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Bank Runs and Moral Hazard

A Review of Deposit Insurance

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Abstract

Deposit insurance is a widely adopted policy to promote financial stability in the banking sector. Deposit insurance helps ensure depositors' confidence in the financial system and prevents contagious bank runs, but it also comes with an unintended consequence of encouraging banks to take

on excessive risk. This paper reviews the economic costs and benefits of deposit insurance and highlights the importance of institutions and specific design features for how well deposit insurance schemes work in practice.

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Bank Runs and Moral Hazard: A Review of Deposit Insurance

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1. Introduction

Deposit insurance is widely adopted across the globe and constitutes an integral part of the financial safety net provided to the banking system. During the global financial crisis, a number of countries introduced new deposit insurance schemes or extended the scope and coverage of existing schemes to restore confidence and to avert potential contagious runs on their banking sectors. These interventions rekindled the debate on the impact of deposit insurance on financial stability and the moral hazard costs associated with government intervention.

In this paper, we review the literature on deposit insurance. We begin with the theoretical underpinnings of deposit insurance. We discuss the main economic benefits of deposit insurance that come from reducing contagious runs on the banking system. We then discuss economic costs of deposit insurance that result from moral hazard and review the empirical evidence on the impact of deposit insurance on banking stability. The more recent literature suggests that deposit insurance design and implementation can have a significant impact on how well deposit insurance schemes perform in practice. We review and discuss the theoretical and empirical literature on optimal deposit insurance design and premium pricing. Finally, we discuss how these design choices are influenced by political economy and how deposit insurance works in different institutional environments and offer concluding thoughts.

2. Economic Rationale for Deposit Insurance

One of the important functions of the banking system is to transform short-term deposits into long-term loans, commonly referred to as maturity transformation. When savers face income uncertainty or consumption shocks, they are reluctant to invest in long-term illiquid assets. Economic projects, however, often require long term investment and commitment, and these projects can result in significant economic losses if they have to be liquidated before being completed. If liquidity needs of savers are imperfectly correlated, then banks can pool savings to minimize the amount reserves that need to be set aside to meet the needs of savers when they realize a liquidity or consumption shock. Bryant (1980) was the first to suggest the notion that

banking can be viewed as a diversification tool to overcome the need to hold large liquidity reserves. In this regard, intermediation through banking allows for greater aggregate investments in productive but illiquid assets and can thus improve overall welfare.

The economic benefits of maturity transformation are magnified if demand deposits can be used as a medium of exchange – that is when savers have the ability to exchange their demand deposits with others in the economy. In order for savers to trade risky claims of a bank, however, the claims have to be insensitive to the underlying value of the assets (Dang, Gorton, Holmstrom and Ordonez 2014). Since demand deposits are short term and have seniority over other claims, they are considered to be informationally insensitive. That is, their values are insensitive to changes in information about the underlying asset. In addition to the benefit that comes from maturity transformation, demand deposits are also valuable as a transacting medium.

Banks' ability to invest in long term assets and to create liquid deposits that can be used in transactions breaks down if a substantial portion of depositors withdraw their money at the same time. There could be rational reasons as to why small savers may want to demand their deposits simultaneously resulting in the depletion of banks' liquidity reserves. A decline in the value of the assets held by banks can cause depositors to withdraw funds from the bank (Gorton, 1988; Jacklin and Bhattacharya, 1988; Allen and Gale, 2000). Since demand deposits are paid on a first-come first-serve basis, if the decline in asset values is large and sudden, it is rational for depositors to withdraw their funds. If the bank runs out of reserves and is forced to suspend withdrawals, depositors at the front of the line could receive all their funds while those at the end of the line could receive nothing.

In industries other than banking, a sell-off by investors can serve as a way to exert discipline on the firm's managers. Sudden sell-off in the form of a bank run can also exert discipline on banks. However, because banks are in the business of maturity transformation, they tend to be highly levered with lower levels of asset volatility, whereas non-financial firms tend to have lower leverage and higher asset volatility. High leverage combined with immediate demand-ability of deposits can result in an equilibrium where a run occurs on solvent banks resulting in unnecessary economic loss.

Diamond and Dybvig (1983) provide a model of such runs where depositors find it optimal to withdraw their funds if they expect other depositors to do the same. If depositors believe that a run will not occur, then only investors with real liquidity needs withdraw their

funds and the bank is able to meet these demands without costly liquidation of assets. However, if all depositors believe that a run will occur, then a run becomes a self-fulfilling prophecy as investors rush to avoid being last in line. The bank is then forced to engage in costly liquidation of long-term assets, suffering large economic losses as a result. The first-come, first-served nature of demandable debt contracts combined with leverage generates a bad Nash equilibrium in the Diamond-Dybvig model. Within this framework, deposit insurance essentially works as an equilibrium selection device. If depositors believe that they will get their money back from the insurance fund regardless of what other depositors do and regardless of whether they are last in line, then they no longer have incentives to run and withdraw their funds. The bank does not need to liquidate long-term assets and remains solvent. Deposit insurance thus eliminates the equilibrium in which everyone runs. In this equilibrium, the economic cost of insurance is zero. The insurance scheme is funded with taxes in the model. Since investors do not run when deposit insurance is in place, no taxes are imposed.

It is important to note that the effectiveness of deposit insurance in the Diamond-Dybvig model relies crucially on the assumption that the insurance is viewed to be credible by depositors. If depositors believe that there is even a small possibility that the insurer will run out of funds, then it becomes rational for the investors to be the first in line to withdraw their deposits. All insurance schemes are under-funded in the sense that they do not hold funds to fully cover all potential losses. But, there is typically an expectation that the state would provide a full backstop should such a need arise during a crisis. But this requires the state to have the political will and more importantly the economic resources to intervene to fund depositor losses. In countries with large banking sectors and deteriorating public finances, intervention is not always a viable option and underfunding is a real possibility. As we will discuss in the next section, during the financial crisis there have been several episodes that have threatened the credibility of deposit insurance schemes in a number of countries.

If bank runs are a result of liquidity shortages as opposed to solvency problems, it is natural to ask whether a similar function can be performed by a central bank working as a lender of last resort. In most countries central banks are allowed to provide temporary liquidity to the banking sector to relieve short-term frictions that might result in a bank run. In fact, similar to the deposit insurance in the Diamond-Dybvig model, if the central bank has the capacity and credibility to act as a lender of last resort, the central bank's very willingness to do so can have a

stabilizing effect without the need to directly intervene. In practice, however it is difficult to distinguish liquidity problems from problems related to solvency. Investors may withhold funding or refuse to roll over existing debt of a troubled bank. This can then result in that bank liquidating its assets at fire-sale prices in order to raise capital. Lower asset prices in turn can push a bank into insolvency. This further exacerbates liquidity problems resulting in a vicious cycle. It is thus very difficult, even for the central bank, to distinguish illiquidity from insolvency. This is difficult to do in normal times and nearly impossible during a crisis. Also, central bank assistance tends to be discretionary whereas deposit insurance imposes a legal obligation to act. Credibility of the safety-net schemes in place, as mentioned earlier, is integral to raising confidence in the system.

A number of papers have extended the Diamond-Dybvig model after its publication. Many theoretical papers have tried to enhance it by adding features that exist in real-life bank deposit contracts (see for instance Von Thadden 1998, Bhattacharya and Gale 1987, Villamil 1991). One of the main refinements to the model came from a paper by Jacklin (1987). Jacklin points out the fact that demand deposit contracts are simply assumed in the Diamond-Dybvig model and questions the optimality of these contracts in raising funds for investments. He shows that long-term projects can be financed by equity investments by savers and the liquidity needs of these savers could be met by trading their equity shares with other savers when they face consumption shocks. As long as consumption shocks are not perfectly correlated, long term projects can be financed without exposing banks to runs. Jacklin's critique of demand deposits points out the possibility that the dominance of banks as liquidity providers could be due to external institutional factors as opposed what emerges from an optimal contracting equilibrium.

Perhaps the most important refinement to the model is the introduction of bank risk-taking. Banks in the Diamond-Dybvig world invest in riskless assets. Hence risk-taking incentives do not enter the model. Introducing investments in risky assets and the impact of deposit guarantee on the risk-taking incentives of banks and their private monitors raises concerns of voluntary risk taking, or "moral hazard" which has been central in later theoretical extensions (Kane, 1995; Calomiris, 1996; Cooper and Ross, 2002). Introducing this trade-off, the theoretical analysis recognizes the need to introduce deposit insurance to prevent wasteful liquidations of bank assets, but at the same time, strives to identify deposit insurance design features that would minimize moral hazard.

3. Brief History of Adoption and Recent Changes

Prior to the implementation of state sponsored deposit insurance, clearing houses in the early nineteenth century played a similar role in the United States. The goal of the clearing houses was to ensure the continuous flow of transactions in the banking system during times of distress. The earliest state sponsored insurance schemes go back to 1829 when the state of New York created a safety fund for banks operating in New York. The safety fund was meant to insure bank notes and major bank liabilities, but failed to provide protection during the panic of 1837. Over the years from 1831 to 1859, Vermont, Michigan, Indiana and Ohio also set up insurance schemes with mixed results. From 1908 to 1917 eight more states passed deposit guarantee legislation. All eight guarantee funds failed during the 1920s, starting with Washington's fund in 1921. Of the eight, all but the Texas guarantee fund left depositors with uninsured losses (Calomiris 1989). The Great Depression resulted in the failure of thousands of banks which led to the establishment of the Federal Deposit Insurance Corporation (FDIC) in 1933.

It was not until the 1960s that other countries started implementing deposit insurance schemes. Calomiris and Jaremski (2016) argue that early implementation of deposit insurance schemes in the United States was the result of the unit-banking structure that was unique to the United States at the time. By 1980, only about 20 countries had some form of deposit insurance (Demirguc, Kunt, Kane and Laeven 2008). Over the next two decades there was a steady increase in adoption. The proliferation of banking crises in the 1980s and 1990s led a large number of countries to establish explicit deposit insurance systems. Demirguc, Kunt, Kane and Laeven (2008) argue that the increase in adoption is partly due to growing consensus by domestic and international regulatory bodies to implement deposit guarantees on retail deposits. During that time, the International Monetary Fund and the World Bank encouraged the adoption of deposit insurance as a way of stabilizing markets. Consistent with this view, Demirguc, Kunt, Kane and Laeven (2008) show that deposit insurance is more likely to be adopted during financial crises due to external political pressure. During the same time, the European Union issued a directive for member countries to have in place some form of deposit insurance in order to level the playing field across member states.

Currently, over 107 countries have some form of explicit deposit insurance, up from 93 in 2013 according to the Bank Regulation and Supervision Survey (BRSS) conducted by the World Bank. Figure 1 shows the number of countries in each income group with explicit insurance in the 2013 and 2016 BRSS surveys. Figure 2 shows the percentage of countries with explicit insurance in 2016 as well as the increase compared to 2013, which are indicated by dashed lines on the graph. Over 80% of the countries in the high-income group have some form explicit deposit insurance in place. There has been an increase in the percentage of countries with explicit deposit insurance since 2013, especially in the low-income group. Figure 3 shows the average percentage of total bank liabilities that are covered by deposit insurance within each income group. Over 40% of liabilities are covered for the high and upper middle-income countries, while less than 10% of liabilities are covered in low income countries.

Some of the recent changes have been implemented in the aftermath of the global financial crisis. During the crisis, several countries including Australia and Singapore introduced explicit deposit insurance schemes for the first time. Other countries, like the United States and Spain, substantially increased the coverage limit, while others like Germany and Ireland introduced unlimited coverage in order to restore confidence in the markets. Figure 4 shows the percentage of countries that have implemented changes in their deposit insurance systems in response to the crisis. Most countries, especially those in the high-income group significantly increased both the limit and the type of accounts covered under deposit insurance.

Overall, explicit deposit insurance is widely adopted across the globe and is now a standard policy of bank regulators and supervisors. The recent crisis has reinforced the importance of deposit insurance in promoting stability and its role in the overall financial safety net provided to the banking sector.

4. Economic Benefits of Deposit Insurance

As the preceding discussion suggests, banks are uniquely prone to runs because of the role they play in the economy in transforming short-term demand deposits into long-term assets. This maturity-mismatch is inherently unstable. In addition to causing individual banks to fail, bank runs can have a ripple effect and trigger full-blown contagion. Banks are connected

through interbank lending and other risk-sharing arrangements. Fears about the insolvency of one bank can spread into a generalized contagion causing multiple banks to fail.

As banks remain the dominant source of financing for firms and households, a stable, well-functioning banking system is an important determinant of a country's economic growth and development. A large number of bank failures can cause serious disruptions of a country's economic activities and result in significant social and fiscal costs (Hoggarth et al. 2002; Smith 2016). Disruption in lending caused by multiple bank failures can result in lost output, lost investments and higher unemployment. In addition, there are long-term societal costs that result from lower economic activity and higher unemployment. More direct fiscal costs of banking crisis include tax-payer funded bailouts, liquidity support to various financial institutions and increased government spending on social safety net programs. More importantly, bank runs and panics can paralyze the payment system by causing failed banks to default on payments in transit. As most of the global economy relies on settlement systems without cash, lack of ability to service and honor demand deposit contracts can have a significant impact on daily commerce. Given the significant costs associated with banking crisis, deposit insurance, to the extent that it prevents contagious runs, can be highly valuable.

A number of papers document the economic benefits of deposit insurance in reducing bank runs. Martin, Puri and Ufier (2017), using account level data, examine the effect that deposit insurance has on inflows and outflows of distressed banks. They find that uninsured depositors flee banks following bad regulatory news and that deposit guarantees reduce the outflow of deposits, providing much needed liquidity. Iyer, Jensen, Johannesen and Sheridan (2017) study a run on uninsured deposits in Danish banks that resulted from a reform that limited insurance coverage. They show that the reform caused a 50% decrease in deposits above the insurance limit. DeLong and Saunders (2011) find that depositors were less prone to withdraw their deposits from weaker banks after the introduction of fixed-rate federal deposit insurance in the United States. Chernykh and Cole (2011) use the deposit-insurance scheme introduced into the Russian banking system as a natural experiment to examine the effects of deposit insurance. They find that the introduction of deposit insurance led to increased deposits and reduced reliance on state-owned banks as custodians of retail deposits. They find that the effect was stronger for regional and smaller banks. Angkinand (2009) examines whether deposit insurance can reduce the output costs of banking crises. Using data from 47 crises in 35 countries during

1970–2003, she finds that the output cost was lower for countries with high deposit insurance coverage.

In addition to reducing the possibility of bank runs, deposit insurance provides other indirect economic benefits. In particular, most deposit insurance schemes provide rules and formal mechanisms for either closing or resolving failed banks. To the extent that countries lack explicit formal rules to deal with failing banks, establishment of a formal deposit insurance scheme can provide an opportunity to establish rules and regulation to quickly resolve and close problematic banks. Forbearance, the notion of allowing banks that are insolvent to continue to operate, can generate large economic losses (Phyle 1986, Lucas and McDonald 2006). Insolvent banks have incentives to take on excessive risks to recover asset values which result in negative externalities and raise the economic costs of resolution later on. Regulators and politicians, however, tend to favor forbearance delaying the inevitable closure of insolvent financial institutions (Brown and Dinc 2005). Political considerations can come into play since closure of banks results in contraction of bank credit, which may have adverse consequences at the polls. In such cases, deposit insurance can limit regulatory discretion by mandating prompt corrective action to be taken and for the immediate closure of insolvent banks.

Moreover, there is some evidence that regulators and politicians are unwilling to enact and enforce rules to effectively supervise banks (Kane 1989). By introducing the possibility that a deposit insurance fund and ultimately the taxpayers will have to cover bank losses, deposit insurance can provide the right set of incentives for regulators and politicians for supervision. Gropp and Vesala (2004) find that the introduction of explicit deposit insurance schemes in the European Union led to lower risk-taking by banks. They attribute this to reduction in the overall implied safety net as explicit deposit insurance allowed regulators and public authorities credibly to limit the extent of what is covered under the deposit insurance scheme.

A common goal in developing countries is to expand the formal banking systems in order to deepen availability of credit. Minimizing depositors' uncertainty about the stability of the banks and their ability to redeem their deposits can help mobilize household savings. A formal banking system can then invest these household savings more efficiently. Fungacova, Weill and Zhou (2014) show that deposit insurance reduces the impact of capital on liquidity creation for banks that have relatively high retail deposits. Cull, Senbet and Sorge (2005) find that explicit

deposit insurance increases economic growth and reduces the volatility of financial activity in countries with strong institutions.

Another cited benefit of deposit insurance is that it can foster greater competition. Greater competition in the banking system has been shown to increase financial stability by reducing systemwide risk (Anginer, Demirguc-Kunt, Zhu 2014). Without an explicit guarantee, depositors are incentivized to put their saving in very large banks, which are more likely to be diversified and are more likely to benefit from implicit too-big-to-fail guarantees. Deposit insurance can level the playing field and allow smaller banks to attract deposits and thus foster greater competition in the system. Deposit insurance can also help private banks to compete against state-owned banks, which typically benefit from explicit or implicit guarantees from the government. Similarly, deposit insurance can help domestic banks to compete with foreign banks that benefit from insurance coverage from their home country.

It is important to note, however, that the benefits described above are indirect. Some of these economic benefits can be achieved with direct government policy and regulation. For instance, rules and regulations regarding the resolution of failed banks can be put in place without the introduction of explicit insurance schemes. Likewise, anti-trust rules or regulations on the activities of foreign banks can be introduced and enforced if bank competition is a problem.

5. Economic Costs of Deposit Insurance

The existence of deposit insurance guarantees that depositors will get their money back should their bank fail. This assurance, as mentioned in the previous section, brings confidence to the market, but at the same time distorts incentives of both bank managers and depositors, resulting in the well-known economic problem of moral hazard. The incentive distortions are two-fold. First, deposit insurance gives insured banks incentives to take on riskier investments, since economic profits from higher risk-taking are privately captured by the bank but losses are socialized through the deposit insurance fund. Second, since depositors are protected when a bank fails, their incentive to monitor the financial condition of their bank is significantly reduced.

The term moral hazard originated from the insurance industry with the idea that insurance often distorts behavior. Within the context of banking, these distortions on incentives are magnified. Private insurance typically insures only against losses that are clearly defined, and excludes certain types of risk from coverage, such as exclusion of suicide from life insurance coverage. These exclusions are meant to provide incentives to guard against preventable losses. Deposit insurance in this respect is not really insurance in the common usage of the term but more of a guarantee against loss. Deposit insurance covers depositors against losses resulting from any type of bank failure, regardless of the reason for that failure.

The rationale for not having exclusions goes back to the importance of having credibility in coverage that we discussed in the context of the Diamond-Dybvig model. Confidence requires an iron-clad guarantee. But, Diamond and Dybvig (1983) in their model of deposit insurance assume that banks invest in riskless assets. The incentives of depositors and bank managers to take on risk do not enter in their model. Later theoretical work extended their analyses to include investments in risky assets. Cooper and Ross (2002), for instance, analyze the relationship between deposit insurance and capital regulation in a model similar to Diamond and Dybvig's with banks having the option to invest in risky assets. In their model, deposit insurance has the benefit of preventing bank runs, but it also reduces the incentives of depositors to monitor banks. This results in excessive risk-taking.

In a banking system without deposit insurance, if a bank makes a risky loan it would need to compensate the depositors with higher rates for taking on additional risk. In a system with deposit insurance, however, depositors know that their losses are covered up to the legal limit and will not demand a higher rate for riskier loans made by a bank. The depositors are also less likely to be careful in the initial selection of their bank, monitoring its financial condition and are less likely to withdraw funds early on when financial problems first arise. This has the effect of dulling the relationship between risk and cost of funding for the bank. The bank then has incentives to take on additional risk. They can do this by either by investing in riskier assets or by increasing their leverage by reducing the amount of capital and liquid reserves they hold to enable them to weather shocks. These incentives remain in place as long as the total expected profits from banks' risk-taking are higher than the explicit costs of deposit insurance in the form of explicit premiums they have to pay and the implicit costs of insurance regulation.

Other market participants can also be indirectly affected by the protection provided by deposit insurance. Since deposit insurance reduces the possibility of contagious runs, this incentivizes other financial institutions that are not formally protected by deposit insurance to take on excessive risk or to under-provision for liquidity. In addition, deposit insurance provides incentives for financial institutions to take on correlated risks increasing systemic-wide fragility (Acharya 2009). Moral hazard can also affect regulators and politicians. They may become reluctant to curb risk-taking by banks or require insolvent banks to take remedial action because there is little or no threat of market discipline to force them to act. Deposit insurance can also provide a cover for politicians to intervene in the regulation of banks often demanding forbearance, which as discussed can be very costly.

There is a large empirical literature that examines the economic costs of deposit insurance. A number of studies examine what happens after a country implements an explicit deposit insurance scheme. Demirguc-Kunt and Detragiache (2002), using adoption by neighboring countries as an instrument, find that the implementation of an explicit deposit insurance by a country results in a higher probability of that country experiencing a banking crisis. Other studies have found that the implementation of deposit insurance reduces market discipline leading to greater risk-taking by banks. Nier and Baumann (2006) examine how deposit insurance affects capital buffers across a large cross-section of countries. They find that adoption of deposit insurance reduces capital held by banks. Demirguc-Kunt and Huizinga (2004) show that deposit insurance reduces the sensitivity of deposit rates to changes in bank risk. They show that this effect is larger for insurance systems with higher and more broad coverage, and for insurance systems that are publicly managed.

Calomiris and Chen (2016) using a large cross-section of countries find that the adoption of deposit insurance results in higher loan-to-asset and higher debt-to-equity ratios. This leads to more frequent bank defaults as a consequence of higher asset risk and higher leverage. Ioannidou and Penas (2010) find that after the adoption of deposit insurance in Bolivia, banks were more likely to initiate riskier loans without paying higher rates for taking excess risk. Similarly, removal of deposit insurance increases market discipline. Gropp, Gruendl and Guettler (2014) show that after a lawsuit removed government guarantees for savings banks in Germany in 2001, banks cut off credit lines to their riskiest borrowers and shifted their liabilities away from risk-sensitive debt instruments.

Not all studies, however, find an increase in bank risk taking. For instance, Wheelock and Wilson (1994) and Alston et al. (1994) find that deposit insurance has not led to an increase in bank failures in the United States. Karels and McClatchey (1999) also fail to find evidence that the adoption of deposit insurance increased the risk taking of U.S. credit unions. Peria and Schmukler (2001) using data from Argentina, Chile and Mexico during the 1980s and 1990s, find that depositors withdraw funds and require high interest rates during times of distress thus providing market discipline. They attribute their finding to deposit insurance schemes not being fully credible. Wagster (2007) finds an increase in idiosyncratic risk of Canadian banks and trust companies after adoption of deposit insurance, but finds that the overall risk declines.

The reason for the mixed findings could be due to other important factors, such as banks' charter values, credibility of the insurance scheme or the effectiveness of monitoring by non-deposit creditors, affecting the impact of deposit insurance on risk taking. Failure to take into account some of these factors may explain the mixed findings in the empirical literature. It is also difficult to disentangle the positive stabilizing effects deposit insurance from negative effects that result from moral hazard. While deposit insurance can increase moral hazard and make financial systems more vulnerable to crises during good times, it can also enhance depositor confidence and reduce the likelihood of contagious bank runs during crisis periods. The net effect of deposit insurance on bank risk and stability depends on whether the benefits of deposit insurance outweigh its costs. Some recent papers have tried to determine whether the "moral hazard" effect dominates the "stability effect" of deposit insurance.

Ngalawa, Tchana and Viegi (2016) argue that if the adoption of deposit insurance is associated more with bank insolvency than it is with bank runs, then one can conclude that the moral hazard effect dominates. Using an empirical approach that distinguishes liquidity problems arising from panic withdrawals of deposits from problems arising from insolvency, they find that the moral hazard costs outweigh the stability benefits of deposit insurance. Anginer, Demirguc-Kunt and Zhu (2014) examine the effect of deposit insurance on bank stand-alone and systemic risk before and after the global financial crisis. They find that more generous deposit insurance schemes increase bank risk and reduce systemic stability in non-crisis years. During the global financial crisis, they find that the bank risk is lower and systemic stability is greater in countries with more generous deposit insurance coverage. The overall effect of deposit insurance over the full sample they study remains negative, however.

A number of other factors also have an impact on how deposit insurance affects risk-taking. First, bank charter values can curb excessive risk-taking. If banks are able to earn economic rents because of reputation and valuable client relationships acquired over many years, or because of regulatory capture, the value of the bank as a going concern can be very high and the default of the bank very costly (Boot and Greenbaum 1992, Rajan 1992, Keeley 1990). Also, unlike shareholders who tend to have diversified investments over many companies, bank managers tend to have a substantial portion of their wealth as well as their business reputation tied to the performance of their bank (Anginer, Demirguc-Kunt, Huizinga and Ma 2017) which can help mitigate the effects of deposit insurance on risk taking.

Second, as deposit insurance schemes are not fully funded, they have to be credible ex-ante in order to stop contagious runs. As discussed earlier, if there is uncertainty about the insurer's ability to meet its obligations, depositors will withdraw their savings at the same time resulting in a run. The recent experiences with deposit insurance in Cyprus and Iceland reaffirm the importance of the state's ability to fund deposit insurance for it to be credible. Bonfim and Santos (2017) examine the behavior of Portuguese depositors after the announcement that insured depositors in Cyprus could be asked to share on the losses of their banks. They find that Portuguese depositors whose savings were insured still reduced their deposits in smaller and less profitable banks. This finding suggests that the depositors started actively monitoring banks as they became less certain about the credibility of deposit insurance coverage. This is consistent with earlier work, where Calomiris and Powell (2001) find that insured liabilities of banks earned dramatically different interest rates in Mexico suggesting that the depositors were uncertain about the government's ability and willingness to fund deposit insurance liabilities.

Third, monitoring by borrowers who are not covered by deposit insurance can impose discipline and curb excessive risk taking by banks. Large depositors, shareholders, and other unsecured creditors all play an important role in monitoring banks. There is empirical evidence that the amount of uninsured and subordinated debt banks carry on their balance sheet is associated with greater market discipline (Flannery and Sorescu 1996; Sironi ,2003). Moreover, since uninsured depositors can lose money when a bank fails, they will charge higher rates when a bank takes on more risk. Higher market prices provide a valuable signal of greater risk-taking by banks which can then be used by regulators to discipline those banks. A number of factors affect how well discipline by uninsured borrowers and shareholders works in practice. Flannery

and Bliss (2018) highlight the importance of financial structures, agency problems and incentives in how well market discipline works in curbing excessive risk taking.

Fourth, banks that are too-big-to-fail may benefit from implicit government guarantees for uninsured debt. There is empirical evidence that the risk is not fully priced in the cost of uninsured funding for large banks that are deemed systemically important by the market (Acharya, Anginer and Warburton 2017). Expectation of support by the market results in moral hazard problems in the form of excessive and correlated risk taking, similarly to those associated with deposit insurance. Thus, larger banks may lack market discipline regardless of whether an explicit insurance scheme protects depositors.

Finally, the way in which deposit insurance is designed and implemented varies widely from one country to the next. A number of papers emphasize the importance of specific design features in how deposit insurance affects risk. For instance, risk-based pricing of deposit premiums by regulators can lead to some of the economic costs of moral hazard to be internalized by individual banks. The recent empirical work also emphasizes the role the larger institutional environment plays in adoption of deposit insurance and how well it works. In the next section we examine some of these issues.

6. Deposit Insurance Design and the Institutional Environment

There is empirical evidence that suggests that a well-designed deposit insurance scheme combined with effective regulation and supervision can provide stability while minimizing some of the distortions introduced by deposit insurance. In particular, two key design features, coverage limits and risk-based pricing, can have important effects on how well deposit insurance functions in a banking system.

Coverage limits are common in the private insurance industry to limit and control risk. For explicit deposit insurance schemes, there are different ways in which the scope and coverage of insurance can be controlled. First, there are limits on the types of institutions that are covered. Typically, only commercial depository institutions are covered by deposit insurance. In some countries savings and broker and dealer firms are also covered. There is also variation across countries as to whether protection is extended to locally-chartered subsidiaries or locally-

domiciled branches of foreign banks. Regardless of the types of institutions covered, it is important to make membership of each type in the deposit insurance system compulsory. This increases the size of the insurance pool and prevents strong institutions from selecting out of the pool whenever the fund needs an injection of new capital. Second, there are limits on the types of deposits that are covered. In most countries, only retail savings and demand deposits are guaranteed. During the financial crisis, a number of countries extended coverage to include bank liabilities other than retail deposits. An extreme example is Ireland which instituted a blanket guarantee on all bank liabilities including interbank deposits and subordinated debt. Third, there are limits on the maximum amount of deposits that are insured under the scheme. There is much variation across countries in these limits (Demirguc-Kunt, Kane and Laeven 2014). In the United States, the guaranteed limit amount (per depositor, per bank) was increased from \$40,000 to \$100,000 in 1980. This limit was raised to \$250,000 in 2008 to restore confidence in the banking system during the crisis.

Determining the optimal coverage for deposit insurance is difficult. On the one hand, the amounts covered must be high enough to prevent runs, but on the other too extensive a coverage can reduce effective market discipline. The International Monetary Fund recommends coverage per person that is roughly one or two-times per capita GDP as a general rule for appropriate limits for deposit insurance. Empirical research suggests that more generous deposit insurance schemes in terms of coverage are more likely to suffer from moral hazard. For instance, Demirguc-Kunt and Detragiache (2002) estimate that countries where the deposit limit is four times GDP per capita are five times more likely to suffer a banking crisis than countries where the deposit limit is less than the GDP per capita. Coverage should exclude large depositors, subordinated debt holders, and correspondent banks, convincing them that their funds are at risk. This will incentivize them to enforce effective private monitoring to complement official supervision of the institutions.

Charging banks risk-adjusted premiums is another way to alleviate moral hazard. Premiums for providing deposit insurance to banks can be based on a flat rate or they can be based on the risk each bank poses to the system. Compared to flat-rate premiums, risk-adjusted premiums force insured institutions to internalize the costs of the risks that they take on and can help curb excessive risk-taking behavior. Risk-based pricing was originally pioneered in the United States in the early 1990s and quickly spread to other countries. In 1997, only Finland,

Peru, Sweden, and the United States reported charging premiums based on risk (Demirguc-Kunt and Huizinga, 1999). As of 2016, this number has increased to 55 countries. Figure 5 shows the percentage of countries that use risk-adjusted premiums by income group. Risk-adjusted deposit insurance is especially prevalent in high-income countries. In the 2016 BRSS survey, the percent of countries charging risk-adjusted premiums among the high-income countries was 78%. For the middle and low-income countries, the same percentage has been below 40%.

Although risk-adjusted deposit insurance provides a way to internalize banks' risk taking, it is challenging to determine the premium that should be charged to the banks. Typically, banks' examination ratings, capital adequacy, liquidity and asset quality are used to determine premiums. The FDIC, for example, assigns banks to several risk categories based on the banks' capitalization level and supervisory rating, and then charges a different insurance premium for each risk category. Some of the measures used can be subjective and crude, and are usually better at explaining past and current risks rather than future risks. This naturally incentivizes banks to take on new risks once the premiums are determined as a way to game the system. It may also take time for the regulators to understand and price-in the costs of new and unfamiliar risks. The premiums are also based on banks' stand-alone risk. The costs of insuring deposits and resolving failed banks, however, are much higher when multiple failures occur at the same time. Moreover, deposit insurance based on stand-alone bank risk can encourage banks to take excessive systemic risk. Pennacchi (2006), for instance, shows that banks have incentives to take on excessive correlated risk when insurance premiums are set to an "actuarially fair" value. Laeven (2008) shows that countries have typically underpriced deposit insurance because banks in many developing countries cannot afford to pay actuarially fair premiums. Nonetheless, empirical evidence suggests that risk-adjusted premiums work better than flat-rate premiums in reducing excessive risk taking by banks (Demirguc-Kunt and Detragiache 2002, Hovakimian, Kane and Laeven 2003).

Another way to correct the incentive distortions caused by deposit insurance is to complement it with robust supervision and regulation of the banking system. More generous deposit insurance schemes are associated with lower capital buffers, making banks more fragile to shocks (Bier and Baumann 2006, Fonseca and González 2010). Theoretical models of deposit insurance suggest that banks with lower capital ratios have more incentives to take advantage of the deposit insurance subsidy by taking on more risk (Merton 1977). More stringent capital

requirements are one way to prevent banks from taking on excessive risk. Higher capital requirements result in bank shareholders having greater skin in the game, reducing their incentives to shift risk on to taxpayers. Cooper and Ross (2002) in a theoretical model show that additional capital requirements can reduce excessive risk-taking incentives of banks under deposit insurance. Although higher and more stringent capital requirements help reduce some of the moral hazard problems, they do not completely eliminate them. Havokimian and Kane (2000) find that risk-based capital requirements did not prevent large U.S. banks from shifting risk onto the safety net. Similarly, Barth, Caprio and Levine (2002) show that tight capital regulations only have a marginal effect in reducing the adverse impact of deposit insurance on bank fragility.

Public monitoring and supervision can also reduce the negative effects of deposit insurance on risk taking. Bank examinations are a common feature of deposit insurance schemes. Examinations allow regulators to closely monitor liquidity and asset risks of banks as well as their internal operational and risk management systems. Experience has shown, however, that simply monitoring financial statements is not sufficient to reduce bank risk. Effective monitoring and supervision require authorities to have the power to take preemptive measures before problems arise and to take timely corrective action when they do happen. For instance, supervisors may limit certain bank investments or limit the extent to which banks can engage in correlated risk-taking activities. It is also important for the supervisors to have authority to quickly and efficiently resolve failed banks. Failure to close banks on a timely basis can significantly increase insurers' liability as banks have incentives to take on even greater risk when they are close to default (Phyle 1986, Lucas and McDonald 2006). There is cross-country evidence that efficient public monitoring and greater supervisory power reduce the impact of deposit insurance on risk. Anginer, Demiguc-Kunt and Zhu (2014) consider how a bank supervisory quality index, which measures whether the supervisory authorities have the power and the authority to take specific preventive and corrective actions, such as replacing the management at a particular bank, affects the relationship between deposit insurance and bank system fragility. They find that better bank supervision can help mitigate the adverse consequences of deposit insurance while low bank supervisory quality exacerbates the negative impact of deposit insurance on bank stability.

Private monitoring by market participants such as uninsured lenders, shareholders and rating agencies can also reduce the adverse effects of deposit insurance. Anginer and Demiguc-Kunt (2013) show that greater private monitoring of financial institutions leads to lower systemic fragility in the banking sector. They also emphasize the role of information transparency. It is difficult for uninsured debtholders or shareholders to effectively monitor their investments unless they get reliable financial information about the banks they invest in. Stringent disclosure rules, independent outside audits and availability of public and private credit rating agencies all increase transparency and allow for greater discipline by market participants (Djankov, McLiesh and Shleifer 2007).

Both public and private monitoring mechanisms discussed above will not work unless they can be credibly enforced in an environment where the rule of law prevails. Effective regulation and supervision require consistency in the enforcement of rules, independence from interference by politicians and accountability of regulators to the taxpayers. Effective private monitoring also requires strong rule of law. In particular, enforcing debt contracts and covenants, holding directors and managers accountable for fraud, and protecting minority shareholders from self-dealing all require a strong independent judiciary and laws protecting shareholder and creditor rights.

A number of papers emphasize the importance of rule of law in how well deposit insurance works. In poor institutional settings, generous design features tend to destabilize the banking system and to undermine market discipline. Demirguc-Kunt and Detragiache (2002) consider the effect of various measures of institutional quality, such as the effectiveness of regulation and supervision and strength of the legal system, on deposit insurance. They find that explicit deposit insurance increases the probability of a banking crisis, but that this effect is lower in countries with higher levels of institutional quality. Angkinand (2005) and Angkinand and Wihlborg (2008) also analyze the impact of institutional variables such as rule of law, corruption and shareholder rights on the relationship between deposit insurance and bank system fragility. They find that an institutional environment that fosters effective monitoring mitigates the negative effect deposit insurance on bank risk. Dewenter, Hess and Brogaard (2014) find that the effect of deposit insurance varies depending on the levels of economic freedom, rule of law, and corruption in a given bank's home country. Cull, Senbet and Sorge (2004) show that in

weak institutional environments, deposit insurance reduces economic growth and financial development.

Moreover, there is empirical evidence that weak institutional environments can undermine deposit insurance design. In particular, rule of law and specific features of a country's private and public contracting environments have been shown to be important in deposit insurance adoption and design (Demirguc-Kunt and Kane, 2002, Hovakimian, Kane and Laeven 2003).

7. Concluding Thoughts

Deposit insurance is now an accepted and widely adopted policy to promote stability in the banking sector. It has long been part of the International Monetary Fund's best practice recommendations to developing countries. The global financial crisis has increased the focus on deposit insurance, with many countries either introducing or significantly increasing existing deposit insurance coverage. The crisis has also highlighted both the strengths as well as some of the shortcomings of deposit insurance. Except for a few exceptions, there have not been contagious runs by retail depositors, but the crisis was devastating nonetheless because of its magnitude and scope.

It is now well established in the empirical literature that overall deposit insurance may ensure depositor confidence and prevent bank runs, but it also comes with an unintended consequence of encouraging banks to take on excessive risk. The empirical evidence points out the importance of design features and shows that poorly designed schemes can increase the likelihood that a country will experience a banking crisis. It is important for deposit insurance schemes to incorporate features to help internalize risk-taking by banks. In addition to the specific design features, deposit insurance that is complemented by more stringent capital regulations and a system in which supervisors are empowered to take prompt corrective action, tend to function more effectively in practice. It is also important for countries to cultivate an environment in which private market participants such as large uninsured depositors, shareholders and other creditors have the right set of incentives to monitor the banks they invest in. Most importantly, both public and private monitoring can only be effective in countries that have strong institutions and rule of law. In countries that lack strong institutional environments, explicit deposit insurance can end up doing more harm than good in terms of improving financial

stability. In summary, the impact of deposit insurance can be unpredictable. Whether it benefits or harms a country depends on how well it is designed and administered.

Figure 1: Number of countries with explicit deposit insurance

This figure shows the number of countries with explicit deposit insurance schemes in each income category. The data is from Bank Regulation and Supervision Survey conducted by the World Bank.

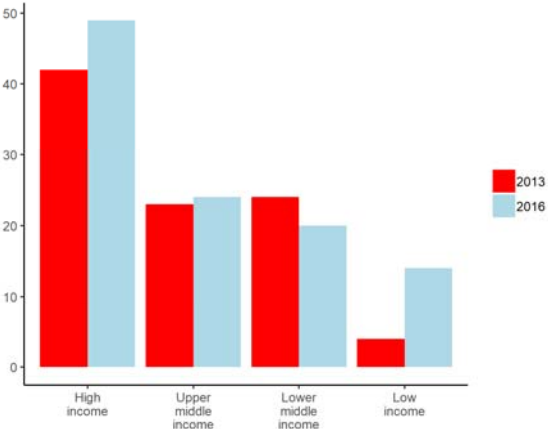


Figure 2: Percentage of countries with explicit deposit insurance

This figure shows the percentage of countries in each income group that have explicit deposit insurance. The dotted bar shows the increase in percentage since 2013. The red bar shows the percentage of countries with no explicit (implicit) insurance schemes. We assume that any country that lacks explicit deposit insurance scheme has implicit deposit insurance. The data is from Bank Regulation and Supervision Survey conducted by the World Bank.

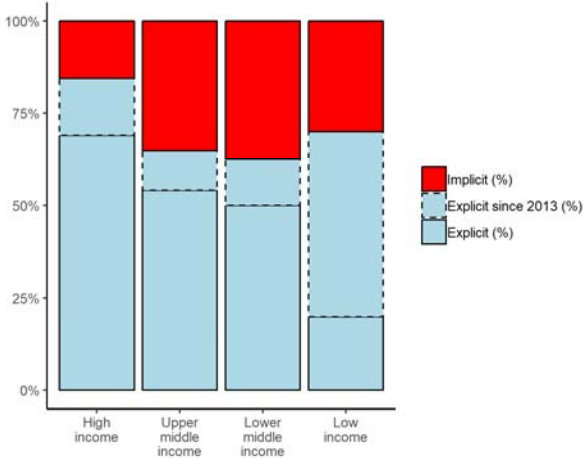


Figure 3: Percentage of bank liabilities covered by deposit insurance

This figure shows the average percentage of total bank liabilities that are covered by deposit insurance across countries in each income group in the year 2016. The data is from Bank Regulation and Supervision Survey conducted by the World Bank.

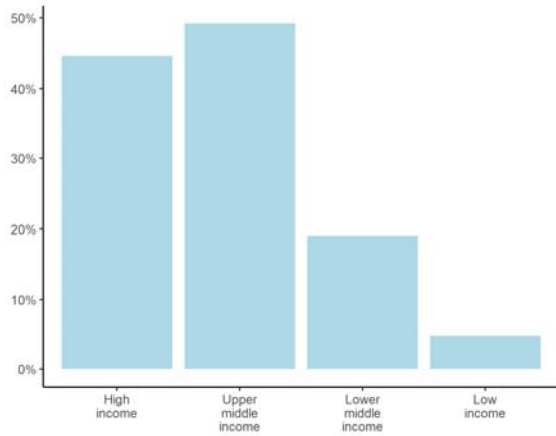


Figure 4: Percentage of countries that have increased coverage as a result of the financial crisis

This figure shows the average percentage of countries implementing changes to the deposit system as a result of the 2007-2009 global financial crisis. A country is included in the Amount increased category if it has increased the limit on amounts covered by deposit insurance. A country is included in the Coverage increased category if it has increased deposit insurance coverage in terms of types of depositors and accounts included in the insurance system. The data is from Bank Regulation and Supervision Survey conducted by the World Bank.

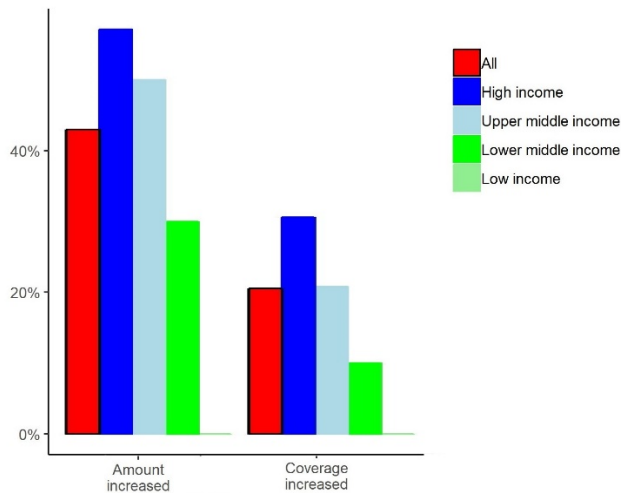
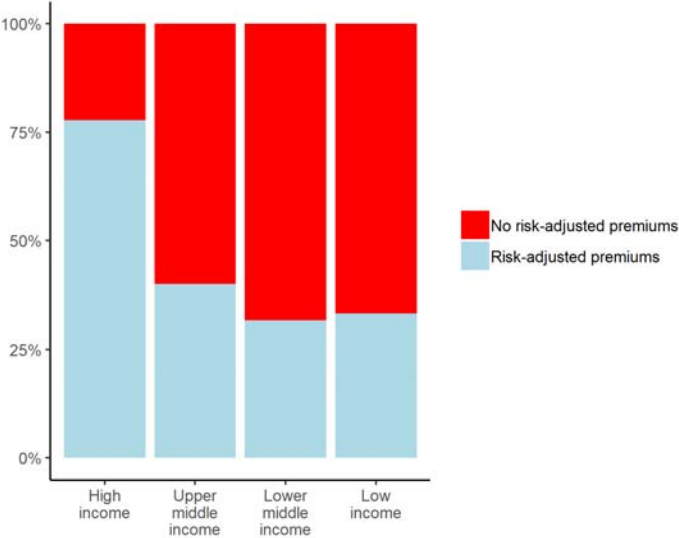


Figure 5: Percentage of countries that charge risk-adjusted premiums

This figure shows the percentage of countries charging risk-adjusted premiums for deposit insurance coverage in each income category. The data is from Bank Regulation and Supervision Survey conducted by the World Bank.



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