arise in their model because the banking system is prone to "bad" equilibria which can be thought of as self-fulfilling runs, but the counter-example set out here suggests that the problems caused by runs can be eliminated relatively easily by allowing private investors to separate themselves into depositors and equity-investors. Runs can be eliminated when equity-holders maintain a sufficient capital buffer to provide depositors with credible reassurance that their deposits are safe. Equity-holders would choose to maintain an adequate capital buffer (i.e., one that would reassure depositors)[18] because they would be promised a return from doing so, and as residual claimants they can only receive their return after all the depositors have been paid off. They have at least as much to gain from eliminating runs as the depositors themselves.

This approach emphasizes the role of bank capital and the reassurance that a capital buffer provides to bank depositors, and it is curious that while bank capital is often mentioned in the literature, it has played virtually no role in the recent formal literature which has attempted to provide a rigorous analysis of banking instability. Most of these theoretical papers ignore the difference between depositor-investors and equity-investors which is what distinguishes a genuine bank from the peculiar kind of mutual fund to be found in DD and related work.[19] If we wish to model genuine banking instability—the kind of banking instability we observe in the real-world—and not just the instability of a type of mutual fund which apparently does not exist anyway, then the theoretical literature ought to pay more attention to bank capital and the role it plays in protecting the integrity of the banking system.

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adopted poor failure resolution policies that have substantially increased their losses. There is a strong argument that bureaucrats generally have less incentive to look after taxpayers' resources than private managers do to look after their shareholders'. Note, incidentally, that this undermines the common argument that the private sector could not support a viable system of private deposit insurance because of the scale of potential losses. If private sector agents can support as taxpayers the larger deposit insurance liabilities of their government, then they can certainly support any smaller liabilities they might incur as insurers in their own right. In any case, most of these liabilities would simply involve transfers within the private sector itself.

17. An interesting question is why instances of private deposit insurance seem to be historically so rare. A possible reason is that alternative means of protecting depositors are more cost-effective, perhaps because of the moral hazard problems that deposit insurance creates. From time to time, state governments in the U.S. have encouraged deposit insurance systems in their jurisdictions, but by and large these cannot be regarded as "private" deposit insurance systems. For more on these experiences, see Kane [9, 4–5] and Benston et al. [2, 78–9, 190–2, 247–8].

18. The question might then be asked why runs should ever occur. Our analysis suggests that runs might occur under laisser faire when shareholders misjudge the equity they ought to observe to maintain confidence, or when the bank suffers "exceptional" loan losses, or when fraud is suspected.

19. In other words, we can define a bank as a financial intermediary that issues both equity and deposits (or more generally, fixed-value debt), and we can define a mutual fund as a financial intermediary that makes no such distinction between its liabilities.

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