WWW.WORLDBANK.ORG/FINSAC

DEPOSIT INSURANCE SYSTEMS: ADDRESSING EMERGING CHALLENGES IN FUNDING, INVESTMENT, RISK-BASED CONTRIBUTIONS & STRESS TESTING

Edited by Jan P. Nolte & Isfandyar Z. Khan

November 2017

WORLD BANK GROUP
Finance & Markets
Financial Sector Advisory Center (FinSAC)

Contents

1818 H Street NW
Washington DC 20433
Telephone: 202-473-1000
Internet: www.worldbank.org

INTRODUCTION

A well functioning financial sector safety net is an essential elemement for a financial sector. It guarantees the safety of the banking system and its deposits, inspires confidence in the system and safeguards against any shocks. The global financial crisis of 2008/9 highlighted, among other things, the need for countries to strengthen one pillar of this safety net, their deposit insurance frameworks[1], to ensure a high degree of depositor confidence in the financial system.

As a direct response to the crisis, IADI (the International Association of Deposit Insurers[2]) published first jointly with the Basel Committee for Banking Supervision in 2009 the Core Principles for Effective Deposit Insurance Systems. The Core Principles (updated in 2014) cover a wide range of issues - including mandate and powers, funding, payout capacity and contingency planning as well as crisis management of the DIS and its staff. The Core Principles stipulate a minimum standard against which deposit insurance schemes around the world benchmark themselves. Since its publication, the Core Principles have supported many deposit insurance related reforms around the world and have been instrumental in setting up new schemes.

In the European Union, the Deposit Guarantee Scheme Directive which was first effected in 1994 underwent a thorough reform process after the crisis. It was replaced with the introduction of a 'maximum harmonization' Directive on Deposit Gurantee Schemes (2014/49/EU) to be followed in all Member States. The Directive added increased protection for depositors, a minimum target level for the deposit insurance funds, risk-based premiums, investment rules for the deposit insurance fund as well as a requirement for stress testing. The Directive is in the process of being fully implemented in the EU. But its reach goes beyond its Member States as other countries in the wider region use the Directive as a guiding principle for their own frameworks.

The Financial Sector Advisory Center (FinSAC) has responded to the need for deposit insurance reform and engages with various stakeholders to strengthen deposit insurance schemes in its client countries. Based in Vienna, FinSAC is a dedicated technical unit of the World Bank's Finance & Markets Global Practice that aims to deliver policy and technical advice and analytical services to client countries in the Emerging Europe and Central Asia (ECA) region[3]. Until today, it has sponsored technical assistance for deposit insurance projects in countries such as Bosnia and Herzegovina, Bulgaria, Croatia, Montenegro, Romania and Serbia.

---

[1] Deposit insurance is a system established to protect depositors against the loss of their insured deposits in the event that a bank is unable to meet its obligations.

[2] www.iadi.org

[3] FinSAC was established in June 2011 through joint collaboration of the Austrian Ministry of Finance and the World Bank's Private and Financial Sector Department. A Trust Fund Agreement, financed by the Austrian Government, was signed between the parties and FinSAC opened its offices in September 2011 with the creation of a Technical Advisory Center in Vienna.

The four guidance papers of this FinSAC publication are dealing with topics which have been identified during the technical assistance projects as important, current issues for deposit insurance practitioners where further guidance is needed. The topics are of interest for all types of deposit insurance systems irrespective of its mandate[4]. They deal with aspects of funding (the ability of the deposit insurer to calculate its financial needs), investment (the challenge of the deposit insurer to find safe and highly liquid investments in the current investment climate), risk-based contribution (how to develop a model which takes into account the individual risk of banks) and, finally, how to perform stress testing of a system (to be better prepared for future crisis and ensure rapid response to different scenarios).

We hope that deposit insurers as well as other members of the financial safety-net such as central banks and supervisors will find this publication helpful for their work.

[4] Typical mandates can be broadly classified into four categories: Pay Box; Pay Box Plus; Loss Minimizer; and Risk Minimizer.

DETERMINING THE TARGET DEPOSIT INSURANCE FUND: PRACTICAL APPROACHES FOR DATA-POOR DEPOSIT INSURERS

John P. O'Keefe & Alexander B. Ufier

WORLD BANK GROUP
Finance & Markets
Financial Sector Advisory Center (FinSAC)

Contents

1. Introduction

The main public policy objectives of a deposit insurer are to reimburse depositors after bank failure and to contribute to the stability of a financial system. To achieve these objectives and to build public confidence in a deposit insurance system, deposit insurers must have operational readiness to be able to act quickly after a bank failure. Sound funding arrangements are essential aspects of such readiness, as they ensure prompt reimbursement of insured depositors and sufficient funds for the deposit insurer to unwind the institution. Depositor confidence depends, in part, on knowing that adequate funds for deposit insurance would always be available to ensure the prompt reimbursement of their claims. It is therefore considered a best practice to build credible ex-ante funding mechanisms which have the financial capacity to ensure that these obligations are met.

The appropriate method to determine the adequacy of a Deposit Insurance Fund (DIF), according to internationally accepted best practice by the International Association of Deposit Insurers (IADI), is the Target Fund Ratio (or Reserve Ratio).[1] The Target Fund Ratio is the ratio of the balance in the DIF to estimated insured (or for some countries, total) deposits in the banking system, and each country is encouraged develop their own target level and funding path to achieve said target based on their financial obligations using relevant data and a transparent methodology. Each national target fund is likely to differ to some degree based on the level of financial development, banking concentration, and regulatory environment, in addition to meeting minimum demands placed on them by other voluntary agreements such as the EU Directive on Deposit Guarantee Schemes.[2] This target fund level should be reviewed regularly and the method to calculate it subject to validation in accordance with changing financial conditions.[3]

This paper presents a framework to assist deposit insurers in determining a Target Fund Ratio. The framework takes into consideration the role that credit and liquidity risks play in bank failure. The goal of the paper is to show how deposit insurers might adapt the Target Fund Ratio framework to their economies and overcome the data limitations many jurisdictions face when attempting to determine potential deposit insurance losses. The framework has previously been applied to determine the Target Fund Ratio for deposit insurers in Nigeria, Zimbabwe (both as **World Bank executed technical assistance projects with the financial support from FIRST initiative**) and the U.S (O'Keefe and Ufier 2016a, O'Keefe and Ufier 2016b.) Data for the U.S. Federal Deposit Insurance Corporation (FDIC) is used in this paper.[4]

---

[1] See IADI (2009, 2014).

[2] Art. 10 (2) of Directive 2014/49/EU.

[3] See "IADI Core Principles for Effective Deposit Insurance Systems", November 2014, p.29.

[4] We do not present target fund model results for the Nigeria Deposit Insurance Corporation (NDIC) and Zimbabwe Deposit Protection Corporation (DPC) in this paper.

1.1. Deposit Insurance Funding

There exists a vast literature on deposit insurance that examines all elements of deposit insurance schemes, with the largest question addressed by this literature being "how should the deposit insurer pay for bank-failure resolution and related insurance costs?" IADI has synthesized much of this literature and IADI (2009) discusses three funding options: 1) funding used to resolve a bank failure that is received *prior* to the bank's failure (ex-ante funding); 2) funding received *after* the bank's failure (ex-post funding); and 3) hybrid approaches that combine ex-ante and ex-post funding. There are pros and cons to each funding alternative. Ex-ante funding can help avoid delays compared to ex-post funding, with delays often being potentially very expensive. Presence of a fund can improve public confidence. It is arguably fairer to fund ex-ante as failed banks contribute to the fund prior to failure as opposed to only collecting taxes from survivors. Risk-based premiums can be used to discourage risky behavior easily in ex-ante settings but less so in ex-post ones, and premiums can be adjusted to reduce pro-cyclicality in bank profits to spread resolution costs but cannot in ex-post regimes. However, ex-ante funding comes at the cost of lost capital to banks that may otherwise have put it to better use outside the insurance fund. It places high burdens on individual banks in markets with few banks compared to ex-post funding, imposes administrative costs to manage the fund that would not exist were it collected ex-post, and introduces issues of moral hazard for both the banks and the fund managers of having a large standing resolution fund (IADI 2009).

IADI (2009) concludes that the benefits of ex-ante funding outweigh the costs and that ex-ante funding of deposit insurance is preferred to ex-post, especially for recently established deposit insurance systems.[5] IADI (2009) states that most deposit insurance funding schemes combine elements of ex-ante and ex-post funding, as it is likely beneficial from a social welfare perspective to spread failure-resolution cost recovery over a long period before, during, and after a severe crisis. IADI (2009) states that the target deposit insurance fund should, at a minimum, be adequate to absorb insurance losses the insurer might incur under "normal" circumstances. As a result, this paper seeks to estimate the necessary size of an ex-ante deposit insurance fund and leaves ex-post deposit insurance schemes for future work.

[5] IADI (2009) states that 80 percent of deposit insurance schemes at that time used ex-ante funding.

1.2. Determining the Target Deposit Insurance Fund

IADI (2009) states that the majority of countries use their historical experience with bank-failure losses to determine the target deposit insurance fund. Given sufficient data on failure costs, a deposit insurer can estimate the empirical frequency distribution of losses and use that distribution to determine the level of losses the insurance fund should be able to absorb. This approach to determining the target deposit insurance fund is known as the **Loss Distribution Approach**. However, countries with limited experience closing failed banks will lack sufficient data to develop an accurate empirical loss distribution and may have difficulty estimating the likelihood of low-probability, high-loss events. As a result, practitioners must calibrate observed losses to an assumed probability distribution of losses, and results are highly sensitive to assumptions made in estimating the likelihood and size of low probability, high loss events. This approach is inherently backward looking and cannot take into consideration recent changes in the banking industry profile as well as the regulatory environment.[6]

A more forward looking alternative to the Loss Distribution Approach is the **Credit Portfolio Approach** that allows one to incorporate the effects of current economic conditions into deposit insurance losses. The Credit Portfolio Approach to modeling the target deposit insurance fund is based on the model of bond pricing by Merton (1974) and the loan portfolio model of Vasicek (1987, 1991 and 2002), hereafter the Merton-Vasicek Model. Merton (1974) develops a model for the pricing of corporate bonds that takes into account the possibility the issuing firm might default on payments. Merton (1974) presents the simple case of a corporation financed by a single bond and equity. In the model, bondholders have a claim on all of the corporation's assets should the corporation default on bond payments while equity holders receive nothing. Merton recognizes that bond holders have a call option of the value of the firm's assets, therefore, bonds can be priced using the Black and Scholes (1973) option pricing framework. Under Merton's approach, a firm fails when the market value of firm's assets (call option value of the bond) falls below the nominal value of the firm's obligations to bond holders. Merton recognized this default model generalizes to failures occurring when the market value of a corporation's assets falls below the nominal value of the corporation's liabilities and all of the corporation's creditors can be viewed as having call options on the corporation's assets.

Vasicek (1987, 1991 and 2002) generalizes the Merton (1973) framework to model losses on loan portfolios. Vasicek assumes obligors' asset value changes are determined by idiosyncratic and systemic risk factors. The systemic risk factor is common to all obligors (i.e., the state of the economy). In the Vasicek model, changes in the value an obligor's assets are correlated with that of other obligors through the common risk factor. Finally, the correlation among obligors' asset values changes determines the correlation among obligor defaults. The possibility of correlated default events is particularly important to models of the target deposit insurance fund.

---

[6] Potential concerns include deregulation, changes in depositor preference, changes in deposit insurance assessment schemes, or any number of banking rule changes.

The Credit Portfolio Approach assumes that the features of the financial safety net that can influence deposit insurance costs are captured in historical data and do not change over the forecast horizon. This approach has been used to model the target deposit insurance fund for many countries, including Colombia (Fogafin, 2013), Canada (CDIC, 2011), Singapore (Oliver, Wyman & Company, 2002), Nigeria (Katata and Ogunleye, 2014) (O'Keefe and Ufier, 2016a), and Zimbabwe (O'Keefe and Ufier, 2016b), supporting its use in a similar setting in this paper. The Credit Portfolio Approach allows for a forward looking view of banking industry risk through separate estimates of bank probability of failure, correlation in failures, insurer exposure, and losses given failure. This will provide estimates superior to a loss distribution approach with lower data prerequisites that can easily be applied and customized for numerous national settings.

2. Proposed Target Fund Framework

Using a Merton-Vasicek based model, the Credit Portfolio Approach, to estimate deposit insurance losses allows deposit insurers to revise the target fund estimate as industry conditions change. It does not attempt to model the indirect influences of the financial sector safety net on deposit insurance costs but rather assumes these effects are reflected in model input data. Expected losses are expressed by equation 1.

$$Expected\ Losses\ in\ state\ of\ world\ t = PD_t \times LGD_t \times EAD_t \quad (1)$$

Where EAD_t is the overall exposure at default in state of the world t, LGD_t is the loss rate per default in state of the world t, and PD_t is the probability of default in state of the world t. This model will generate failures PD_t based on measures of default probabilities as well as correlations of defaults, and use rules developed from data on loss given default LGD_t and exposure at default EAD_t, in a simulation to yield total expected losses and as a result a necessary fund level given a certain level of risk tolerance. Before discussing each component that together generates losses, we will discuss differing states of the world which may affect all of the components and thus how we estimate each of these components of the default model.

2.1. Identifying States of the World

In order to develop a robust estimate of deposit insurance fund adequacy, we consider how deposit insurance losses vary under different macroeconomic conditions as denoted by subscript t. Specifically, we consider three states of the economy–a severe economic downturn (crisis period), the average conditions over a business cycle (through the cycle) and current (normal) conditions–and calibrate the target fund simulation model to these states. In each of these states, we generate defaults from observed defaults and correlations of returns that contribute to *PD* as well as to select different parameters for *LGD* and *EAD*.[7] In order to identify these periods, we analyzed U.S. macroeconomic economic data over the period 1983:Q4 – 2016:Q1 and identified quarters of the worst economic performance, employing both general macroeconomic indicators as well as measures of bank condition in this analysis. Our approach is to first identify the combination of economic indicators, e.g., civilian unemployment rate, gross domestic product, that best explain variation in the economic data for the U.S. and subsequently study how the economy, as characterized by these indicators, changes over time. Specifically, we use **principal component analysis** (PCA) to reduce analysis to a single composite variable–the first principal component. Further information about principal components analysis and extensions to this approach that can refine period selection can be found in appendix A.

[7] These three views of the economy are designed to show variation in potential deposit insurance losses and are similar in spirit to the views of the economy used in mandatory capital stress-tests for U.S. banks.

2.1.1. Constructing Principal Components

We used the following measures to differentiate U.S. crisis from non-crisis periods: *GDP growth, civilian unemployment rate, labor force participation rate, net exports as a share of GDP, inflation as measured by the consumer price index, and nonperforming bank loans as a share of total loans*. We use principal component analysis to create six principal components from these six variables. We focus on the first principal component in this analysis, PC_1, which explained 39 percent of the overall variation in the chosen economic data. Table 1 presents the variable weights for six key economic indicators for the period 1983:Q4 – 2016:Q1. These factor weights suggest that higher (lower) values of PC_1 imply worse (better) economic conditions.[8]

Table 1:
Macroeconomic Variables used to Explain U.S. Economic Conditions (1983:Q4 – 2016:Q1)

Variable	Variable Weight for First Component[9]
GDP Growth	-0.24
Labor Force Participation Rate	-0.50
Net Exports, % of GDP	-0.03
Civilian Unemployment Rate	0.57
Consumer Price Index	0.27
Nonperforming Bank Loans, % of Loans	0.54

We recover the values for the first principal component for the U.S. between 1983:Q4 and 2016:Q1 using the weights as illustrated by equation 2, and then sort years from best to worst using the principal component.

$$PC_{1,2009:Q1} = (-0.24) \times GDP\ Growth_{2009:Q1} + \ldots + (0.54) \times NPL/Loans_{2009:Q1} \quad (2)$$

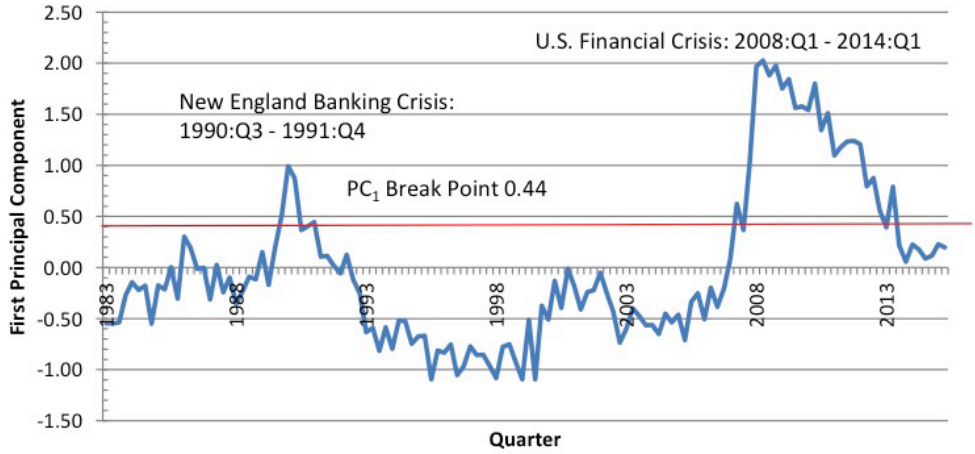
[8] A country may see a reversed scale from what is shown here, with higher values meaning better performance and lower values meaning worse performance. It will cause more interpretation problems if signs were mixed - for example, unemployment rate and GDP growth having the same direction of weights - that require deeper investigation of variables included in the principal components.

[9] If each of these weights is squared, then each column will add up to 1.

2.1.2. Identifying Crisis Periods

After sorting years by relative level of economic stress, the second step in crisis period identification is to determine a cutoff value of the first principal component to distinguish between crisis and non-crisis periods. For this, we use a ***Bai and Perron break test*** to find a single break in the data series for PC_1 when arranged from highest (here, the worst) to lowest (here, the best) PC_1. Note that we are not arranging quarters chronologically, but by value of their principal component. We identified a break point in the PC_1 series at size-ranked observation 104 of 130 which corresponds to a *PC1* value of 0.44. We identify values with higher PC_1 values than the cutoff as crisis periods. We observe that the crisis period quarters happen to be in two distinct bands, as shown in figure 1. As additional support for the PC_1 approach, we find the worst PC_1 (2.03) occurred in 2009:Q3 which corresponds closely to the height of the most recent U.S. financial crisis.

Figure 1:
First Principal Component: U.S. Macroeconomic Indicators (1983:Q4 – 2016:Q1)



Based upon our analysis of U.S. economic data for the period 1983:Q4 – 2016:Q1 there are two distinct crisis periods. The first crisis period occurred during the period 1990:Q3 – 1991:Q4 which largely coincides with the New England banking crisis. The second crisis period we identified occurred during the period 2008:Q1 – 2014:Q1 which generally coincides with the recent U.S. and global financial crisis, and slow economic growth thereafter. The start of these crisis periods roughly correspond to those identified by the National Bureau of Economic Research (NBER), a private nonprofit research group with expertise in identifying U.S. business cycles that is widely cited by U.S. academic and government economists. The first NBER period is July 1990 – March 1991 and the second period is December 2007 – June 2009. It is important to point out that the NBER methodology differs from ours and is focused on "peak-to-trough" business cycles while we are focused on the severely adverse economic downturn periods.[10] Our periods likely last considerably longer as our model includes nonperforming loans and unemployment, which tend to lag behind general measures of economic performance such as GDP. We will use the data from both of these periods combined to form our estimates for crisis period parameters.

[10] Business cycle dates are available at the NBER website, http://www.nber.org/cycles/cyclesmain.html

2.1.3. Calibrating to Other Periods

In addition to identifying crises periods, we also wish to calibrate the target fund model to conditions over a full business cycle, as well as current economic conditions. The NBER states that of the 11 business cycles they identified for the period 1945 – 2009, the average time from one trough to the next trough was about 70 months or just under 6 years, and the longest cycle from previous trough to peak was 120 months or 10 years. To ensure we capture as much of a full business cycle as possible, we use the most recent 10-year period **2006:Q1 – 2016:Q1** as our **through-the-cycle period**. Finally, we use the most recent two-year period, **2014:Q1 – 2016:Q1**, as our **current period**. Table 2 combines our findings for U.S. economic state identification.

Table 2:
Crisis Period and Business Cycle Identification

Economic State	Periods
Crisis	1990:Q3 – 1991:Q4 2008:Q1 – 2014:Q1
Through-the-Cycle	2006:Q1 – 2016:Q1
Current	2014:Q1 – 2016:Q1

This model explicitly treats each of these periods as different data generating processes, as opposed to assuming that there is a single data generating process and crises, for example, are particularly low draws from the asset returns process. The crisis parameters would be assuming a distribution of returns calibrated only on the worst years, current times calibrated on average years at the center of a single distribution, and through the cycle calibrated on all years. Differing approaches to generating default probabilities and segmenting data generating processes can generate different results, and regulators should carefully consider their calibrations to match their own business cycle experiences.

3. Probability of Bank Failure

This section focuses on the *PD* element of the default model, here probability of bank failure, which section 6 builds on by considering the correlation of returns and thus failures between different financial institutions. This *PD* constitutes the most heavily modeled portion of the target fund framework, and will be composed of credit failures PD_c, liquidity failures PD_l, and systemic failures PD_s, each coming from asset return simulations:

$$PD = PD_c + PD_l + PD_s \tag{3}$$

3.1. Types of Failures in Simulation Study

The 2007 – 2009 global financial crisis showed that the interaction of credit and liquidity risks, coupled with systemic market shutdowns, can lead to catastrophic deposit insurance losses. We begin by discussing our conceptual approach to simulating bank failures caused by credit risk PD_c, followed by descriptions of the interaction of credit and other risks, liquidity and systemic risk, through the simulation.

3.1.1. Credit Failures

For the purposes of this discussion, obligor default is synonymous with bank insolvency or failure. As stated previously, in a Merton-Vasicek Model obligors are assumed to default when their wealth or total asset value falls below that of their outstanding liabilities. Equation 4 expresses an asset's one-period gross return as a weighted average of systemic and idiosyncratic risk measures. In equation 4, R_i is the one-period asset return, w_i is the weight placed on a single systemic risk factor, X, and n_i is the weight placed on idiosyncratic risk factor, E_i. The systemic risk factor is something faced by all actors–high unemployment, asset price collapses or changes in a government policy that affect bankruptcies may affect the credit quality of loans held by all banks, for example. The idiosyncratic risk factor is specific to the bank–several of its lines of business may be doing particularly well or poorly. All obligors face the same systemic risk and while X can be a set of several risk measures Gordy (2000) shows these risks can be reduced to one systemic risk factor. Conversely, each obligor i has different idiosyncratic risk, E_i.[11]

$$R_i = w_i \times X + n_i \times E_i \tag{4}$$

[11] This discussion of asset return process is based largely on Gordy (2000). Gordy shows that one can view the asset return generation process as being driven by a latent variable that is also determined by systemic and idiosyncratic risks.

Without loss of generality the Merton-Vasicek Model assumes that X and E_i are standard normal random variables, hence asset returns, R_i , are also distributed as standard normal random variables.[12] As we shall see in subsequent sections of this paper the use of standard normal random variables greatly simplifies quantification of insurance losses.[13] Obligor default occurs when the change in the value of their assets is less than or equal to some critical value, C_i :

$$w_i \times X + n_i \times E_i \leq C_i \tag{5}$$

A more common representation of the asset return model is shown in equation 6.

$$R_i = \sqrt{p} \times X + \sqrt{1 - p} \times E_i \tag{6}$$

In equation 6 the term p is the correlation between firms' asset returns and is assumed to be identical across any two firms. We next describe the asset return and failure simulation process in general terms; specifics on model calibration are presented in sections 6 and 7.

3.1.2. Monte Carlo Simulations of Credit Failures

To create a loss distribution for a nation's banking sector, we must first create a frequency distribution of bank failures using a Monte Carlo simulation of asset returns. Rather than comparing simulated bank asset returns and ending asset values to those of liabilities, the Monte Carlo simulation takes a more straightforward approach to simulating failure events; failures are assumed to occur whenever a randomly chosen asset return is more negative than that implied by the bank's expected failure probability.

Using the assumptions of the Merton-Vasicek Model the asset return associated with an expected failure probability can be obtained by taking the inverse of the cumulative standard normal density function, evaluated at that failure probability, as shown is equation 7:

$$R_i = \Phi^{-1} \left(\textit{Expected Failure Probability}_i \right) \tag{7}$$

Using this approach, we are assured that the simulated failure rate for each bank out of a large number of random draws of asset returns equals the expected failure probability. We use three sources of information on expected failure probabilities—a logistic regression model of bank failure, bank failure rates associated with banks' issuer default ratings, and actuarial failure rates.

---

[12] Standard normal random variables are normalized by subtracting the mean value of the variable and dividing this difference by the standard deviation. Hence, a standard normal random variable has a mean of zero and standard deviation of one.

[13] Notice, equation 4 does not include a time subscript since the default model is a one period model.

We use the Merton-Vasicek Model assumptions to randomly sample asset returns. Specifically, we generate asset returns by taking random draws of values of the idiosyncratic and systemic risk factors in equation 6. Next, we use an estimate of the correlation in bank failures based on bank stock return correlations to weight the risk factors and sum the weighted terms to get a single random draw of the asset return. As shown in equation 8, bank failure is assumed to occur whenever the simulated asset return is more negative than that implied by the failure probability estimate (worse than the stated critical value C_i.) As stated at the beginning of this section, equation 8 only refers to credit failure events.

$$If\ R_i < \Phi^{-1}\ (\ Expected\ Failure\ Probablity_i\ )\ then\ Bank\ i\ Fails \tag{8}$$

We calibrate the systemic risk factor to an economy using the mean and standard deviation of the annual GDP growth rate. Since the idiosyncratic risk factors are standard normal random variables, we generate failure events by random draws from the weighted sum of a normal random variable and a standard normal random variable and using expected failure probabilities to determine the failure threshold for asset returns.

3.1.3. Liquidity Failures

Banks rely on a variety of short-term funding sources and interruption in funding can make it impossible for banks to continue operations. This was the case during the 2007 – 2009 global financial crisis when interbank lending and loan securitization markets froze as a result of heightened uncertainty about banks' conditions. Without the immediate provision of liquidity from the central bank and other support programs, many of the largest banks in the U.S. and other countries faced failure.

Because of the existence of these liquidity programs, observed failure rates during this crisis were lower than they otherwise would have been. Had these institutions instead failed, higher costs would have accumulated to the deposit insurer. Additionally, if the deposit insurer were funding some of these emergency programs, they would incur additional costs. Ignoring these near-failures due to liquidity would potentially underestimate the liability that could accumulate to the deposit insurer in times of financial distress. Thus, we expand failures beyond just credit defaults to include the possibility of liquidity defaults as well, PD_l. We consider the possibility of liquidity failures by assuming that banks will lose a significant portion of uninsured deposits and other short-term funding if their asset returns place them "near" credit failure status and no further government guarantees are forthcoming. At this point, fire sales of assets to meet liquidity demands may drive the bank to failure. The near credit failure threshold is admittedly subjective and regulators can consider conditions for

their country, but this provides a useful overlay to increase bank default risk. We assume a near-credit-failure event occurs whenever the asset loss is 90 percent or more of that which would cause a credit failure, excluding the previously discussed credit failures, as shown in equation 9.

$$If\ 0.90 \leq \frac{R_i}{\Phi^{-1}(PD_i)} < 1.0\ and\ R < 0\ then\ bank\ i\ experiences\ a\ liquidity\ failure \tag{9}$$

In simpler terms, equation 9 increases bank failure rates via directly tightening the default threshold to account for the possibility that liquidity failures may occur in weakly capitalized banks, such as self-fulfilling runs and asset fire sales.

3.1.4. Systemic Failures

In addition to the credit and liquidity risks banks face, there is the possibility of a systemic event that disrupts the operations of all banks. One might model systemic risk as arising from a loss of confidence in short- and long-term interbank lending for all banks, including lending by banks outside the country to banks in-country. All interbank lending might cease at the point where borrowing lost due to all individual credit and liquidity failures exceeds a critical threshold. Taking into consideration the importance of interbank borrowing to each bank, if the lost funding exceeds an assumed threshold, banks that rely significantly on interbank funds might all fail due to the shutdown of that market. An example of how one might model systemic failures follows:

> *We wish to model the systemic risk arising from a loss of confidence in short- and long-term interbank lending for all U.S. banks, including lending by non-U.S. banks to U.S. banks. We assume all interbank lending ceases at the point where borrowing lost due to all individual credit and liquidity failures is at least 30 percent of total interbank borrowing. We also consider the importance of interbank borrowing to each bank and if the lost funding is at least 10 percent of the bank's assets the bank is assumed to fail due to the market-wide loss of interbank funds.*

Unfortunately, U.S. banks do not report sufficiently detailed information on lending to and borrowing from other banks in the U.S. and elsewhere to include systemic failures in our Target Fund Ratio analysis. This is not necessarily the case for other jurisdictions, however, and we recommend incorporating systemic risk in the Target Fund Ratio framework.

3.2. Estimating Probabilities of Failure

Moving beyond the distinct components that will compose default probabilities, we next consider data sources for those probabilities of defaults. We enumerate three approaches to estimating bank failure probabilities below: statistical models (usually logistic regressions), credit rating agency studies, and actuarial failure rates.

3.2.1. Statistical Models of Bank Failure

Deposit insurers that have extensive experience closing insolvent banks can use this information to develop statistical models of bank-failure prediction. The most commonly used approach to modeling bank failure is logistic regression in which the dependent variable is a binary (0, 1) indicator of the occurrence of bank failure within a specific time period, usually one year. The most informative explanatory variables for bank failure prediction will vary across countries; however, the bank-failure prediction literature finds bank financial measures of capital adequacy, asset quality, management quality, earnings strength, liquidity, and sensitivity to market prices (hereafter, CAMELS attributes) are frequently informative explanatory variables. As an example, we estimated a stepwise logistic regression of the determinants of bank failure within a given one-year period, using the CAMELS attributes as explanatory variables. Specifically, we used measures of the CAMELS attributes as of quarter-ends 2014:Q1, 2015:Q1 and 2016:Q1 as explanatory variables in the logit model and related these covariates to the incidence of failure in the year following each of these quarter-ends. The potential explanatory variables were those used by the FDIC's off-site bank monitoring model, SCOR.[14]

Table 3:
Stepwise Logistic Regression of Determinants of U.S. Bank Failures (Forecast Horizon is One Year)

Independent Variables*	2014:Q1 to 2016:Q1 Estimated Coefficient (Standard Error)
Equity	-0.6958*** (0.1166)
Loans Past due 30 days or more	0.4448*** (0.1160)
Loan Loss Reserves	0.5919** (0.2212)
Income Before Taxes	-0.8811* (0.3541)

[14] See Collier, Charles, Sean Forbush, Daniel Nuxoll, and John O'Keefe (2003).

Independent Variables*	2014:Q1 to 2016:Q1 Estimated Coefficient (Standard Error)
Loans and Long-term Securities	-0.1083*** (0.0300)
Liquid Assets	-0.0736** (0.0261)
Provisions for Loan Losses	-2.2281* (1.0077)
Gross Charge-offs	1.7021* (0.7495)
Intercept	6.7699** (2.4539)
Pseudo R-squared	0.6358
N	19,105

* p<0.05, ** p<0.01, *** p<0.001
Note: All variables are measured as percentage of gross assets.

Table 3 shows the estimated coefficient signs for the explanatory variables are as expected; increases in loans past due 30 to 89 days, loan loss reserves, and loan charge-offs increase the likelihood of failure while increases in equity capital, income before taxes, loans and long-term securities, liquid assets, and loan loss provisions decrease the likelihood of failure.

A deposit insurer can select the appropriate time period over which to estimate the logistic regression to provide estimates of default that reflect different periods of economic conditions—current period, through-the-cycle, and crisis period conditions—and apply these coefficient estimates to subsequent period financial data to obtain out-of-sample predictions banks' failure probabilities. For example, in this study we used the above logit model estimates (table 3) and year-end 2016 financial data to predict bank failure probabilities for 2017.

If a country has too few explicit bank closings with which to estimate a logistic regression, it may still be possible to model the likelihood that bank's become critically undercapitalized. Models considering capitalization levels can use a variety of capital adequacy measures such as equity plus reserves-to-book assets and tier 1 plus tier 2 capital-to-risk weighted assets and observe when a threshold is breached, although the exact measure and capital level is up to the individual deposit insurer. Thresholds for determining when a bank becomes critically undercapitalized can be based on regulatory capital requirements or expert judgment. For example, a 2 percent threshold for equity capital-to-book assets that is in line with U.S. prompt corrective action bank closure policies. An "in-substance" failure could be said to occur when the aforementioned capital measures drop below 2 percent, but the regression remains otherwise the same

There are two limitations to the statistical bank-failure prediction model. First, government support to the banking industry during crisis periods may make industry condition appear better than would be the case without government support, such as credit guarantee or liquidity programs, affecting the profit and thus indirectly the capital position of banks. Second, government capital injections will improve bank capital adequacy and reduce the occurrence of observed failures, directly improving the capital position of banks.

3.2.2. Rating Agency-based Forecasts of Bank Failure

To counter the aforementioned weakness in the statistical bank-failure model one could alternatively estimate failure probabilities with forecasts based on banks' credit ratings. Banks that issue publicly traded debt receive credit ratings from rating agencies; Fitch, Moody's, and Standard and Poor are the three most well know credit rating agencies that rate both the default risk of individual securities and issuers.

According to FitchRatings (2014, 2013b, 2011) Fitch credit ratings are designed to rate debt issues and issuers vulnerability to default, where default refers to failure to meet interest and principal payments on securities. Since we are primarily interested in banks versus all securities, we focus on Fitch Issuer Default Ratings (IDRs) for banks. Fitch IDRs rate banks' ability to service outstanding debt and are credit risk ratings. IDRs do not take into consideration market, liquidity and other risks except to the extent these risks affect the ability of the bank to make debt payments.

Fitch bank IDRs have two components: 1) the default vulnerability of the issuer assuming "ordinary support" from internal and external sources and 2) the likelihood of receiving extraordinary support. Ordinary support includes support from parent organizations, shareholder support, as well as external support, such as regular access to a central bank for liquidity. Extraordinary support includes support from external sources that one would expect to be forthcoming should the bank become in danger of default, such as under a threat of system-wide collapse. Extraordinary support includes liquidity, guarantees, and capital injections. Fitch states that extraordinary support that was forthcoming in the past is not necessarily assumed to be available in the future, hence, not all the government programs used to manage the 2007 – 2009 financial crisis are assumed by Fitch analysts to be available in future when they rate banks likelihood of receiving extraordinary support. Since Fitch IDRs are measures of default risk, regardless of the source of a bank's financial support, IDRs are the higher of a bank's individual rating and support rating.[15] Fitch states that IDRs are not designed to be predictors of the numeric probability of default but rather are ordinal risk measures. As a consequence, the observed default rates for across all IDR ratings bands vary over economic cycles. As with other measures of default, regulators must choose available data carefully to assign default probabilities to differing periods.

[15] Fitch ratings of issuer default risk have evolved over time; however there has not been any fundamental change of the way Fitch sets IDRs. Specifically, Fitch replaced its Individual Ratings (IRs) with Vulnerability Ratings (VRs) in 2011. The VRs consider the same core risks are IRs but use a more granular rating scale than did IRs.

Fitch Ratings (2013a) reviews the experience of bank issuers of debt globally and presents cumulative *failure rates* for one-to-three year horizons by IDR. Fitch points out that issuer default and issuer failure are not the same thing. An issuer may be able to make debt payments but if that ability is contingent on the bank receiving extraordinary support, Fitch classifies the bank as "failed" even though it's not in default. More generally, when computing historical issuer failure rates, Fitch includes banks that were non-viable without external support among the failed banks. Table 4 lists the current, average long-term and global financial crisis period one-year bank failure rates from the 2013 Fitch study.

Table 4:
Fitch Credit Ratings and Global Bank Failure Rates[16]

Individual Rating	Long-term IDR	Most Current Available	Long-term Average	Crisis Period Average
Fitch IR Bands	Fitch LT IDR Bands	2011 failure rate (%)	1990 – 2011 average annual failure rate (%)	2008 – 2009 average annual failure rate (%)
A	AAA, AA+, AA	0	1.05	30.0
A/B	AA+, AA,AA-,A+,A	0	1.03	9.60
B	AA-, A+,A, A-	0	0.77	6.26
B/C	A, A-, BBB+, BBB	0	0.90	4.55
C	BBB+,BBB, BBB-, BB+	0.42	1.59	3.58
C/D	BBB-, BB+, BB, BB-	1.16	2.03	2.01
D	BB, BB-,B+,B,B-	4.60	2.96	2.09
D/E	B+,B,B-,CCC	1.72	3.93	7.93
E	CCC,CC, C	13.33	7.38	18.16
All Banks		1.82	1.71	4.92

Note that the average bank failure rates in table 4 do not always increase the poorer the Fitch individual ratings (IRs). Specifically, table 4 shows that average failure rate for A-rated banks exceeds that for B-rated banks for the 1990 – 2011 period and the average failure rates for A, B, and C-rated banks exceed that for D-rated banks for the 2008 – 2009 period. The non-monotonic relationship between Fitch IRs and bank failure rates is not inconsistent with the definitions of IRs and bank failures in the Fitch 2013 study, as Fitch classified some banks as failed due to reliance on extraordinary support even though these same banks made debt payments. The largest banks therefore were most likely to receive assistance as they were systemically important and also likely to have the best credit rating, generating this pattern.

[16] See "Global Bank Rating Performance Study: 1990-2012", FitchRatings, November 27, 2013, p. 9.

3.2.3. Actuarial Bank Failure Rates

Countries can estimate directly bank failure rates based on the global banking industry or on their domestic industry. This will require a calculation of actuarial tables. To accommodate short-term and long-term perspectives in target fund design we include three bank-failure forecast horizons in the target fund framework—one-, two- and three-year cumulative failure rates.[17] As an example, we obtained historical failure rates from the FitchRatings (2013a) study on global bank failure rates between 1990 and 2011. Sources may also include the central bank or other regulators tracking business activity. Table 5 presents historical cumulative failure rates from the FitchRatings (2013a) study.[18]

Table 5:
Cumulative Bank Failure Rates from FitchRatings (2013) Study

Economic State	Period	One Year	Two Years	Three Years
Crisis Period	2008 – 2009	4.92%	7.29%	7.70%
Through-the-Cycle	1990 – 2011	1.77%	3.66%	5.61%
Current Period	2011	1.82%	2.61%	8.59%

Table 6 presents one-, two- and three-year cumulative failure rates for U.S. FDIC-insured banks for the three economic states we identified previously. Clearly, if a country has a significant history of bank closings, country failure rates are preferred to external failure rates. A shortfall of industry average failure rates is that one cannot differentiate banks in terms of failure risk and one failure rate is applied to all banks.

Table 6:
Cumulative Bank Failure Rates for the U.S.

Economic State	Period	One Year	Two Years	Three Years
Crisis Period	1990:Q3 – 1991:Q4	1.10%	1.93%	2.38%
Through-the-Cycle	1.10%	0.65%	1.27%	1.87%
Current Period	2006:Q1 – 2016:Q1	0.13%	0.18%*	0.20%*
*Rates truncated since failure data only exists through 2017:Q1				

[17] In the event of three years of failure versus one year of failure, we are not taking three versus one draws from the distribution, but rather taking a "total" three year result with a certain cumulative failure rate versus a one year result with a certain failure rate.

[18] See "Global Bank Rating Performance Study: 1990 – 2012", Special Report, FitchRatings (November 27, 2013)

4. Loss Given Default

This section discusses the determinants of DIF loss rates as a percentage of failed-bank assets.[19] Sections 4.1 and 4.2 discuss the features of a deposit insurer that influence DIF losses. Section 4.3 describes the key cash inflows and outflows that determine DIF losses and section 4.4 presents information on U.S. FDIC losses on bank closings between 1984 and 2016. While the examples of insurance loss determinants given in this section may not apply to all insurers, the section does provide information on how deposit insurers generally should approach the task of determining loss given default. The model employed in this paper will use data to create a rule for loss given default, and does not model or simulate explicitly in the calculation of losses as it does default events. Regulators may choose a single value for loss given default or select differing values for loss given default to reflect all current conditions in the country.

4.1. Failure Resolutions

The bank failure-resolution process has three main elements. First, the deposit insurer makes payments to insured depositors using the resources of the DIF. Assuming depositors are paid fully and promptly, sensible performance goals on their own, this should not vary much across deposit insurers. Second, the insurer is entitled to receive reimbursement from asset liquidations based on the subrogated rights of insured depositors. Third, the deposit insurer reimburses all other bank creditors using the proceeds (recoveries) from failed-bank asset liquidations and/or proceeds from other forms of failure resolution. These last two can be significant sources of variation in loss rates across deposit insurers.

4.1.1. Priority of Claimants

The primary determinant of deposit insurance losses lies in how asset recoveries are disbursed. The FDIC Act states that the FDIC's subrogated claim has priority over that of uninsured depositors and other creditors. Among claimants, deposits have preference over all other non-secured, non-preferred claimants. If a deposit insurer has first claim on assets, even a relatively low recovery rate will mean very few losses for the insurer. Not all deposit insurers have the same claim structure, however. If the deposit insurer is pari passu with other claimants, losses are likely to be high even with a relatively high recovery rate.

[19] Failed-bank assets are measured the quarter-end prior to failure. This loss rate base was chosen since one will only know reported bank assets prior to closing for the purpose of projecting losses.

4.1.2. Structure of Losses

Table 7 summarizes the key cash flows associated with bank-failure resolutions for the DIF. Note that all recoveries, including recoveries from appointed agents and the courts, are included in the recoveries listed in table 7. Deposit Insurers often record recoveries from failed-bank resolutions by bank asset type. In table 7 we use three broad categories of bank assets—Risk (e.g., loans), Physical (e.g., fixed assets) and Investment (e.g., securities)—to illustrate this point.

Table 7:
Failed-bank Recoveries and Claims Payment

Cash Inflows: Recoveries on Risk Assets, Physical Assets and Investments	After Bank Closure Recoveries made by DIF – Risk asset repayments/collateral sales – Physical asset sales – Investment asset sales Recoveries made by appointed agents Recoveries from court cases/litigation
Cash Outflows: Disbursements for creditor claims and liquidation expenses	Insured Depositor Claims Receivership Expenses – Liquidation Expenses – Asset Management – Appointed Agent Expenses Uninsured Creditor Claims
Secured Claims	Are paid directly from collateral

4.2. Deposit Insurance Losses

Equation 10 shows net recoveries on assets for an individual failed bank, j, as the sum of recoveries over the life of the receivership (periods 0 to T) minus receivership expenses.

$$Net\ Recoveries_j = \sum_{t=0}^{T} Recoveries_t - \sum_{t=0}^{T} Liquidation\ Expenses_t \quad (10)$$

After receivership expenses and preferred claims, FDIC has next claim on recoveries equal to the subrogated claim of insured depositors; hence FDIC's net cash flow is always less than or equal to zero, i.e., never a profit.

$$Net\ Cash\ to\ FDIC_j = Net\ Recoveries_j - Preferred\ Claims_j - Insured\ Deposits_j \quad (10)$$

Should net recoveries exceed insured deposits and preferred claims, FDIC would distribute the excess to uninsured claimants.

4.3. FDIC Loss Rates

Tables 8 and 9 present information on FDIC net loss rates as a percentage of failed-bank assets for the crisis, through-the-cycle, and current periods identified previously. Insurance losses take into consideration recoveries from asset liquidations and/or bidder payments for failed-banks, receivership expenses, preferred and secured liabilities, and FDIC's subrogated claim. These rule based values are then used with failure simulations to determine net losses for each simulated year. We computed loss rates on failed-bank assets for five bank asset size groups to control for the historical relationship between bank size and deposit insurance loss rates—loss rates tend to decline as bank size increases.[20]

An alternative approach would be to compute loss rates by asset types, e.g., Risk Assets, Physical Assets, and Investments; however, these types of loss rates were not available for this study.

Table 8:
FDIC Loss Rates on Failed-Bank Assets

Asset Size	Crisis Period	Through-the-Cycle	Current Period
<= $100 M	23.8%	29.1%	20.1%
$100 M to $500 M	24.4%	24.7%	16.0%
$500 M to $1 B	22.5%	22.3%	7.0%
$1 B to $10 B	18.4%	18.8%	12.0%
Over $10 B	13.1%	15.4%	---

[20] Possible reasons for the inverse relationship between bank size and failure-resolution costs are the market monitoring of large, publicly traded banks, continuous on-site supervisory presence at the largest banks, and greater portfolio diversification and franchise value of large compared to small, community banks. An examination of the determinants of large versus small bank failure resolution costs is, however, beyond the scope of this paper.

Table 9:
Number of Failed Banks by Asset Size Group

Asset Size	Crisis Period	Through-the-Cycle	Current Period
<= $100 M	250	129	16
$100 M to $500 M	292	262	9
$500 M to $1 B	69	63	1
$1 B to $10 B	65	56	1
Over $10 B	11	9	---

5. Exposure at Default

Estimating deposit insurance exposure at default is relatively straightforward compared to other parameters necessary to estimate a deposit insurance fund target. Data on deposits and bank liabilities should be available from quarterly bank financial statements that banks file with their regulators. Estimates of insured deposits are often reported by banks as well, sometimes directly to the deposit insurer and other times to the central bank. The accuracy of self-reported insured deposits varies with the complexity of deposit insurance coverage rules, with more complex rules yielding worse estimates. The percentage of deposits that are insured will vary with bank type within the country, and insurance exposures depend heavily on the deposit insurance thresholds relative to average depositor wealth levels as well as wealth distributions. Thus the resulting exposure at default parameter will not be explicitly modeled in the simulation, but rather determined as a rule from available data.

5.1. The U.S. Case

U.S. insured banks with assets over $1 billion are required to report an estimate of insured deposits quarterly to their primary federal regulator. Based on U.S. bank data as of December 2016, insured deposits as a percentage of domestic deposits decrease as bank asset size increases. Among banks with assets over $10 billion, insured deposits as a percentage of domestic deposits were 61 percent, and among banks with assets between $10 billion and $1 billion, the percentage of insured deposits was 74 percent. While we do not have self-reported insured deposits for banks with assets under $1 billion, the FDIC does have information on insured deposits at closing for 161 banks that failed between January 1984 and December 2016; we note that this sample is a small selected fraction of the 1,859 banks that failed during this period. However, as the purpose of this exercise is to bound the cost of the deposit insurer, we find insured deposits were an average of 97 percent of total deposits for these 161 failed banks. In the U.S. Target Fund Ratio estimates, we use the self-reported insured deposit shares for banks with assets over $1 billion and assume the percentage

of deposits that are insured is 97 percent for banks with assets under $1 billion. Countries with higher income inequality usually have a higher proportion of uninsured deposits, and regulators may elect to segment exposure at default by institution size or economic conditions as they see fit, or may instead choose to use only a single proportion for exposure given default across all banks and periods.

6. Correlation of Bank Failures

A major contribution of this paper is going beyond default probabilities discussed in section 3 to model the correlation of defaults through the correlation in asset returns, *p*. Obtaining correlations of bank failures to combine with overall probabilities of bank failure allows regulators to simulate a more realistic distribution of defaults. We discuss two primary approaches that can be used to obtain correlations in the movement of bank values and thus their proximity to failure.

6.1. Stock Return Data

Pricing data for publicly traded banks will incorporate all publically available information (and possibly some private information as well) about the valuation of the company. Correlations obtained from this data can be aggregated based on desired periods to generate correlation inputs for the simulation model. Regulators could estimate pairwise Pearson correlations for each pair of bank stock returns, and then take the average of these correlations to get an overall industry average correlation.

Table 10 shows the mean pairwise correlation in quarterly stock returns for all publicly traded U.S. insured banks for the three economic periods previously identified. Overall, return correlations are low but do increase with economic stress, as expected. This is potentially due to the US banking sector having numerous banks of varying size, product mix, geographic coverage, and complexity.[21]

Table 10:
Bank Quarterly Stock Return Correlation

Period	Mean Correlation
Crisis	0.094
Through-the-Cycle	0.090
Current	0.049

[21] An alternative approach to using mean pairwise stock return correlations for all bank stocks is to compute average pairwise average correlations by industry segments, based on asset size, business orientation (e.g., wholesale versus retail banking), or other bank characteristics. For simplicity we use the overall pairwise average correlations in this paper.

6.2. Book Equity

Alternatively, one could derive correlation using book equity in a similar process. Banks that are required to report financial statements to the central bank would report returns on equity, and regulators could estimate pairwise Pearson correlations for each pair of bank returns on equity, and then average these correlations for an overall correlation in returns on equity. While every bank will have a value using this approach, even smaller private banks, they will not be subject to the same amount of public scrutiny and information gathering that stock return data is subject to, and thus this measure of asset correlation is generally of worse quality. Regulators should choose carefully between a larger number of low quality equity measures from book equity data and a smaller number of higher quality equity measures from common stock data.

7. Model Calibration

Estimating the national level bank failure loss distribution using the Monte Carlo simulation model requires estimates of four parameters as discussed above—probability of default, loss given default, exposure at default, and correlation of default. For this particular example, we lay out the simulation options again in brief and note the selections we made.

7.1. Probability of Default

Deposit insurers should keep records on the number of bank closings during their history to use as a basis for simulating defaults. However, countries that lack long term data must use other methods for estimating probability of default. Options for all these data environments are presented below:

7.1.1. Statistical predictions

Statistical predictions of undercapitalization may be used as when failure information is sparse. In this approach, regulators estimate the likelihood of banks becoming critically undercapitalized (e.g., less than 2 percent equity and reserves-to-assets ratio in the US case) using available bank financial data, usually with a logistic model. This is discussed in section 3.2.1

7.1.2. Issuer Default Ratings

Credit ratings have been used to model bank failure risk in many jurisdictions where actual closings are infrequent or when data is not available to make statistical predictions of undercapitalization or closing. This is discussed in section 3.2.2.

7.1.3. Industry Failure Rates

Failure rates based on actual closings may be available for some periods but not others. Records may be missing in some cases, and in other cases the variance in closures may be artificially high if banks are closed periodically as part of major government consolidation initiatives rather than when they become insolvent. This is discussed in section 3.2.3. This is the measure used for this U.S. simulation, with differing values for each of the three economic periods t and from one to three year horizons, shown in table 6, and contributes to the credit as well as liquidity probabilities of failure.

7.2. Loss Given Default

Estimating loss given default requires access to information about recoveries from past asset liquidations among differing economic conditions t as discussed in section 4. Losses given default are not explicitly modeled in the simulation, but rather are determined by a rule from historical experience, and each country must choose these values based on their experience and institutional background. This simulation uses differing values of loss given default for each of the three economic periods and by bank asset size, as shown in table 8.

7.3. Exposure at Default

Countries should have access to estimates of share of insured deposits as well as overall asset size from their banks' reporting as discussed in section 5. This will allow regulators to create a rule-based value for the share of insured deposits in each bank, and regulators can elect to have it vary by period or across banks at their discretion. Exposure at default varies by individual bank in this simulation, but is constant across all three economic periods. In the U.S. Target Fund Ratio estimates, we use the self-reported insured deposit shares for banks with assets over $1 billion and assume the percentage of deposits that are insured is 97 percent for banks with assets under $1 billion.

7.4. Correlation of Default

Regulators can either use publically available stock returns or figures reported to the regulators on book equity to generate a measure of default correlation as discussed in section 6. For this simulation, we use stock market data and overall pairwise return correlations by economic period, as shown in table 10.

8. Model Results

Using the above inputs across the three differing sets of economic conditions—current, through-the-cycle, and crisis period—regulators can estimate losses from bank failures. Crisis conditions are likely to generate the highest required reserve ratio, and are likely to be the binding target for deposit insurers.

We used 500 random joint draws of systemic and idiosyncratic risk factors in the Monte Carlo simulations to generate failure events across each of these three periods of conditions over one, two, and three-year horizons. The greater the number of simulations, the greater the ability of the model to detect high-loss, low probability events. Since there were approximately 5,857 FDIC-insured banks as of December 2016, we limited the number of random draws of the risk factors to 500. The simulations resulted in over 2.9 million bank-simulation failure-loss results from which we derive the FDIC's cumulative loss distribution.[22] It is common in these scenarios to have the vast majority of simulations result in few or no failures, with a few simulations yielding large numbers of failures. After identifying the failure events, each failed bank will impose costs to the insurer equal to the product of the loss given default rule and the exposure at default of that bank. These losses per bank are then summed to estimate total losses to the deposit insurer for that particular random draw.

8.1. Desired Fund Size

The aggregate amount of deposit insurance losses an insurer wishes to be able to absorb over a specific time horizon is a public policy choice. As a benchmark, over the past 40 years U.S. Aaa and Aa rated municipal bonds have made payments of interest and principal 99.97 percent of the time.[23] The 99.97 percent confidence level is also commonly used as a benchmark for U.S. banks' economic capital models and the Basel II capital requirements.[24] The 99.97 percent confidence level implies a loss level that is exceeded once in every 3,333 Monte Carlo simulations. The 99.97 percent loss threshold is, however, at odds with the U.S. experience with deposit insurance. The Federal Savings and Loan Corporation became insolvent, the National Credit Union Share Insurance Fund narrowly avoided bankruptcy by capitalizing a portion of member credit unions' capital and the FDIC twice became book-equity insolvent due to high failure-loss reserves that were not needed thanks to government support programs during previous banking crises. For these reasons we chose a lower,

---

[22] The Excel simulation model execution time for bank-simulation events will vary with the capacity of the computer used to run the simulations; our simulation run time was approximately 5 hours. Countries with vastly smaller numbers of banks than the U.S., e.g., 20-to-30 banks, can run 50,000 simulations in minutes.

[23] See "Safety of Investment Grade Bonds - Examining Credit Ratings and Default Rates of Municipal and Corporate Bonds" by Stephen J. Huxley and Brent Burns, Asset Dedication White Paper Series (February 2011).

[24] There is inherently a tradeoff between selecting periods of the economy to use to calibrate default probabilities and the confidence level. Assuming that the economy uses only one data generating process, one would need to look at a higher confidence level than if one were to consider the economy uses multiple data generating processes instead and looking at the data generating process for the bad states of the economy, to get the same level of safety.

more realistic confidence level for the U.S. Target Fund Ratio estimate—the 99.8 percentile confidence level—that ensures the target fund is exceeded only once in 500 trials. The confidence level we selected is consistent with previous research on the adequacy of the FDIC's insurance fund in non-crisis periods.[25]

Table 11 presents the results for estimates of the Target Fund Ratio necessary to absorb insurance losses at the 99.8 percent confidence level for three economic states where all results are based on U.S. historical bank failure for probability of default (as in section 7.1), insurance loss rates for the loss given default rule (as in section 7.2), bank balance sheets to summarize exposure (as in section 7.3), and average pairwise correlation in stock returns as a measure of failure correlation (mentioned in 7.4). We assume rigorous enforcement of FDIC's least costly resolution rule by assuming losses cannot exceed the value of insured deposits. To avoid false precision, we round Target Fund Ratio estimates to the nearest full percentage point. Using a one-year bank failure horizon and limiting insurance losses to insured deposits, the Target Fund Ratio estimates under current, through-the-cycle, and crisis period conditions are 3, 4, and 5 percent of insured deposits respectively.

The FDIC's current Target Fund Ratio is 2 percent of estimated insured deposits, a target which has been reaffirmed annually. The FDIC did not arrive at its Target Fund Ratio using a credit risk modeling approach as was used here; rather, the FDIC based its Target Fund Ratio choice in part on an analysis of historical FDIC losses, income and insurance fund levels. In addition to historical analysis, the FDIC must consider specific statutory factors when selecting the Target Fund Ratio—the risk to the DIF in current and future years, economic conditions, the potential for sharp swings in insurance assessment rates and other factors the FDIC's Board of Directors deem appropriate. The FDIC published a historical analysis by Davison and Carreon (2010) which used data from the period 1950 to 2010 and a different model from this one that was based on aggregate data in an income and expense simulation model that reviewed the FDIC's historical losses and simulated insurance fund levels under alternative insurance premium and fund maintenance strategies, arriving around a 2% minimum fund estimate.

It is thus difficult to directly compare our credit loss model estimates of the Target Fund Ratio with the FDIC's historical insurance fund analysis. The credit loss model in this paper uses a point in time estimate of potential insurance losses over one-, two- and three-year failure horizons and does not incorporate funding from insurance assessments and FDIC investment income over a long horizon that Davison and Carreon (2010) take into consideration. Other countries may not have as much flexibility in directing investments for their deposit insurance funds or making special or prepaid assessments of the banking sector as the FDIC has, which would necessitate a more conservative fund target. Finally, the credit loss model cannot take into consideration certain statutory factors the FDIC must consider when setting the Target Fund Ratio, such as potential future changes in regulatory legislation.[26]

---

[25] Schuermann and Kuritzkes (2005) use a Merton credit loss model of the FDIC's Bank Insurance Fund (BIF), estimated as of year-end 2000 and find that the BIF was adequate to cover losses up to the 99.85 percentile level but note that under different, stressed market conditions the confidence level was 96 percent. See Til Schuermann and Andrew Kuritzkes, Deposit Insurance and Risk Management of the U.S. Banking System: What is the Loss Distribution Faced by the FDIC?" Journal of Financial Services Research 27:3 217–242, 2005.

[26] See FDIC (2010).

Table 11:
Target Fund Ratio as a Percentage of Insured Deposits (Target for 99.8% Confidence Level)

Cumulative Failure Rate	Current Period	Through-the-Cycle	Crisis Period
One Year	3%	4%	5%
Two Year	3%	4%	5%
Three Year	4%	7%	7%

8.2. Longer Horizons

The Target Fund Ratio estimates increase as we increase the bank failure horizon to allow the deposit insurer to weather longer crises, with the three year failure horizon Target Fund Ratio estimate reaching 7 percent under crisis period conditions. Table 11 shows the sensitivity of the Target Fund Ratio estimates to the bank failure horizon and the economic conditions FDIC operates under when liquidating failed-bank assets.[27]

9. Inherent Weaknesses of Model Assumptions

All approaches to estimating the target deposit insurance fund require one to make assumptions about which factors influence the target fund (i.e., drivers of insurance losses) and the manner in which these factors combine to influence the target fund. The Loss Distribution Approach relies on historical data on deposit insurance losses and is entirely a data-driven approach. Implicit in the Loss Distribution Approach is the broad assumption that past drivers of deposit insurance losses remain relevant in the future and that the manner in which these drivers combine to influence insurance losses remains much the same in the future. The Credit Portfolio Approach relies on less data than the Loss Distribution Approach and, therefore, the Credit Portfolio Approach must use explicit assumptions about the drivers of insurance losses and how these drivers combine to influence insurance losses. While it is still reliant on historical data, it can be used to generate simulations based on new conditions and incorporate data from sources other than the historical experiences of the host country.

As discussed previously, the Credit Portfolio Approach does not model the influence of the legal and regulatory environment on insurance losses and assumes the structure of the financial safety net, and deposit insurance regime in particular, remain unchanged from that reflected in the model input data. The Credit Portfolio Approach also makes strong

[27] We recommend deposit insurers also conduct sensitivity analysis around the sensitivity of Target Fund Ratio estimate to changes in the Monte Carlo simulation model parameters— probability of default, exposure at default, loss given default, and failure correlation.

assumptions about the process that generates bank asset value changes and, therefore, bank failures. The specific assumptions for asset returns are:

a. assets value changes are driven by a linear combination of systemic and idiosyncratic risk factors (Merton-Vasicek Model),
b. both risk factors are transformed to standard normal random variables (mean zero and standard deviation of one),
c. idiosyncratic risk and systemic risk are distributed independently of one another,
d. the idiosyncratic risk of any two obligors is distributed independently of one another,
e. idiosyncratic risk of all obligors is not serially correlated.

It is generally acknowledged by economists that firms' profitability, liquidity and capitalization are influenced by firm-specific factors and events (e.g., hiring of new corporate executives), as well as by general macroeconomic conditions, i.e., systemic factors. There is less agreement, however, on how to measure idiosyncratic and systemic risk factors and on the manner in which these factors combine to determine asset returns.

The strongest assumption of Merton-Vasicek Models is that asset returns are normally distributed. Financial securities returns are typically non-normally distributed and have return distribution with "fat tails" that allow for higher probabilities of large losses. While the normal return distribution assumption might lead to some underestimation of low probability, high loss events, we feel the calibration of the loss distribution to three states of the economy—current, through-the-cycle, and crisis period—and the use of a high threshold for the loss confidence level, 99.8 percent, helps ensure the adequacy of target fund estimates.

10. Conclusion

Deposit insurers need not restrict themselves to one methodology for determining the target deposit insurance fund. Further, the target fund estimation has been the subject of many academic studies. For these reasons, deposit insurers can choose a Target Fund Ratio by drawing upon several sources of information. For example, the FDIC has studied the target fund question using a wide variety of sources of information—FDIC historical experience, simulations based on past FDIC losses, credit risk models developed by outside experts and academic literature on deposit insurance. The target fund framework presented herein describes a transparent process that can be undertaken by regulators to estimate the Target Fund Ratio even when faced by significant data challenges.

Acknowledgements

This paper is based on World Bank executed technical assistance projects with financial support from the FIRST initiative. The authors would like to thank Julian Casal and Jan Nolte of the World Bank for their advice and assistance as well as Chris Martin and Chacko George of the FDIC who provided feedback during the peer review process for entry of the paper into the working paper series.

References

Basel Committee on Banking Supervision and International Association of Deposit Insurers. 2009. Core Principles for Effective Deposit Insurance Systems, (June 2009).

Black, Fisher and Myron Scholes. 1973. The Pricing of Options and Corporate Liabilities. *The Journal of Political Economy*, Vol. 81, No. 3 (May – Jun., 1973), pp. 637 – 654.

Calomiris, Charles W. 2010. The Past Mirror: Notes, Surveys, Debates – banking crises yesterday and today. *Financial History Review*, Vol. 17, No. 1 (2010), pp 3 – 12.

Canadian Deposit Insurance Corporation. 2011. Consultation Paper Premium Assessment Approach and Target Fund Level (June 2011).

Collier, Charles, Sean Forbush, Daniel Nuxoll, and John O'Keefe. 2003. The SCOR System of Off-Site Monitoring. *FDIC Banking Review*, Vol. 15, No. 3.

Davison, Lee K. and Ashley M. Carreon. 2010. Toward a Long-Term Strategy for Deposit Insurance Fund Management. *The FDIC Quarterly*, Vol. 4, No. 4.

De Lisa, Riccardo, Stefano Zedda, Francesco Vallascas, Francesca Campolongo and Massimo Marchesi. 2011. Modelling Deposit Insurance Scheme Losses in a Basel 2 Framework. *Journal of Financial Services Research* Vol. 40, pp. 123 – 141.

Dodd-Frank Wall Street Reform and Consumer Protection Act. 2010. Pub. L. No. 111 – 203, § 929-Z, 124 Stat. 1376, 1871 (2010) (codified at 15 U.S.C. § 78o) [Bluebook R. 12.4].

Federal Deposit Insurance Corporation. 2010. Designated Reserve Ratio. *Federal Register*, Vol. 75, No. 243, (December 20, 2010), pp. 79286 – 79293.

FitchRatings. 2014. Definitions of Ratings and Other Forms of Opinion (December 2014)

FitchRatings. 2013a. Global Bank Rating Performance Study: 1990 – 2012 (November 27, 2013)

Special Report

FitchRatings. 2013b. Ratings Reality: Explaining What Fitch's Ratings Do and Do Not Address Special Report (May 8, 2013)

FitchRatings. 2011. Viability Ratings: An Introductory Primer Special Report (July 20, 2011)

Fogafin. 2013. "A Methodology for Determining the Target Funding Level of a Deposit Insurer", Paper No. 4 (February 2013). (Fogafin is a state-owned institution that protects bank depositors in Columbia.)

Gordy, Michael B. 2002. A Risk-Factor Model Foundation for Ratings-Based Bank Capital Rules, Working Paper, Board of Governors of the Federal Reserve System.

Gordy, Michael B. 2000. A Comparative Anatomy of Credit Risk Models, Journal of Banking & Finance Vol. 24, pp. 119 – 149.

International Association of Deposit Insurers. 2009. "Funding of Deposit Insurance Systems", Guidance Paper Prepared by the Research and Guidance Committee International Association of Deposit Insurers, (May 6, 2009).

International Association of Deposit Insurers. 2011. "Evaluation of Deposit Insurance Fund Sufficiency on the Basis of Risk Analysis", Discussion Paper Prepared by the Subcommittee on DIF Sufficiency Research and Guidance Committee (2011).

International Association of Deposit Insurers. 2012. "Enhanced Guidance for Effective Deposit Insurance Systems: Reimbursement Systems and Processes", Guidance Paper Prepared by the Research and Guidance Committee International Association of Deposit Insurers (November 2012).

International Association of Deposit Insurers. 2014. "IADI Core Principles for Effective Deposit Insurance Systems" (November 2014).

Internal Monetary Fund and World Bank. 2013. Financial Stability Assessment Program: Crisis Management and Crisis Preparedness Frameworks Technical Note (May 2, 2013).

Katata, Kabir S. and R.W. Ogunleye. 2014. "Target Funding Ratio and Assessing the Adequacy of the Deposit Insurance Fund", Nigerian Deposit Insurance Corporation, Working Paper (2014).

Koyluoglu, H. Ugur and Andrew Hickman. 1998. A Generalized Framework for Credit Risk Portfolio Models. Working Paper (September 14, 1998).

Merton, Robert C. 1974. On The Pricing of Corporate Debt: The Risk Structure of Interest Rates. *Journal of Finance*, Vol. 29, No. 2. pp. 449 – 470.

Monetary Authority of Singapore. 2002. Deposit Insurance Scheme Consultation Paper (August 6, 2002).

Oliver, Wyman & Company. 2002. Deposit Insurance Scheme: Technical Addendum (for the Monetary Authority of Singapore) (August 6, 2002).

O'Keefe, John and Alex Ufier. May 2016a. Nigeria: A Methodological Approach for Development of a Target Deposit Insurance Fund Model. Prepared for the Nigeria Deposit Insurance Corporation and World Bank Group.

O'Keefe, John and Alex Ufier. June 2016b. Zimbabwe: A Methodological Approach for Development of a Target Deposit Insurance Fund Model. Prepared for the Zimbabwe Deposit Protection Corporation and World Bank Group.

Thomas, Hugh and Zhiqiang Wang. 2005. Interpreting the Internal Ratings-Based Capital Requirements in Basel II. *Journal of Banking Regulation* Vol. 6, pp. 274 – 289.

Vasicek, Oldrich A. 2002. Loan Portfolio Value. Risk (December 2002), pp. 160 – 162.

Vasicek, Oldrich A. 1991. Limiting Loan Loss Probability Distribution. Technical Document, KMV Corporation (August 9, 1991).

Vasicek, Oldrich A. 1987. Probability of Loss on Loan Portfolio. Technical Document, KMV.

Vijaya Krishnan. 2010. Constructing an Area-based Socioeconomic Index: A Principal Components Analysis Approach. Working Paper, Early Child Development Mapping Project, Community-University Partnership, Faculty Extension, University of Alberta, Edmonton, Alberta, Canada (May 2010).

Vincent, Kyle and Jason M. Sutherland. 2013. A Review of Methods for Deriving an Index for Socioeconomic Status in British Columbia. Working Paper, UBC Centre for Health Services and Policy Research, Vancouver, British Columbia, Canada (April 2013).

Vyas, Seema and Lilani Kumaranayake. 2006. Constructing socio-economic status indices: how to use principal components analysis. Oxford Journals, Medicine & Health, *Health Policy and Planning*, Vol. 21, No. 6, (October 9, 2006) pp. 459 – 468.

Zhang, Lei, Weisheng Dong, David Zhang and Guagming Shi. 2010. Two-stage Image Denoising by Principal Component Analysis with Local Pixel Grouping. *Pattern Recognition*, Vol. 43 (2010), pp.1531 – 1549.

Appendix A – Principal Component Analysis used for Macroeconomic Crisis Periods

1. Principal Component Analysis

Principal component analysis (PCA) can most easily be explained through an example of its application to, for example, risk measurement. Suppose one has year-end 2015 data on bank-level observations for several bank profitability and efficiency measures—return on assets, net interest income-to-assets, expenses on fixed assets-to-total revenue, and noninterest expense-to-total revenue. Principal component analysis finds that linear combination of the underlying variables that best explains the total variation in the data and is orthogonal (uncorrelated) with the original variables.

More formally, let **X** be a matrix containing data on the bank financial ratios we wish to summarize in an index. The columns of **X** are different bank observations and the rows are the different financial ratios. If we measure our variables as deviations from means the matrix product **X'X** becomes the **variance-covariance** matrix of **X**. In addition, if we normalize the deviations from means by the standard deviations, then **X'X** becomes a matrix of pairwise correlation coefficients for the different financial ratios.

PCA transforms a dataset of correlated variables into a dataset of uncorrelated variables, the principal components. There are as many principal components as there are variables in the original dataset. PCA, however, selects that orthogonal row vector **C** (aka, eigenvector) that maximizes the amount of variance in the original dataset explained by the principal components. The product of the data row vector **X'** and column eigenvector **C** is the first principal component:[28]

$$PC_1 = \boldsymbol{X'C} \tag{1A.}$$

PCA assumes the underlying data are quantitative measures or ordinal measures. PCA is scale dependent, hence unless all variables are measured in the same units (e.g., percentages, dollars), the data should be normalized as described previously. In equation 2A, PC_1 is the first principal component and is the sum of the products of the variable weights or factor loadings $c_1, c_2, \ldots, c_N$ based on the eigenvector and the value for the corresponding underlying economic variables $x_1, x_2, \ldots, x_N$ for that observation, here quarter t.[29]

$$PC_{1,t} = (c_1) * x_{1,t} + \ldots + (c_N) * x_{N,t} \tag{2A.}$$

[28] More specifically, to find the first principal component one solves the constrained maximization problem of finding that eigenvector, C, that maximize the variance-covariance matrix (C'X'XC) such that C'C = I, where I is the identity matrix.

[29] The sum of the squared factor loadings will equal one.

PCA ranks these transformed variables based on the amount of variance in the entire dataset the principal component explains, hence the first principal component explains more variance than the second principal component and so on for the remaining principal components. Another property of principal components is that they are all independent (uncorrelated) of one another, with the result that each principal component explains different characteristics of the dataset. While there are as many principal components as there are underlying raw variables, the first one or two principal components usually explain a majority of the variance of the dataset. This latter result means one can obtain a great deal of the information in a dataset using just the first one or two principal components (dimension reduction).

To know how to interpret the principal component values across banks one can estimate the Spearman rank order correlation coefficient between the principal component and the underlying variables. Typically one will find some variables to be more highly correlated with the principal component than are other variables and that the correlations change as one uses the second, third, and remaining principal components. These correlations also provide a way to validate the informational content of the principal component.

2. Two-Stage Principal Component Analysis

If one has, for example, five measures of a single bank attribute, such as asset quality, one can replace these variables with an average value, however, it is not clear how to weight the individual variables used by this average. One way to determine the weights for the individual asset quality measures is to find the first principal component for the five asset quality measures then use this principal component as a variable in a second principal component analysis which we next describe.[30]

In the two-stage PCA each of the key desired attributes, e.g., the six CAMELS attributes, are individually modelled with separate principal components analyses. Next, all first principal components from the first stage PCA are used as variables in a second stage PCA. Equation 3A shows the second stage PCA in which the weights, ai, for the six CAMELS PC1 are determined by the principal components procedure discussed previously. The resulting first principal component is a composite CAMELS attribute index.

$$PC_{1\ composite,\ t} = (a_1) \times PC_{1,\ capital,\ t} + \ldots + (a_6) \times PC_{1,sensitivity\ to\ market\ prices,t} \quad (3A.)$$

The advantage of two-stage PCA is that there is no intermediate variable selection step required and all key variable types, e.g., CAMELS attributes, are maintained through the final step.

[30] Vincent and Sutherland (2013) discuss the use of two-stage PCA in the construction of socioeconomic indexes. Two-stage PCA is also used in pattern recognition models as a way to further reduce the noise in the video signals as discussed in Zhang, Dong and Shi (2010).

The two-stage principal component analysis of banks' CAMELS attributes is one way in which analysts can measure banks' condition using the widely used CAMELS attributes even when supervisory ratings of banks based on onsite safety and soundness exams are not available. The first stage PCA provides principal components (indexes) for each of the six CAMELS attributes (i.e., substitutes for CAMELS component ratings) and the second stage PCA provides a first principal component for bank overall condition (i.e., substitutes for the composite CAMELS ratings).

To evaluate the potential of the first principal component to measure bank riskiness we compare the predictive accuracy of two bank-failure prediction models. **The first model** is a standard logit regression of the determinants of bank failure during a one-year period as a function of prior year-end bank financial condition. We measure bank financial condition using 12 financial ratios that are used by the FDIC's Statistical CAMELS Offsite Rating (SCOR) model.[31] The 12 financial ratios capture each of the six CAMELS attributes and are heavily weighted toward asset quality measures since asset quality is a primary driver of bank safety and soundness. We estimate stepwise logit regressions annually to determine the most predictive variables, and use parameter estimates to estimate out-of-sample failure probabilities for banks in the following year. **The second model** is a one-stage PCA of all 12 SCOR financial ratios using the same year-end data used in the logit model out-of-sample forecasts. We estimate models annually using data on all U.S. insured banks and thrifts between 2008 and 2014, a period that includes the most recent U.S. financial crisis. For brevity we do not present all logit model estimates and results here, however, representative results for the 2009 logit model estimates and 2010 PCA factor loadings used in risk rankings are shown in tables 1A and 2A. In table 1A the logit model coefficient estimates show increases in equity capital and liquid assets reduce the likelihood of failure, while increases in other real estate owned and nonaccrual assets increase the likelihood of failure, as expected. Table 2A shows the factor loadings for the SCOR model ratios also have an intuitive relationship with the risk index, PC_1. The factor loadings for equity capital, liquid assets and income before taxes are negatively related to PC_1, while all remaining SCOR ratios (primarily asset quality measures, loan loss measures and noncore funding) are positively related to PC_1. These factor loading signs suggested bank riskiness increases with PC_1.

In terms of in-sample explanatory power of the two models, the first principal component explained 34 percent of total variance in the data and the first three principal components explain 58 percent of total variance. These results suggest the logit model should outperform PCA in short-term failure prediction.

[31] The 12 SCOR model financial variables are equity capital, loan-loss reserves, loans past due 30-89 days, loans past due 90 days or more, nonaccrual loans, other real estate owned (includes repossessed real estate), loan and lease charge-offs, provisions for loan losses, income before taxes, noncore funding, loans and long-term securities (maturities over 5 years). Liquid assets are the sum of cash balances, securities, federal funds and repurchase agreements sold. Noncore funding is the sum of time deposits over $100,000, foreign deposits, federal fund and repurchase agreements purchased, demand notes issued to U.S. Treasury, and other borrowed money. All financial variables are measured as a percent of the bank's gross assets (assets plus loan-loss reserves). For further details see Collier, Forbush, Nuxoll, and O'Keefe (2003).

Table 1A:
Stepwise Logit Regression of the Determinants of Bank Failure

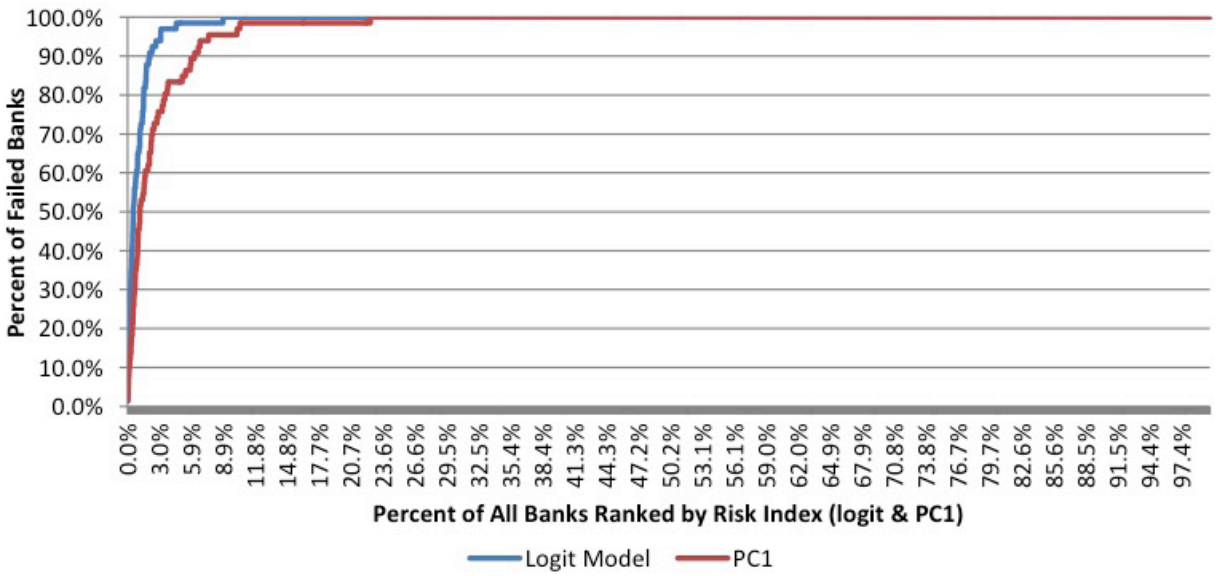
Independent Variables*	Year-end 2010 Estimated Coefficient (Standard Error)
Equity	-1.0792*** (0.1168)
Liquid Assets	-0.0580* (0.0258)
Other Real Estate Owned	0.1122* (0.0486)
Nonaccrual Loans and Leases	0.1018* (0.0421)
Intercept	2.4547* (0.9877)
Pseudo R-squared	0.7199
N	7,490
* p<0.05, ** p<0.01, *** p<0.001 Note: All variables are measured as a percentage of gross assets.	

Table 2A:
Factor Loading (Eigenvector) for First Principal Component

SCOR Ratios	First Principal Component Factor Loading
Equity Capital	-0.1859
Loans PD 30-89	0.2035
Loans PD 90+	0.0554
Nonaccrual Loans and Leases	0.3804
Other Real Estate Owned	0.3059
Liquid Assets	-0.2604
Noncore Funding	0.1650
Charge-offs	0.3589
Income Before Taxes	-0.3273
Loan Loss Reserves	0.3878
Loan Loss Provisions	0.4156
Loans and long-term Securities	0.1689

Figure 1A shows comparative model results for out-of-sample bank failure prediction for 2011.[32] In figure 1A we compare the percentage of 2011 bank failures that are correctly identified by the ranked indexes—logit model failure probability and first principal component. The logit model correctly identifies 82 percent of failed banks in the first 1.56 percent of all 7,490 risk-ranked banks while the first principal component correctly identifies 58 percent of failed banks.[33] Similar results were obtained for 2012 through 2015. While we expected the logit model to be more accurate than PCA in risk ranking banks, deposit insurers in many jurisdictions do not have a sufficient number of historical bank failures with which estimate a logit model of bank-failure prediction.[34] We believe PCA can provide a useful alternative to empirical risk measures that are based on probability distributions, require significant historical data on failure events, or rely on bank risk ratings from credit rating agencies or government safety and soundness examinations of banks. All deposit insurers should have access to bank financial statements and should also have a sufficient understanding of bank risk drivers, e.g., SCOR model variables, with which to use PCA.

Figure 1A:
Failure Prediction: Logit Model vs First Principal Component (Out-of-Sample Forecast for U.S. Banks in 2011)



[32] All model estimates and forecasts are available from the authors upon request.

[33] There were 92 bank failures in 2011. Banks file quarterly financial reports with their primary federal regulators that are used to obtain the SCOR financial ratios. Since 26 banks failed in the first quarter of 2011, prior to filing financial reports for year-end 2010, our sample includes 66 of the 2011 bank failures.

[34] Our tests of PCA's relative predictive power is obviously biased toward the logit model since we obtained a best fit logit model based on the FDIC's long-standing early warning system SCOR. While we did not conduct an exhaustive search for the "best" failure prediction model, the SCOR model contains explanatory variables common to published literature on the determinants of bank failures. Further, we did not conduct a second-stage PCA in the interests of simplicity; however, we anticipate a second-stage PCA would further enhance the predictive accuracy of the approach.

3. Interpretation of First Principal Component

Section 2 demonstrated the ability of the first principal component to risk-rank banks. If one normalizes the financial data used in PCA, i.e., subtract the mean and divide the difference by the standard deviation, one obtains a standard normal variable that has a mean of zero and standard deviation of one. If normality can be reasonably assumed, most statistical textbooks contain the information on the distributions of standard normal random variables (aka, Z scores) that can be used to determine the likelihood of various values. For example, the Z score distribution indicates that 95 percent of scores will fall between +/- 1.96 and 99.7 percent of scores between +/- 3. The Z score distribution is also assumed constant over time, and implicitly this assumes one can compare first principal components not only across banks but over time.

Like an issuer default rating, the default frequency for any PC_1 range (bucket) will vary with economic conditions, and in general rise with economic stress. Where deposit insurers lack information on issuer default ratings, CAMELS ratings, and other formal ordinal risk rankings, it might be possible to determine the default frequencies for banks in several comparable jurisdictions over time and map these to a countries PC_1 buckets. These default rates could serve as a means to calibrate a bank's PC_1 to the failure risk they present to the deposit insurer.

RISK-BASED PREMIUM MODELS FOR DEPOSIT INSURANCE SYSTEMS

Bernd Bretschneider & Dr. Ralf Benna

WORLD BANK GROUP
Finance & Markets
Financial Sector Advisory Center (FinSAC)

Contents

I. Introduction – General principles for running risk based premium models of deposit insurance systems

I.1. Considerations on introducing risk-based premiums systems

Deposit insurance systems (DIS) are a major contributor to enhancing public trust in the safety of deposits entrusted to a bank (or comparable institution). A DIS becomes involved if a bank is no longer able to pay out the entrusted deposits to their clients. This paper assumes that every bank holding deposits from their clients is obligated to be a member of a deposit protection system – regardless of whether this system extends country or sector wide, or whether it protects the institution (so called institutional protection) or just the deposits.

There are numerous ways to design and run such a system[1], but the most important aspect is always funding. Overall credibility and the ability to reimburse depositors depend on this single parameter. The core component, although not the only component[2], of the DIS´ financial means is the funds contributed by members of the system.

Ex ante funding of a system protecting clients' bank deposits is nowadays almost a matter of course and is widely considered to be best practice. The vast majority of literature suggests such an approach, and almost all deposit insurance systems worldwide collect their premiums up front. A risk-based premium system without ex ante funding is hard to imagine, or perhaps better said, ex ante funding is the foundation of a successful risk-based premium system. Moving from a flat-rate premium system to a risk-based one can be beneficial for various reasons:

- A bank with a business model of higher inherent risk, higher volatility of earnings, or lower equity basis has a higher probability of default. A payout case would be more likely than with other banks. In a flat-rate rather than risk-based system (also ex ante) this risk would not have a price, and therefore a "free-rider effect" would occur.
- Introduction of a risk-based premiums system has been shown to trigger risk-reducing behavior of banks. If the protection of deposits by a DIS were no longer considered part of the "public good" but were adequately priced by the DIS, risks in the banking system could be reduced significantly.[3]
- Lastly, and probably the most important argument in favor of an ex ante and risk-based system, is the "Moral Hazard" aspect, explored further below.

---

[1] See e.g. BECK, Thorsten, Deposit insurance as a private club (2001), page 13.

[2] Payment commitments, for example, are also considered an instrument of ex post funding in some jurisdictions. These are not addressed in this paper and should be analyzed separately in terms of effectiveness.

[3] An example is the Protection Scheme of the German Cooperative Banking Network. Following its introduction of a risk based premium system in 2003, measured risks of the system, to 2015, declined by more than 98%.

"Moral Hazard" is an enigmatic topic. In general, moral hazard arises when economic actors have incentives to accept more risk, or can benefit from taking risky actions, because the cost of that risk does not affect them, or those costs are borne, in whole or in part, by others.[4] Pursuing bank-individual goals might create incentives to increase financial risks in the balance sheets of a bank since the potential costs of failure would be borne by all member banks of the DIS. In the context of deposit insurance, protecting depositors from the threat of loss (e.g., through explicit limited deposit insurance coverage) insulates them from the consequences of unsafe and unsound bank practices as well as allowing institutional shareholders and directors to act less responsibly in monitoring risk than might otherwise be the case.

Deposit insurance, like any insurance system, must be designed to mitigate the impact of moral hazard on the behavior of shareholders, management, and creditors. Such mitigation is not a function of a few specific design features. Rather, the overall design of a deposit insurance system should aim to reduce incentives for risk taking.[5] A well-designed risk-based premium-approach is an important feature[6] for a DIS to support a stable financial system safety net.[7]

[4] As defined in "IADI Enhanced Guidance for Effective Deposit Insurance Systems: Mitigating Moral Hazard", May 2013.

[5] See here and IADI Core Principles for Effective Deposit Insurance Systems, November 2014, page. 10 and 11.

[6] The other components are effectiveness of supervision, the legal framework, and early warning, intervention, and resolution regimes; IADI Enhanced Guidance for Effective Deposit Insurance Systems: Mitigating Moral Hazard, 2013, page 11.

[7] See also IADI Core Principles for Effective Deposit Insurance Systems, November 2014, pages. 10 and 11.

I.2. Guiding criteria for operation of a risk-based premium DIS model

The use of a risk-based premium approach to calculate contributions to a DIS is increasingly common,[8] but there is a lack of basic framework conditions, parameters, general principles, and operational advice which is supported by practical evidence. This chapter suggests some criteria for the design of a risk-based premium system, based on existing literature.

In a first step the responsible body for a DIS should focus on the International Association of Depositors (IADI) Core Principles for Effective Deposit Insurance Systems[9] which are accepted as the worldwide standard for deposit insurers. This table shows the IADI Core Principles on the left side and their relevance for a risk-based premium approach:

IADI Core Principles	Relevance for risk-based premium approach
CP2 – Mandate and Powers 1. The Powers of the deposit insurer include, but are not limited to: (a) assessing and collecting premiums, levies or other charges.	This is more or less an essential precondition. The DIS must have the ability to set and collect premiums. It is not necessary that the DIS "determines" the methodology to calculate the premiums. There may be situations (e.g., in circumstances where the deposit insurer is administered by the deposit-taking industry or subject to other authorities) where the deposit insurer is not permitted to independently determine premium levels, levies, or other charges. This is the case within the EU, with the EU-Commission, European Banking Authority (EBA)[10], and/or other European institutions as standard setter.
CP9 – Sources and uses of funds 1. Funding for the deposit insurance system is provided on an ex ante basis.	The ex ante funding principle[11] is a very important precondition for any kind of risk-based or differential premium system. The Financial Stability Board (FSB) has recommended exploring the feasibility and desirability of greater use of ex ante funding.[12]

[8] To name in this context are the EBA-guidelines on risk-based contribution, May 2015; https://www.eba.europa.eu/-/eba-publishes-guidelines-on-contributions-and-payment-commitments-to-deposit-guarantee-scheme; https://www.eba.europa.eu/documents/10180/1089322/EBA-GL-2015-10+GL+on+methods+for+calculating+contributions+to+DGS.pdf

[9] IADI Core Principles for Effective Deposit Insurance Systems, November 2014: http://www.iadi.org/en/deposit-insurance-systems/; http://www.iadi.org/en/assets/File/Core%20Principles/cprevised2014nov.pdf

[10] See EBA-Guidelines on methods for calculating contributions to deposit guarantee schemes EBA/GL/2015/10, 28 May 2015

[11] For more details, see: IADI, Guidance Paper Ex ante funding, June 2015.

[12] For more details, see: FSB, Thematic Review on Deposit Insurance Systems, February 2012.

IADI Core Principles	Relevance for risk-based premium approach
CP9 – Sources and uses of funds 10. If the deposit insurer uses differential or risk-adjusted premium systems: (a) the system for calculating premiums is transparent to all participating financial institutions; (b) the scoring/premium categories are significantly differentiated; and (c) the ratings and rankings resulting from the system pertaining to individual deposit-taking institutions are kept confidential.	These criteria describe "high level", basic, non-technical preconditions to collecting premiums as long as they are not flat-rate. These three points constitute the basis for the detailed description in this guidance-paper.

For a deeper analysis, we focus on an IADI Working Group output, "General Guidance for Developing Differential Premium Systems".[13] The following table shows its summarized recommendations relevant for any risk-based premium approach:

IADI WG Guidance	Relevance for risk-based premium approach
Objectives	The primary objectives of differential premium systems should be to provide incentives for banks to avoid excessive risk taking and introduce more fairness into the premium assessment process. Differential premium systems are effective at achieving these objectives when they provide good incentives for banks to manage their risks and when they are accompanied by effective early warning systems and prompt corrective supervisory action to deal with problem banks.
Situational analysis	Before establishing a differential premium system, it is important to undertake a situational analysis to self-assess the state of the economy, current monetary and fiscal policies, the state and structure of the banking system, public attitudes and expectations, the strength of prudential regulation and supervision, the legal framework, and the soundness of accounting and disclosure regimes. It is important to identify gaps between existing conditions and more desirable situations and thoroughly evaluate available options.

[13] For more details, see: IADI, General Guidance for developing differential premium systems, October 2011.

IADI WG Guidance	Relevance for risk-based premium approach
Approaches used to differentiate bank risk	The approach used to differentiate risk among banks and assign premiums should: (1) be effective at differentiating banks into appropriate risk categories; (2) utilize a variety of relevant information; (3) be forward looking; and, (4) be well accepted by the banking industry and financial safety-net participants.
Authority, resources, and information	The adoption of differential premium systems requires policymakers to ensure that the deposit insurance authority has the necessary authority, resources, and information (i.e., consistent, accurate, and verifiable) in place to administer the system appropriately.

As the IADI's "Enhanced Guidance for Effective Deposit Insurance Systems"[14] states, deposit insurers´ funding objectives should be aligned to their mandates and powers. Equally important in the determination of deposit insurers´ funding is the operating environment, which in turn is dependent on the resilience of the financial system, the soundness of the regulatory and supervisory regime, the inter-relationship between financial safety-net participants, and the financial strength of member banks (including their interlinkage).

In an ex ante system, the main component of funding is contributions from member institutions. Before establishing a premium system it is important to review the state of the economy, structure of the banking system, public attitudes and expectations, the strength of prudential regulation and supervision, the legal framework etc.[15]. In this paper, ex ante funding is a precondition for risk-based premiums and reflects Principle 9 "Sources and Uses of Funds" (essential criteria 1: Funding for the deposit insurance system is provided on an ex ante basis) of the IADI Core Principles[16].

A premium system can be either (i) flat rate or (ii) differential, or more specifically risk-based. Within a flat rate system all member banks are charged the same premium rate. A flat rate system is easy to administer and, as noted by the IADI Enhanced Guidance, could be a starting point for a newly established deposit insurance system[17], but is really only a starting point and needs further development when the DIS and banks have gained some experience of collecting premiums and assessing risks.

While such a system usually generates stable premium income for the deposit insurance fund its drawback is the lack of incentive for member banks to improve their risk profile.

---

[14] Enhanced Guidance for Effective Deposit Insurance Systems: Ex Ante Funding, IADI Guidance Paper, June 2015, page 5.

[15] General Guidance for Developing Differential Premium Systems, IADI, February 2005 updated October 2011, page 7.

[16] IADI Core Principles for Effective Deposit Insurance Systems, November 2014, page 29.

[17] Enhanced Guidance for Effective Deposit Insurance Systems: Ex Ante Funding, IADI Guidance Paper, June 2015, page 13.

Moral hazard[18] incentives from a poorly designed system for parties to accept more risk because the costs are borne by others, in whole or in part, must be avoided. The IADI Core Principles demand as a key design feature that a DIS must be designed to mitigate the impact of moral hazard on the behavior of shareholders, bank management, and depositors, while recognizing that most depositors are typically less able to differentiate between safe and unsafe banks[19]. Although the aspect of moral hazard could be managed by financial safety-net participants in various ways and by different parties, a risk-based premium system of a deposit insurance scheme can be one instrument to mitigate the impact of moral hazard (others being a strict coverage level for example).

To unfold its incentive effect, a risk-based premium system should be risk sensitive in such a way that it detects emerging risks at an early stage. The important aspect of early detection for a deposit insurance system is also identified by IADI Core Principle 13 "Early Detection and Timely Intervention"[20] and supported by IADI Core Principle 6 "Deposit Insurer´s role in Contingency Planning and Crisis Management"[21].

The mandate of a DIS is a further aspect to consider when developing a risk-based premium system. The mandate of the deposit insurer refers to the set of official guidelines describing its roles and responsibilities[22]. The IADI Core Principles differentiate between four main mandates[23]:

- A "pay box" mandate, where the deposit insurer is only responsible for the reimbursement of insured deposits;
- A "pay box plus" mandate, where the deposit insurer has additional responsibilities, such as certain resolution functions (e.g., financial support);
- A "loss minimizer" mandate, where the insurer actively engages in a selection from a range of least-cost resolution strategies; and
- A "risk minimizer" mandate, where the insurer has comprehensive risk minimization functions that include risk assessment/management, a full suite of early intervention and resolution powers, and in some cases prudential oversight responsibilities.

The overall idea of any risk-based premium system is to provide incentives for the insured institutions to manage and reduce their risk; for the DIS as a complex system to tackle the moral hazard problem that results from any kind of deposit guarantee protection per se; and to foster public trust in the safety of deposits. Harmonized principles and core elements for the design of a risk-based premium system also help establish a level playing field among banks from different countries and different economic environments. There is no "one-size-fits-all" solution. This guidance-paper does not therefore aim to champion one specific

---

18 IADI Core Principles for Effective Deposit Insurance Systems, November 2014, page 11.
19 IADI Core Principles for Effective Deposit Insurance Systems, November 2014, page 11.
20 IADI Core Principles for Effective Deposit Insurance Systems, November 2014, page 36.
21 IADI Core Principles for Effective Deposit Insurance Systems, November 2014, page 25.
22 IADI Core Principles for Effective Deposit Insurance Systems, November 2014, page 9.
23 IADI Core Principles for Effective Deposit Insurance Systems, November 2014, page 10.

model nor recommend a solution implemented by any one country or system. The aim is to deliver "design principles" and "practical experiences" to enable decision-making bodies to combine these parameters into an individual solution which fits the DIS needs and recognizes the national circumstances. So some degree of flexibility must be recognized to reflect the different business models followed by the banks operating in different markets, and some non-distorting national specificities (e.g., bank size, diversification and complexity).

I.3. Recommendations for a principle-based framework

The basic considerations for establishing a risk-based premium system should comprise the following:

- analysis of the operating environment including:
  - macroeconomic condition,
  - financial system structure,
  - prudential regulation, supervision, and resolution,
  - legal and judicial framework,
  - accounting and disclosure regime[24];
- the mandate of the DIS; and
- mitigating the impact of moral hazard.

In the aftermath of the 2007 financial market crisis, the European Forum of Deposit Insurers (EFDI) and the Joint Research Centre (JRC) of the European Commission jointly worked on risk-based premium models for DIS funding. The papers published as a result[25/26] recommended a common framework for risk-based premium models that are simple, accurate, reasonable, affordable/sustainable, flexible, open/transparent, and impartial.

In 2014, the EFDI Research Working Group on "Risk-based Contribution" published a paper on risk-based models.[27/28] This introduced a framework based on the following principles and elements:

- **Accuracy:** The model/risk function should be effective in differentiating banks into risk categories. The discriminating power of the model/risk function has to be approved by regular back testing and validation processes. Adequate financial and organizational

[24] IADI Core Principles for Effective Deposit Insurance Systems, November 2014, page 11 et seq.

[25] "Possible Models for risk-based Contributions to EU Deposit Guarantee Schemes", European Commission, Joint Research Centre - Economics and Applied Statistics Unit, June 2009

[26] "Development of common voluntary Approaches to include risk-based Elements for Deposit Guarantee Schemes, EFDI Working Group III, September 2009.

[27] EFDI Research Working Group "Risk-based Contribution", May 2014, page 10 et seq.

[28] Building on the presentation for EMG of Garcia, Gillian G. H. (World Bank) "Deposit Insurance - Risk-adjusted pricing", April 2005

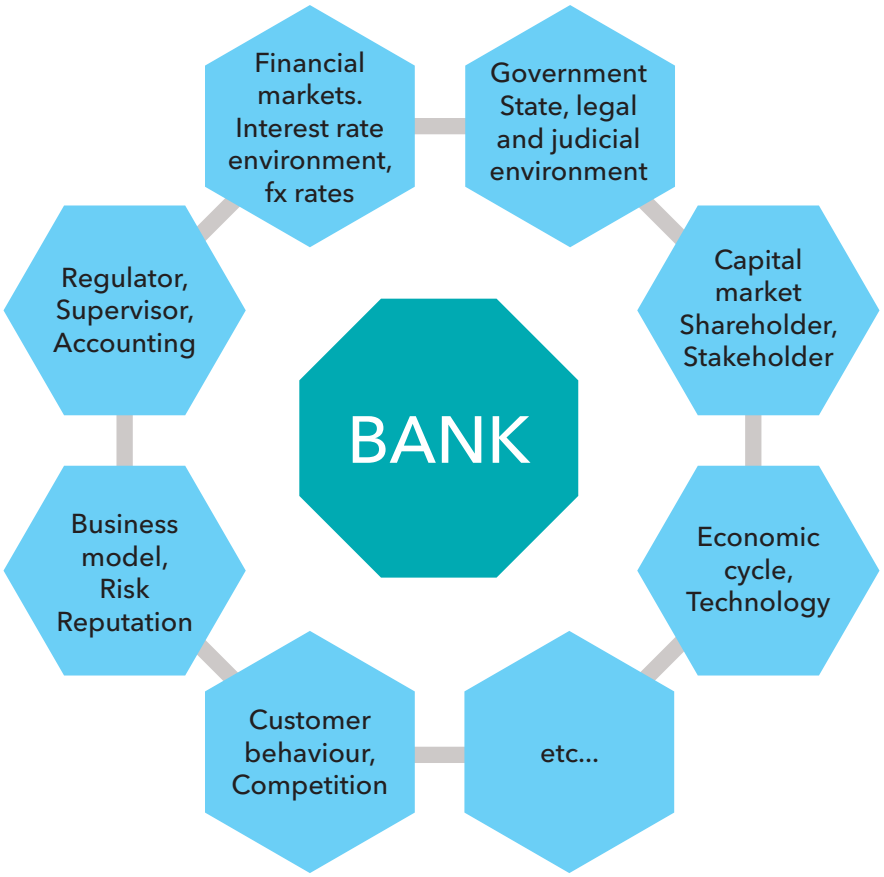
resources should be appointed to run the system. The DIS, or the entity in charge of establishing the contributions for the DIS, should have the necessary authority, resources, and information (i.e., consistent, accurate, and verifiable) in place to administer the system appropriately. The organizational and technical environment must adequately support reliable calculation as well as data collection and data storage.

- **Appropriate incentives:** The model should provide incentives for member banks to reduce their risk profile and to avoid the inherent moral hazard of any kind of protection.
- **Reasonable:** In terms of the amount of information required, i.e., the collection of inputs for the model. Undue burdening of DIS member banks should be avoided.
- **Affordable/Suitable:** The model should not cause insolvency to any member bank, i.e., the costs resulting from the model should be manageable for the banks, and the regular premium shall take due account of the phase of the business cycle and the impact of pro-cyclical effects.
- **Flexible:** The model should be adjustable to different countries, i.e., to different economies, different legal structures, different financial markets and/or different bank-types, and different business strategies. It should be possible to make changes to the analytical variables or their respective weighting at a national level when required in order to maintain the model's explanatory power.
- **Transparent:** The methodology (the bases and criteria) for calculating premiums should be transparent and well understood by all stakeholders. This enhances accountability, sound management, and the functioning of the system. The member banks should know why they fall in one risk category and should be able to verify it. Any kind of manipulation of the system must be avoided; its members should not be able to gain advantage by adjusting technical details.
- **Confidentiality:** Information about the model, the methodology, definition of variables, model weights, and how it works, should be publicly available. DIS member banks' individual outcomes should not be. The results of bank risk assessments should generally be disclosed only to the competent authorities and the bank itself (to avoid market instability/bank runs). The combined overall results for all banks of a country and/or system could possibly be made public, after potential undesired effects on the stability of the banking system are analyzed by the respective authorities/relevant parties and excluded. There could also be a situation in which it might be constructive and desirable to publish a bank-individual result; this should be for each country/system to decide, considering the potentially destabilizing effect of publishing.
- **Impartial:** The model should be fair. Banks with similar risk profile should be treated similarly.
- **Independent:** The DIS, or the entity in charge of establishing the contributions for the DIS, should be operationally independent in its risk assessment. The DIS should be provided with all power and means to administer the system appropriately without undue influence from banks, relevant authorities, and politicians.

EFDI Principles	Relevance for a risk-based premium system
Accuracy	✓ effective in differentiating banks into risk categories ✓ back testing and validation processes ✓ adequate financial and organizational resources
Incentives	✓ providing appropriate incentives to reduce risk profile ✓ tackle moral hazard
Reasonable	✓ information requirement not unduly burdensome member banks
Affordable	✓ no insolvency due to contribution effect ✓ no negative reinforcement of economic cycle
Flexibility	✓ adaptable to environments and structures, i.e., to different economies, different legal structures, different financial markets and/or different bank-types, different business strategies ✓ no "one-size-fits-all"-approach
Transparency	✓ methodology transparent to stakeholders ✓ comprehensible calculation of premium
Confidentiality	✓ result of risk assessment transparent only to a limited group of stakeholders (e.g., bank, DGS, competent authorities) ✓ too much publicity may cause instability (up to bank-runs!)
Impartiality	✓ fair model – similar risk profiles treated similarly
Independence	✓ power and resources to administer the system – access to data ✓ no undue influence by member banks or third parties

The EFDI-principles can be summarized as follows:
The 2014 EFDI framework built on the ideas of Garcia (World Bank) and the papers of the Joint Research Centre and the EFDI Working Group III, but removed the earlier principle of "simplicity". In view of the complex environment of banks (see figure 1 below) simplicity seems an inappropriate framework principle for an adequate risk-based premium model. An adequate risk-based premium model should be as simple as possible and as complex as necessary.

Figure 1:
Banks - Complex environment



II. Criteria to categorize risk-based premium models

II.1. Risk characteristics - what risk should be measured and priced?

To measure risk, three main approaches can be distinguished:

(1) the quantitative approach, relying on quantitative data and ratios;
(2) the qualitative approach, relying on qualitative factors and criteria; and
(3) a mix of quantitative and qualitative factors, combining quantitative data and ratios with qualitative criteria.

The IADI stated in its General Guidance that the advantage of quantitative approaches are that they rely on relatively objective factors and data and are viewed as being transparent and less open to argument than more subjective approaches. They do not, however, allow consideration of important qualitative factors of banks such as the quality of corporate governance and risk management[29].

When implementing quantitative factors, analysis of the operational environment should have shown that accurate data, based on financial statements and/or regulatory reporting within the financial system, is available for the DIS. It is important to note that high-quality, stable data is required for risk-based models (e.g., from audited financial statements or quality checked regulatory reporting) of comparable quality to general accepted accounting principles such as IFRS[30]. An additional issue with banking groups is to decide which entity should provide the quantitative data which is transformed into ratios and risk function. If data comes from sole financial statements, the risk function is very much focused on the origin risk but neglects contagion effects from the consolidated level. Using data from the consolidated financial statement, special structures of a banking group, such as consolidated insurance companies, could lead to dilution of the result, hence, potentially leading to a false risk identification. The relevance of this issue was illustrated during transposition of the EBA Guidelines[31] into German DIS practice. Within its set of core risk indicators, based on data from regulatory reporting, the EBA demanded a range of capital and risk-weighted assets (rwa) driven ratios and a ratio named ´potential losses for the deposit guarantee schemes´ (unencumbered assets to covered deposits). This created confusion as some ratios are not calculated on an individual (sole) basis by some banks, in particular capital and rwa ratios (waiver rule). Whereas covered deposits are only calculated on sole basis.

---

[29] IADI "General Guidance for Developing Differential Premium Systems", Research and Guidance Committee of International Association of Deposit Insurers, issued February 2005 and updated October 2011, page 10.

[30] IFRS: International Financial Reporting Standards.

[31] "Guidelines on methods for calculating contribution to deposit guarantee schemes", European Banking Authority, EBA/GL/2015/10, 28 May 2015.

For international banking groups, even when consolidated data on unencumbered assets could be provided, covered deposits should only be provided up to the national level of the DIS. In the German case some banking groups were not able to provide certain information without undue burden and certain data were not available to a harmonized and equal extent. To avoid such situations and challenges, an early analysis of available data and timely recognition of obstacles is recommendable.

Qualitative approaches can provide relevant information about the future risk profiles of banks based on the assessment of risk management practice and the individual risk appetite of the member banks. A pure qualitative approach is generally less transparent and utilizes a higher degree of judgement and discretion compared to quantitative approaches[32]. Qualitative approaches are challenging as the information must be assessed by qualified and trained analysts, it therefore becomes a question of the quantity and expertise of the DIS staff. The DIS should have full access to the information required for regulatory and supervisory judgement, not least because a member bank could object to its classification (on which its risk-based premium depends) potentially leading to legal action. Such data and information is extremely market sensitive and must only be shared confidentially as necessary among financial safety-net participants given the legal and regulatory implications.

IADI identified a combination of quantitative and qualitative measures as the most common approach to differential premium systems[33/34].

It is common sense that a risk-based premium model should adequately measure and differentiate risks of and among member banks. In order to achieve this, frameworks such as the CAMELS[35] approach are applied.

- Capital
- Asset Quality
- Management Quality
- Earnings
- Liquidity
- Sensitivity to Market Risk

---

[32] IADI "General Guidance for Developing Differential Premium Systems", Research and Guidance Committee of International Association of Deposit Insurers, issued February 2005 and updated October 2011, page 11.

[33] IADI "General Guidance for Developing Differential Premium Systems", Research and Guidance Committee of International Association of Deposit Insurers, issued February 2005 and updated October 2011, page 12.

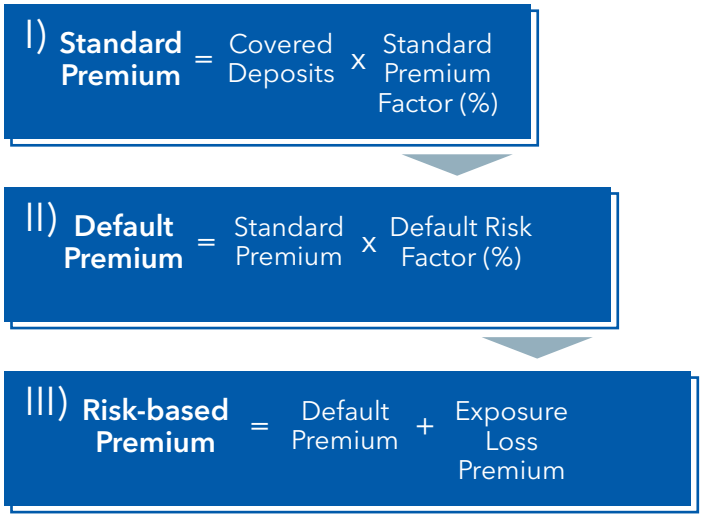
[34] Examples: In the United States FDIC introduced such a system in 1993, in Germany the voluntary deposit protection scheme of the private banks introduced such a system in 1996, in Canada the CDIC introduces such a system in 1999.

[35] Sahajwala, R., Van den Bergh, P. "Supervisory Risk Assessment and Early Warning Systems", Basel Committee on Banking Supervision Working Papers, No. 4, December 2000. EFDI-Research Working Group "Risk-based Contribution, 22 May 2014.

The risk for a DIS is not solely described by the probability of banks´ default. The amount of covered deposits at risk to be reimbursed and the loss a DIS finally has to bear (after recoveries have been made from the estate of the failed bank) should also be considered by the risk-based premium formula. Thus, the DIS must have proper information about the amount of covered deposits per member bank and, beyond this aggregated figure, in the case of reimbursement the DIS must know the covered deposits per depositor (often named as the single customer view) within a very short time period.

These factors suggest a waterfall-type approach, starting with a standard premium based on the covered deposits of the bank and a standard premium factor of the DIS. The standard premium factor could be derived by a DIS fund target level. At the next level, the premium for the default risk is calculated. At the third level, the default premium and a loss exposure premium lead to the risk-based premium (see figure 2).

Figure 2:
Waterfall-type approach



Further premium levels, for example, for the risk of systemically important financial institutions could be considered as well.

II.2. The four sector approach

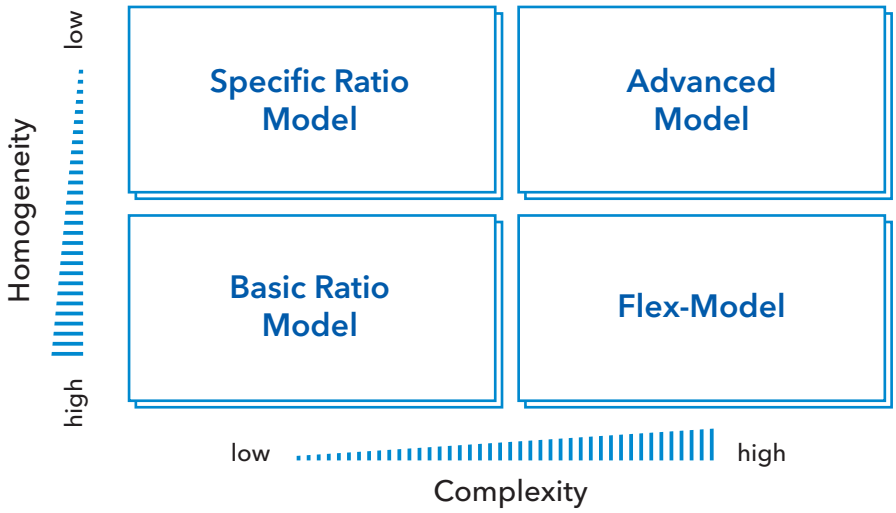
An adequate number of experienced DIS staff, the availability of appropriate data, the structure of the banking system, and the DIS´ mandate are important factors to be taken into account regarding the design of a risk-based premium model.

Size and international activities, along with the business model (e.g., retail, mortgage, investment, or transaction business), determine the risk profile of banks. The more heterogeneous the banking structure within a DIS, the more sophisticated the risk-based model should be, to measure and differentiate risk adequately.

The macroeconomic environment, the level of development of the economic structure and the regulatory environment, the number of financial institutions, as well as the structure of financial safety-net participants, determine the complexity of a banking system.

The aspects of homogeneity and complexity should be considered when designing the risk-based premium model. The more complex and less homogeneous the environment is, the more complex the model should be. The authors recognize four standard cases (see figure 3), considering the postulate "as simple as possible and as complex as necessary".

Figure 3:
The Four Sector approach – elements at a glance



Beyond the influences of the operational environment, the mandate of the DIS is of great importance in deciding on the model. For pure "pay box" mandates, with the objective of adequate funding and timely reimbursement, complex models are not as important as for "loss" and particular "risk minimizers" with early intervention functions.

The least complex model of the 4 sector approach is the **Basic Ratio Model**. It is a quantitative "one size fits all" approach with, for example, approximately six ratios covering the CAMELS approach and a standard weighting structure for the ratios.

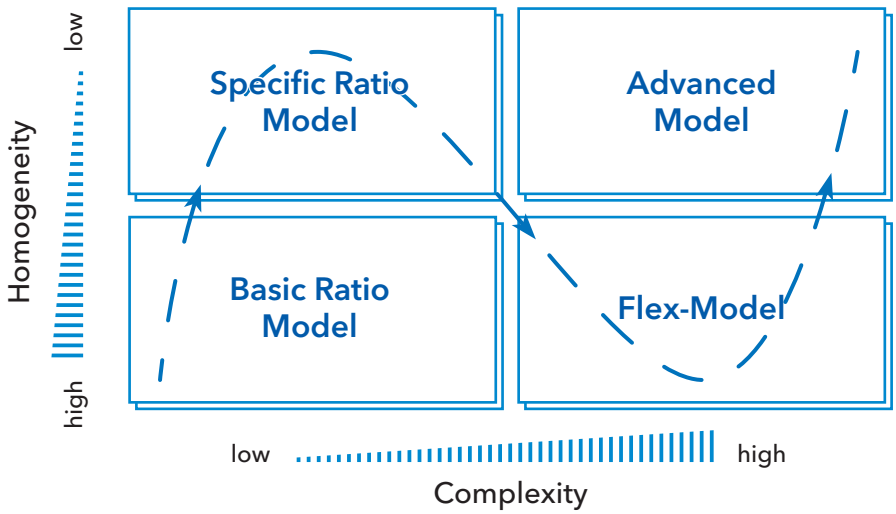
The **Specific Ratio Model** also takes a quantitative approach, consisting of "one size fits all" core indicators and a range of supplementary factors either for a drill down to better differentiate banks with the same risk structure or additional factors to better cover the scope of bank risk.

The **Flex-Model** stands for a higher degree of flexibility. It is a mixture of quantitative and qualitative analysis, covering issues like corporate governance and risk management with the option of specific ratio weight structures for different business models.

The **Advanced Model** is a mixture of quantitative and qualitative analysis and a high degree of bank specific weight structures, particularly for the qualitative factors. The methodology is comparable or equal with a credit rating. The result could be a probability of default figure.

As these models need broader and deeper data and information from sector to sector, the challenges for a DIS are increasing in the same way. The 4 sector approach offers a tool to examine aspects of operational environment and DIS mandate in relation to the design of a risk-based premium system and also a structure for further development (level of sophistication see dashed line figure 4) towards a more specific model and early detection system. This approach may be considered as a kind of "evolutionary path".

Figure 4:
The Four Sector approach – level of sophistication



III. Case study: EU deposit guarantee schemes

III.1. The EU-DGSD'S construction principle and main elements

In 2014, the revised Directive on Deposit Guarantee Schemes (DGSD) was published.[36] Transposition of the DGSD into EU member states national law was required by July 2015.

The DGSD is based on the principle of minimum harmonization for the DIS in the EU. The main factors are a broadened and clarified scope of coverage, faster repayment periods, improved information, and robust funding requirements. The DIS should primarily be used to repay depositors pursuant to the DGSD and therefore fulfill the "pay-box" function.

The DGSD introduced a fixed coverage level of EUR 100 000 per depositor per bank. For the protection of deposits resulting from certain transactions, or servicing certain social or other purposes, the coverage level could be higher than EUR 100 000 for a given period (so called "temporary high balanced" deposits).

The repayment period is set at seven working days[37]. In order to ensure that depositors in all EU member states benefit from similar levels of protection, among other things, financing of the DIS was harmonized with a uniform ex ante financial target level (amount of available financial means)[39].

The premium to the DIS in the EU has to be based on the amount of covered deposits and the degree of risk incurred by the respective member bank. This allows the risk profiles of individual banks to be reflected, including their different business models. It should also lead to a fair calculation of contributions and provide incentives to operate under a less risky business model.[39]

EBA guidelines[40] specify methods for calculating premiums to ensure consistent application of the DGSD, although a DIS may still use their own risk-based methods. The calculation

---

[36] See DGDS as per http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014L0049

[37] DGSD Article 8 1. states that member states shall ensure that the payable amount is available within seven working days. Article 8 1. opens the repayment process towards a transitional period: 20 working days until 31 December 2018; 15 working days from 1 January 2019 until 2020; 10 working days from 1 January 2021 until 2023.

[38] DGSD Article 10 2. states that member states shall ensure that, by 3 July 2024, the available financial means shall at least reach a target level of 0.8% of the amount of the covered deposits of its members. No. 6 allows a minimum target level lower than 0.8% inter alia when the banking sector in which the banks affiliated to the DIS operate is highly concentrated. That reduced target level shall not be lower than 0.5% of covered deposits.

[39] DGSD Paragraph 36.

[40] EBA "Guidelines for calculating contributions to deposit guarantee schemes", EBA/GL/2015/10, 28 May 2015, page 10 et seq.

of the premium has to be proportional to the risk of the member banks and shall take due account of the risk profiles of the various business models. Those methods may also take into account the asset side of the balance sheet and risk indicators, such as capital adequacy, asset quality and liquidity.[41] The EBA[42] guidelines set out principles on the risk component of the calculation method. In addition, they capture various aspects of the bank's risk profile by specifying a number of core risk indicators pertaining to capital, asset quality, management and business model, liquidity and funding, and potential losses for the DIS.

The DIS (or the responsible authorities) have to comply with the following principles when developing the calculation methods:

(1) Calculation methods should, as far as possible, reflect an increased liability incurred by DIS as a result of member banks´ participation.
(2) Calculation methods should be consistent with the build-up period (to reach the target level) envisaged in the DGSD.
(3) Incentives provided by contributions to the DIS should be aligned with prudential requirements.
(4) Calculation methods should take into account specific characteristics of the banking sector, and should be compatible with the regulatory regime as well as with the accounting and reporting practices in the EU member states where the DIS is established.
(5) The rules for calculating contributions should be objective and transparent.
(6) The required data for the calculation should not lead to excessive additional reporting requirements.
(7) Confidential information should be protected.
(8) Calculation methods should be consistent with relevant historical data.

The main elements of the EBA calculation method are the:

- calculation formula,
- thresholds for aggregate risk weights,
- risk categories,
- risk indicators, and
- risk weights.

[41] DGSD Article 13 2.
[42] www.eba.europa.eu

The EBA introduced the following calculation formula:

$$C_i = CR \times ARW_i \times CD_i \times \mu$$

C_i	CR	ARW_i	CD_i	μ
Annual contribution from member bank i.	Contribution rate (identical for all member banks in a given year) - The contribution rate is the percentage (standard premium factor) assuming no risk differentiation is paid to reach the target level.	Aggregate risk weight for member bank i - ARWi is the aggregate of the individual risk scores based on the risk indicators and the indicator weights. The thresholds are defined for the lowest aggregate risk weight within a range between 50% and 75% and the highest aggregate risk weight within a range between 150% and 200%.	Covered deposits for member bank i.	Adjustment coefficient (identical for all member banks in a given year) - The adjustment coefficient should adjust the annual amount of total premiums to reach the target level as evenly as possible, considering business cycles and the pro-cyclical impact of premiums on the banks´ financial position.

The guidelines specify five categories of risk indicators. Within each risk category, there are compulsory core risk indicators with a minimum weight assigned to each core indicator (see table below). The values of risk indicators should be calculated on a solo basis. However, if only consolidated data is available (e.g., in the case of a received waiver), the corresponding indicators should be calculated at the consolidated or semi-consolidated level[43].

To determine risk classes and aggregate risk weights, the guidelines introduce either the bucket method or the sliding scale method.

In the bucket method, a fixed number of buckets should be defined for each risk indicator by setting upper and lower boundaries for each bucket. The number of buckets for each risk indicator should be at least two. For each risk indicator the range of the buckets should be between 0 (lowest risk) and 100 (highest risk).

[43] EBA "Guidelines on methods for calculating contributions to deposit guarantee schemes", EBA/GL/2015/10, 28 May 2015, paragraph 63 et seq.

In the sliding scale method, for each bank an individual risk score will be calculated for each risk indicator. Each risk indicator should have an upper and lower boundary. When a higher risk indicator value indicates a riskier bank and the risk indicator is above the upper boundary, the individual risk score will be a fixed value of 100. Correspondingly, when the risk indicator value is below the lower boundary, the individual risk score will be 0. If the risk indicator´s value is between the defined boundaries, the individual risk score will lie between 0 and 100.

Category / Indicator	Description core risk indicators[44]	Information	Minimum Weight
(1) Capital 18 %			
Leverage ratio	$\frac{\text{Tier 1 capital}}{\text{total assets}}$	Replaced by leverage ratio once it becomes fully operational	9 %
Capital coverage ratio	$\frac{\text{actual CET 1 ratio}}{\text{required CET 1 ratio}}$ or $\frac{\text{actual own funds}}{\text{required own funds}}$		9 %[45]
CET 1 ratio	$\frac{\text{CET 1}}{\text{risk weighted assets}}$	Illiquidity might prevent a deposit insurer from liquidating its investments when its liabilities are triggered upon pay-out	9 %[46]
(2) Liquidity and funding 18 %			
Liquidity coverage ratio (LCR)	LCR ratio	LCR ratio once it becomes fully operational	9 %
Net stable funding ratio (NSFR)	NSFR ratio	NSFR ratio once it becomes fully operational	9 %
Liquidity ratio (national definition)	$\frac{\text{liquid assets}}{\text{total assets}}$	Replaced by LCR ratio once it becomes fully operational	9 %[47]

[44] EBA "Guidelines on methods for calculating contributions to deposit guarantee schemes", EBA/GL/2015/10, 28 May 2015, Annex 2.

[45] DIS has the choice between "capital coverage ratio" and CET 1 ratio.

[46] DIS has the choice between "capital coverage ratio" and CET 1 ratio.

[47] Interim ratio until LCR becomes fully operational.

Category / Indicator	Description core risk indicators	Information	Minimum Weight
(3) Asset quality 13 %			
Non-performing loans ratio (NPL ratio)	$\frac{\text{NPL's}}{\text{total loans \& debt instruments}}$ or $\frac{\text{NPL's}}{\text{total loans}}$	Non-performing loans to be reported gross of provisions	13 %
(4) Business model and management 13 %			
Risk-weighted asset ratio	$\frac{\text{risk weighted assets}}{\text{total assets}}$	For this ratio the use of different calibration for advanced or standardized approaches is permitted	6.5 %
Return on assets (RoA)	$\frac{\text{net income}}{\text{total assets}}$	To avoid including one-off events and pro-cyclicality in contributions, an average of at least two years should be used	6.5 %
(5) Potential losses for the Deposit Guarantee Scheme 13 %			
Unencumbered asset ratio	$\frac{\text{total assets} - \text{unencumbered assets}}{\text{covered deposits}}$	To avoid including one-off events and pro-cyclicality in contributions, an average of at least two years should be used	13 %
∑ minimum weights core indicators:			75 %

The sum of the minimum weights for risk categories and core risk indicators amounts to 75% of total weights. The individual DIS can allocate the remaining 25% by (a) increasing the minimum weights or (b) distributing them among additional risk indicators[48].

(a) Allocating the remaining 25% by increasing the minimum weights for the core risk indicators:

- Capital from 18% to 24%;
- Liquidity and funding from 18% to 24%;
- Asset quality from 13% to 18%;
- Business model and management from 13% to 17%;
- Potential use of DIS funds from 13% to 17%.

[48] EBA "Guidelines on methods for calculating contributions to deposit guarantee schemes", EBA/GL/2015/10, 28 May 2015, paragraph 58.

(b) The weight of any additional risk indicator should not be higher than 15% except for qualitative risk indicators from the category "business model and management" representing the outcome of a comprehensive assessment of the member banks´ risk profile and management[49].

In addition to distributing the remaining 25% among the core risk indicators or among further additional risk indicators (with the limit of 15% for each indicator), the guidelines also permit the distribution of this 25% to the risk category "business model and management" by increasing its weight to 38%.

As well as the core risk indicators, EBA introduced a range of additional risk indicators for illustration purposes. The following table provides an overview of these.

Category / Indicator	Description additional risk indicators[50]
(3) Asset quality	
Level of forbearance	$\frac{\text{exposures with forbearance measures}}{\text{total corresponding instrument on the balance sheet}}$
(4) Business model and management	
Sector concentrations in loan portfolio	$\frac{\text{exposures from the sector with the highest concentrations}}{\text{total loan portfolio}}$
Large exposures	$\frac{\text{large exposures}}{\text{eligible capital}}$
Excessive balance sheet growth ratio	$\frac{\text{total assests in year (t)} - \text{total assets in year (t} - 1)}{\text{total assets in year (t} - 1)}$
Return on equity (RoE)	$\frac{\text{net profit}}{\text{total equity}}$
Core earnings ratio	$\frac{\text{core earnings}}{\text{total loan portfolio}}$
Cost-to-income ratio	$\frac{\text{operating costs}}{\text{operating income}}$
Off balance sheet liabilities ratio	$\frac{\text{off balance sheet liabilities}}{\text{total assets}}$

[49] EBA "Guidelines on methods for calculating contributions to deposit guarantee schemes", EBA/GL/2015/10, 28 May 2015, chapter 2, paragraph 11.

[50] EBA "Guidelines on methods for calculating contributions to deposit guarantee schemes", EBA/GL/2015/10, 28 May 2015, Annex 3.

Category / Indicator	Description additional risk indicators
Qualitative assessment of the quality of management and internal governance arrangements	Assessment based on following sources of information: • questionnaires accompanied by on-site and/or off-site inspections; • comprehensive assessment reflected in the SREP[51] scores; • external ratings by recognized external credit assessment institution.
IPS[52] Membership	$\frac{\text{available ex ante funds in the IPS}}{\text{total assets of the individual IPS member bank}}$
Systemic role in an IPS	• the bank has a systemic role (indicates higher risk); • the bank does not have a systemic role (indicates no higher risk).
Low-risk sectors	• the bank belongs to a low-risk sector (indicates lower risk); • the bank does not belong to a low-risk sector (indicates average risk).
(5) Potential losses for the Deposit Guarantee Scheme	
Loss absorbing capacity	$\frac{\text{own funds and eligible liabilities}}{\text{total liabilities (incl. own funds)}} - \text{MREL}$

[51] SREP - Supervisory Review and Evaluation Process

[52] IPS - Institutional Protection Schemes

III.2. The positioning of the EU-DGSD into the 4-sector matrix

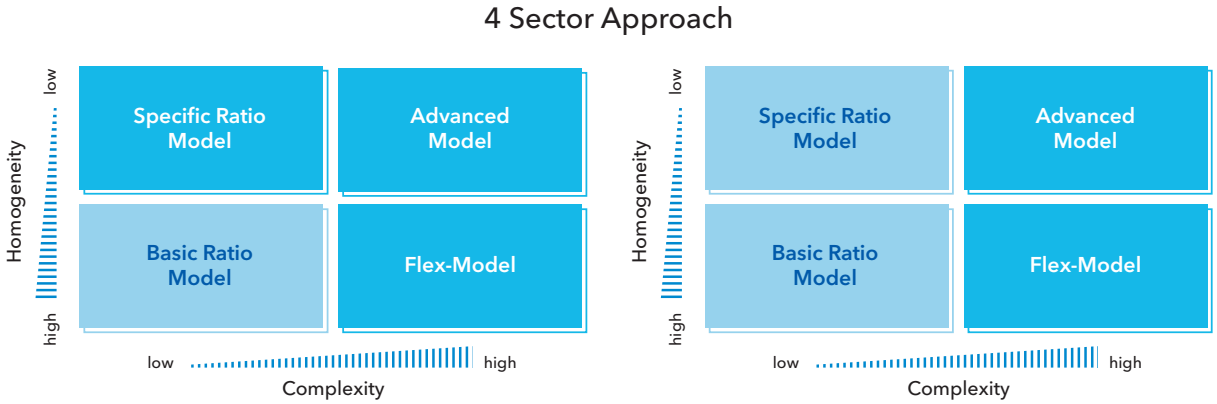
In December 2016, the EU had 28 member states. The EU represents countries of significantly different sizes as well as economic structures and power. Consequently, the financial systems are very heterogeneous. One can find concentrated banking markets such as in France or the Netherlands, and less concentrated banking markets and highly diversified banking systems such as in Germany or Austria.

EU accounting standards are well defined and the regulatory and supervisory system is strong. The European institutions ECB, EBA, ESMA, EIOPA[53], together with the national competent authorities, form a strong regulatory environment, which is as the "Single Supervisory Mechanism SSM" an important part of the three-pillared European Banking Union[54].

The harmonized criteria of the DGSD which set the parameters of a national DIS lead (in most cases) to a DIS with a narrow pay-box mandate, as the DGSD concentrates mainly on the payout functionality to protect consumer deposits.

The core risk indicators, with their standard weights based exclusively on quantitative data from regulatory reporting, represent the "Basic Ratio Model" of the 4 sector approach. But the national DIS / competent authorities have discretion to enrich the scope of risk indicators with further risk indicators analogous to the EBA additional risk indicators. Use, for example, of the low-risk sectors indicator develops the model in the direction of a "Specific Ratio Model" (see Figure 5).

Figure 5:
Positioning of the EU-DGSD into the 4-Sector-Matrix

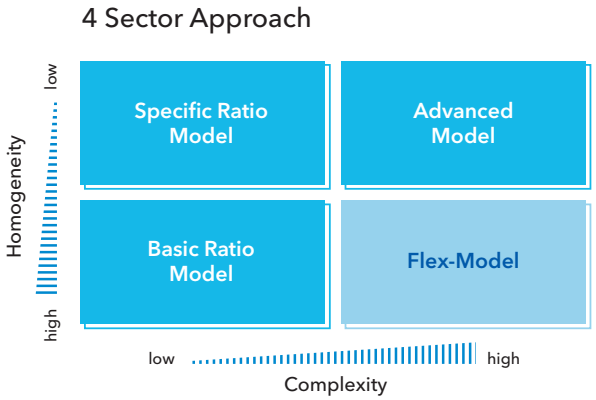


[53] ECB - European Central Bank, EBA - European Banking Authority, ESMA - European Securities and Markets Authority, EIOPA - European Insurance and Occupational Pensions Authority

[54] See http://ec.europa.eu/finance/general-policy/banking-union/index_en.htm

The DIS can opt to enrich the quantitative core risk indicator model within the categories "business model" and "management" with aspects of a qualitative assessment of the quality of management and internal governance arrangements, weighted up to 25% of the total weight. Using this option, the system becomes a more sophisticated combination of quantitative and qualitative system and develops the model in the direction of a "Flex-Model" (see Figure 6).

Figure 6:
Upgraded positioning of the EU-DGSD into the 4-Sector-Matrix



The factor contribution rate (CR) of the EBA formula

$$C_i = CR \times ARW_i \times CD_i \times \mu$$

reflects the first level of the premium waterfall in combination with a certain degree of flexibility introducing the adjustment coefficient μ.

From the perspective of validation and calibration of the risk model, it was unexpected that the EBA mixed elements of bank risk (default premium level) with isolated DIS risk represented by the risk indicator potential losses for the DGS (loss for the DIS). Separation of these different risk perspectives based on the aspect of statistical validation may have been better.

The current EBA risk model for risk-based premium is (for now) a model based on expert opinion as it has not yet been validated through statistical means. The lack of historical data is because some ratios, based on regulatory reporting, were not fully defined by regulators, are in development, or have only recently been introduced.

Demanding thresholds for the lowest and highest aggregate risk weight (ARWi) within a range between 50%/75% and 150%/200% should have an impact on the moral hazard issue.

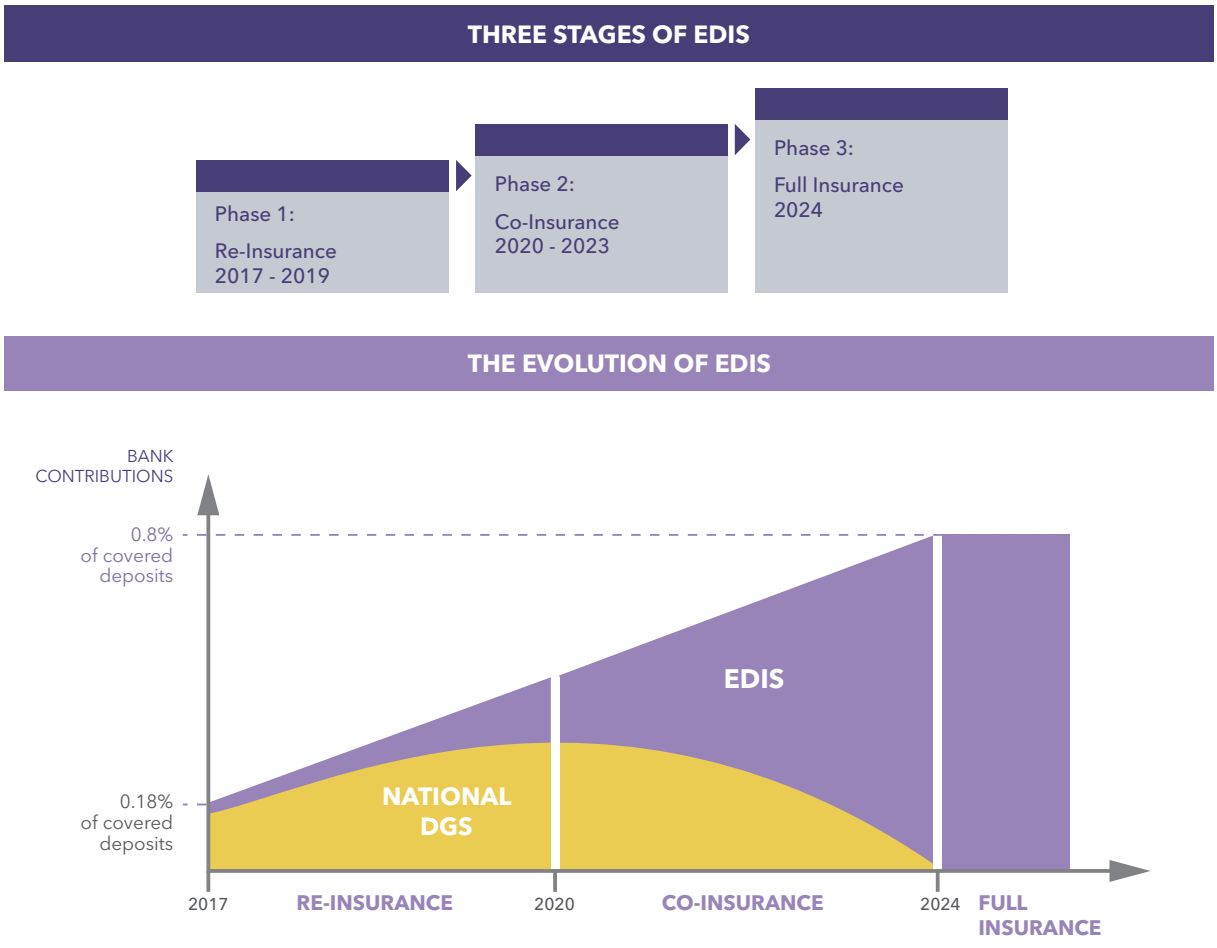
III.3. "EDIS" – the European discussion to create a single European DIS

Based on the DGSD, as described in chapter III.1., the European Commission propose as a further step the creation of a fully harmonized single European Deposit Insurance System (EDIS).

Background and main idea of EDIS

A European Commission policy paper published on June 22, 2015[55] contains further proposals on the "mutualization" of national deposit insurance schemes across Europe. The Presidents of the European Commission, the ECB, the European Parliament, the Council, and the Eurogroup propose merging national deposit guarantee systems to form a European Deposit Insurance Scheme (EDIS) as the third pillar of EU Banking Union. They suggest as a first step creating a system of reinsurance between the existing national deposit protection schemes in the euro area, followed by co-insurance and eventually reaching full-insurance by 2024 (see figure 7).

Figure 7:
The EDIS-Concept at a glance



[55] Junker, J.C., Tusk, D., Dijsselbloem, J., Draghi, M., Schulz, M. The Five President´s Report: Completing Europe´s Economic and Monetary Union, 22 June 2015.

During the re-insurance phase the relative risk of institutions will be determined only at the national level, the calculation is based on the amount of covered deposits and the degree of risk relative to **all** other credit institutions affiliated to the same participating DIS. Starting with the co-insurance period, it is intended that the calculation will be based on the amount of covered deposits and the degree of risk incurred by each credit institution relative to all other banks at the Banking Union level.[56]

The current state of discussion to calculate risk-based premiums is that the contribution collected from banks should be based on[57]:

- The amount of covered deposits; and
- The degree of risk incurred, taking into account the following criteria:
  - The level of loss absorbing capacity of the bank;
  - The bank´s ability to meet its short and long term obligations;
  - The stability and variety of the bank's sources of funding and its unencumbered highly liquid assets;
  - The quality of the bank´s assets;
  - The bank´s business model and management;
  - The degree to which the bank´s assets are encumbered.

Whereas most EU member states have announced the implementation of the DGSD, the next step to fully harmonize deposit protection in the EU and to introduce a single European Deposit Insurance System is still under discussion.

[56] EU Commission, non-paper, Effects Analysis (EA) on the European Deposit Insurance Scheme (EDIS), 11 October 2016.

[57] AHWP on Strengthening the Banking Union, non-paper, Risk Based Methodology for the calculation of contributions under EDIS, 20 January 2017.

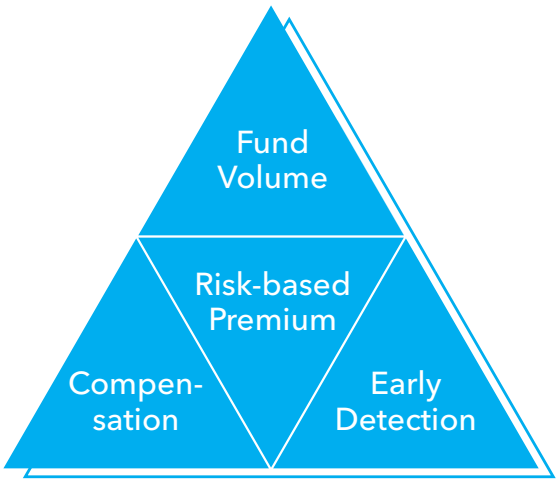
IV. Recommendations to establish and run a risk-based system

IV.1. The scope of a risk-based system

A well designed DIS is an essential element for financial market stability. To generate confidence and to prevent bank runs, with their possible contagion effects, an adequate fund volume is one of the most important backbones for a DIS[58]. Timely reimbursement of deposits after a bank failure provides confidence and stability. A well-designed risk-based premium system is the primary funding facility. If premiums are linked to risk and other differential measures, the added cost for deposit insurance may deter excessive risk taking and help mitigate moral hazard[59]. However, the incentive effect fails if the system does not detect risk at an early enough stage to increase the individual bank premium or does not detect risk at all. Early detection of weak or problem banks is therefore crucial for the effective and stable functioning of the financial system and the DIS, particularly for loss and risk minimizers. It helps to ensure due preparation for bank failures and provides the time the deposit insurer will need to quickly accumulate and allocate the necessary financial, human and operational resources.[60]

Figure 8 illustrates the central role risk-based (premium) systems play a within the DIS framework.

Figure 8:
Application Pyramid



[58] Others are "Liquidity", "Trust/Confidence" and "Operational capabilities".

[59] IADI "Enhanced Guidance for Effective Deposit Insurance Systems: Mitigating Moral Hazard", Guidance Paper by the Research and Guidance Committee, May 2013, page 17.

[60] IADI "General Guidance on Early Detection and Timely Intervention for Deposit Insurance Systems", by Research and Guidance Committee, June 2013, page 12.

Risk classes - asymmetric dispersion

To mitigate moral hazard effects, it is not sufficient to only distinguish weak and strong banks, but to do this at an early stage accompanied by a substantial premium surcharge. Thus, in defining the risk classes, the DIS must determine the number of risk classes and the corresponding surcharge levels. EFDI recommends five classes with a corresponding surcharge core area between 75% and 150% using an asymmetric dispersion[61] (see example table below).

Low risk		Average risk	High risk		
Risk class	1	2	3	4	5
Aggregated risk weight	75%	100%	110%	125%	150%

Asymmetrical dispersion of risk classes means there should be more surcharge than discount classes. The example comprises three surcharge classes (high risk class 3 to 5), one class for average risk with standard premium (average risk class 2) and one discount class (low risk class 1).

Risk classes - fund volume

The calibration of the aggregated risk weight should consider the aspect of fund volume. A high discount rate for the low risk class (in particular for major premium payers) places an additional burden on all other member banks, meaning higher standard premiums to reach target level during the accumulation phase or risk missing the target. The DIS must find a balance between funding requirements and setting incentives for less risky business models. In a mature system with an adequate fund volume (of at least the target level), funding requirements are less important and the incentive for less risky business models and mitigation of moral hazard should come to the foreground.

Risk classes - migration analysis

A higher number of risk classes can help support analysis of risk development. Movement between the classes and a migration analysis of these movements can illustrate how the risk of DIS member banks' portfolios evolve. Migration of a bank to a higher risk class can also act as an early warning signal.

[61] EFDI "Risk-based Contribution", EFDI-Research Working Group, 22 May 2014, page 20.

Stress test

The EBA guidelines[62] list the following two main risk areas to be covered by stress tests:

- Operational risk, i.e., that the DIS cannot meet its obligations due to inadequate or failed internal processes, inadequate staffing, and systems;
- Funding risk, i.e., the risk that sources of funding (regular premium, extraordinary premium, and alternative funding arrangements) are insufficient to enable the DIS to meet its potential liabilities, or to meet them within the time periods required by national or EU law.

If a bank is identified as being a risk, through for example risk class migration combined with an adverse financial stress test, it may be decided to perform an operational reimbursement stress test. This provides information on covered deposits at risk, and therefore the liquidity needed, and the number of depositors at risk, to identify the possible impact on the fund and (from an operational point of the DIS) the organizational and human resources necessary to deal with a failure of such a bank.

Liquidity

As a DIS has two crucial roles in a reimbursement case, the role of a loss absorber and the role of a liquidity provider, the aspect of sufficient liquidity is important for the assessment of an adequate fund volume. In a case of liquidity shortfall extra measures must be in place (e.g., extraordinary premium, other liquidity arrangements with banks, DIS, or Central Bank).

An appropriate model

The more heterogeneous a bank portfolio is with regard to size, franchise and business model, the more challenging it is to design an accurate quantitative ratio model to detect risk at an early stage. For homogeneous DIS member bank portfolios with similar risk structures (not to be mistaken with similar risk appetite), quantitative models work properly. A more forward-looking approach than a pure quantitative risk-based model is a combined quantitative and qualitative model. The disadvantage is that the Flex or Advanced Model (see chapter II.2) require significantly more effort.

In accordance with a lean procedure, a Flex or Advanced Model could be processed in two steps. The first step involves a pure quantitative assessment and a classification to risk classes (as Basic Ratio or Specific Ratio Model). An additional assessment based on qualitative criteria (and additional quantitative ratios) will be performed in the second step only for banks beyond a defined risk class or defined structures (e.g., size).

The development of the risk model towards an advanced probability of default model, combined with a loss given default assessment analogous to an expected loss approach, can be used as a basis to identify fund volume adequacy.

---

[62] EBA Final Report "Guidelines on stress tests of deposit guarantee schemes under Directive 2014/49/EU", EBA/GL/2014/04, 24 May 2016

Bucket approach vs. sliding scale approach

The transmission from risk indicator to score value, as illustrated in the EBA guidelines[63], can be performed by a bucket approach or a sliding scale approach. In the bucket approach, small movements at the thresholds could lead to significant effects in the result. While this could be an incentive not to migrate to a higher risk bucket it does mean that minor changes could have exaggerated effects. Within the thresholds of a bucket, no further means of differentiation and no incentives for improvement exist.

As the sliding scale approach has no buckets, it avoids the exaggerated effect of a small change leading to a leap between buckets. However, even the smallest change of a risk indicator is registered on the sliding scale and appears as a change in the risk situation. For a DIS with a small member bank portfolio, bucket allocation could be challenging. A sliding scale approach may therefore be easier to handle in these cases. But while this approach avoids the exaggerated effects of the bucket approach it may give an impression of pseudo accuracy.

Source information

As already described in chapter II.1., the risk indicators can be based on quantitative and qualitative data. In designing a risk-based model, a decision has to be made on its sources of information.

Three main sources of information are[64]:

- Highly aggregated market information (e.g., share prices, credit spreads);
- Publicly available information (e.g., annual reports, investor relation presentations);
- Confidential information (e.g., supervisory audit reports, regular annual report of the auditor, regulatory reporting, internal risk reports, specific questionnaires).

The use of highly aggregated market information raises the question of availability for all member banks of a DIS and reliability due to market efficiency.

Publicly available information such as annual reports are quality assured, but provide subjective statements from the company´s point of view to a certain extent. Confidential information is a recommendable source of data as it is quality assured and/or risk-oriented. Particular attention shall be given to the aspect of confidentiality regarding the transmission of data to the DIS. The more sophisticated the level of work of a DIS (4 Sector Approach see figure 4 in chapter II.2.) the more important it is for the DIS to have unrestricted access to all relevant data and information.

---

[63] EBA "Guidelines for calculating contributions to deposit guarantee schemes", EBA/GL/2015/10, 28 May 2015

[64] EFDI "Development of common voluntary Approaches to include risk-based Elements for Deposit Guarantee Schemes", Working Group III, September 2009, page 22.

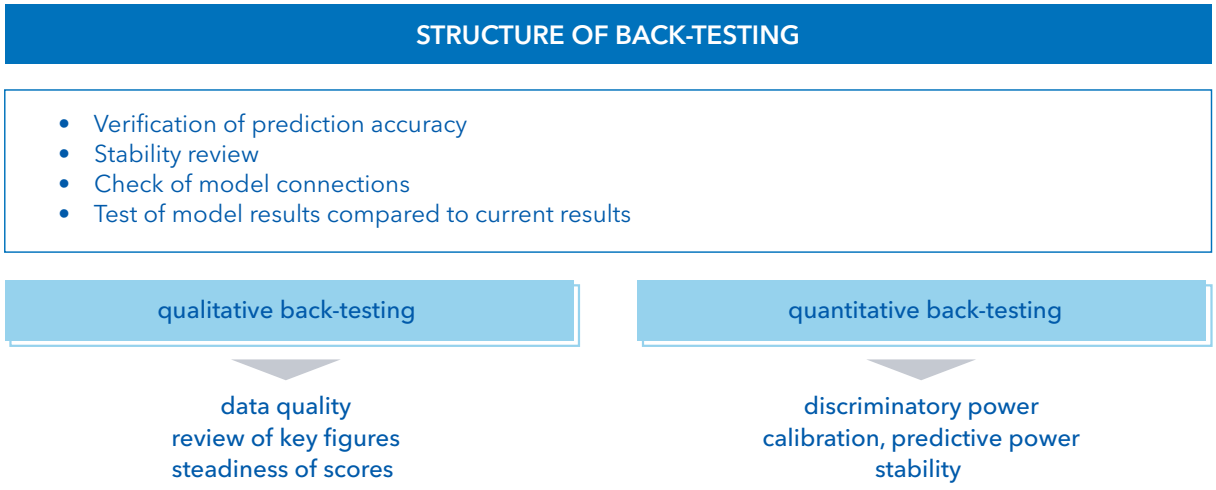
In cases where the DIS does not directly gather information but relies on the supervisor instead, formal agreements need to be in place to ensure information required for administering the risk-based premium system is collected, verified for accuracy, and transmitted on in a timely manner[65]. Processes and structures for the transmission of data and storage in a database must be subject to a high standard of data security and data leakage protection.

Back-testing and validation

An adequate risk-based premium system must be calibrated in such a way that it detects risky banks and distinguishes weak from sound banks. To ensure this, the risk model should undergo a regular back-testing and validation process. There should be statistical evidence that the methodology (ratios, weights, score transmission) is producing accurate results (discriminating power). As the business environment and the regulatory framework of the member banks is continuously developing, a risk-based premium model requires ongoing monitoring, revision, and adjustment if discriminating power weakens. Back-testing should therefore be undertaken regularly and validation if necessary.[66]

A regular back-testing process includes the prediction of accuracy and stability, the review of model connections, and the testing of model results compared to actual results. The process can be divided into two separate strands: qualitative back-testing and quantitative back-testing. The objective of qualitative back-testing is to ensure the applicability and the correct use of the methods in practice. Data quality, key figures, and the steadiness of scores are reviewed in this strand. Quantitative back-testing reviews the discriminatory power, calibration, predictive power, and stability of the results.

Figure 9:
Back-testing



[65] IADI "General Guidance for Developing Differential Premium Systems, issued February 2005 and updated in October 2011, page 22.

[66] EFDI Research Working Group "Risk-based Contribution", May 2014, page 22.

If the back-testing indicates adjustment is required, a validation process should be initiated. In the validation process, various analyses (univariate analyses, multivariate analyses) and tests are performed to maintain the high quality of the risk-based premium model.

Structures, processes, methodologies, data, etc. have to be properly documented and stored as a basis for assessments and audits of competent authorities and as evidence in the case of legal appeal.

IV.2. Introducing a risk-based premium system

A well-managed transition process can help contribute to the success and acceptance of a risk-based premium system. One of the first steps in ensuring a successful transition is to have a clear plan which sets out the transitioning objectives, responsibilities, resource requirements, timetable, and deliverables. The transition plan should be communicated to all relevant parties. With respect to timing, a transitional period can enable member banks to familiarize themselves with the risk-based premium system and the proposed processes, as well as provide an opportunity to improve their financial results, risk management practices, and data warehouse. Transition periods typically range from one year to several years. Generally, the more complex the risk-based premium system and its information requirements are, the greater the adjustment period needs to be.[67]

The EFDI Research Working Group presented the following implementation structure[68]:

Initialization phase

- Creation of a common understanding of the main aims, tasks, and rights of the DIS, to the extent of the duties of the member banks. The deposit insurer should have the necessary authority, resources, and information in place to carry out its responsibilities with regard to the operation of such systems;
- Confirmation of confidentiality;
- Development of a step-by-step action plan to introduce risk-based contribution systems;
- Build-up of the necessary resources (people, IT systems, organizational framework, and structure);
- Definition of the addressees of bank-specific reports and system-summarized reports.

---

[67] IADI "General Guidance for Developing Differential Premium Systems, issued February 2005 and updated October 2011, page 17.

[68] EFDI Research Working Group "Risk-based Contribution", May 2014, page 31 et seq.

Development of the database

- Review of existing, available, and necessary data from each bank;
- Clear definition of the data sources;
- Decision to use a market system or to develop own system;
- Decision to use individually created questionnaires or other methods to collect data;
- Safeguarding of data quality (e. g. use of international accounting standards, solo- or consolidated accounts, currency).

Development of the model

- Collection and build-up of adequate data history (minimum three to five years is recommended);
- Decision on general principle: empirical foundation or expert system;
- Quantitative modeling (core of the system with the definition of the figures, their weighting, and consolidation);
- Consultation with competent authority.

Test phase

- Test sample / out of sample;
- Redefinition/revalidation of the model;
- High likelihood of a second (or more) test(s).

Implementation phase

- Presentation of the new system and process to member banks (roadshow/on-site visits, written information, internet);
- Confidential communication of the individual risk class and premium to each member bank (written/on-site);
- Help-desk/Hotline;
- Development of the operational premium system.

Operation phase (DIS-internal)

- Safeguarding financing of the system (administrative costs) and operational readiness to compute and collect premiums;
- Determination of documentation obligations;
- Data security and confidentiality;
- Back testing and validation of the model;
- Definition of the organizational structure (IT, employees);
- Internal and/or external auditor (e. g. internal auditing, auditing company);
- Map how to handle incorporated systemic relevant banks in case of a real crisis and juridical responsibility of owners;
- Audit by competent authority.

Operation phase (member banks)

- Servicing of the defined report-addresses with bank-individual and summarized results;
- Communication of the relevant information to the banks as individual risk scores, risk class and premium (e.g. letter, report, download);
- Catalog of bank specific and individual measures (e. g. calculation of the risk-based premium itself for the bank, hints, obligations);
- Definition of escalation mechanism (in the case a bank does not accept the output of the system);
- Definition of an arbitral procedure.

Enhancement phase

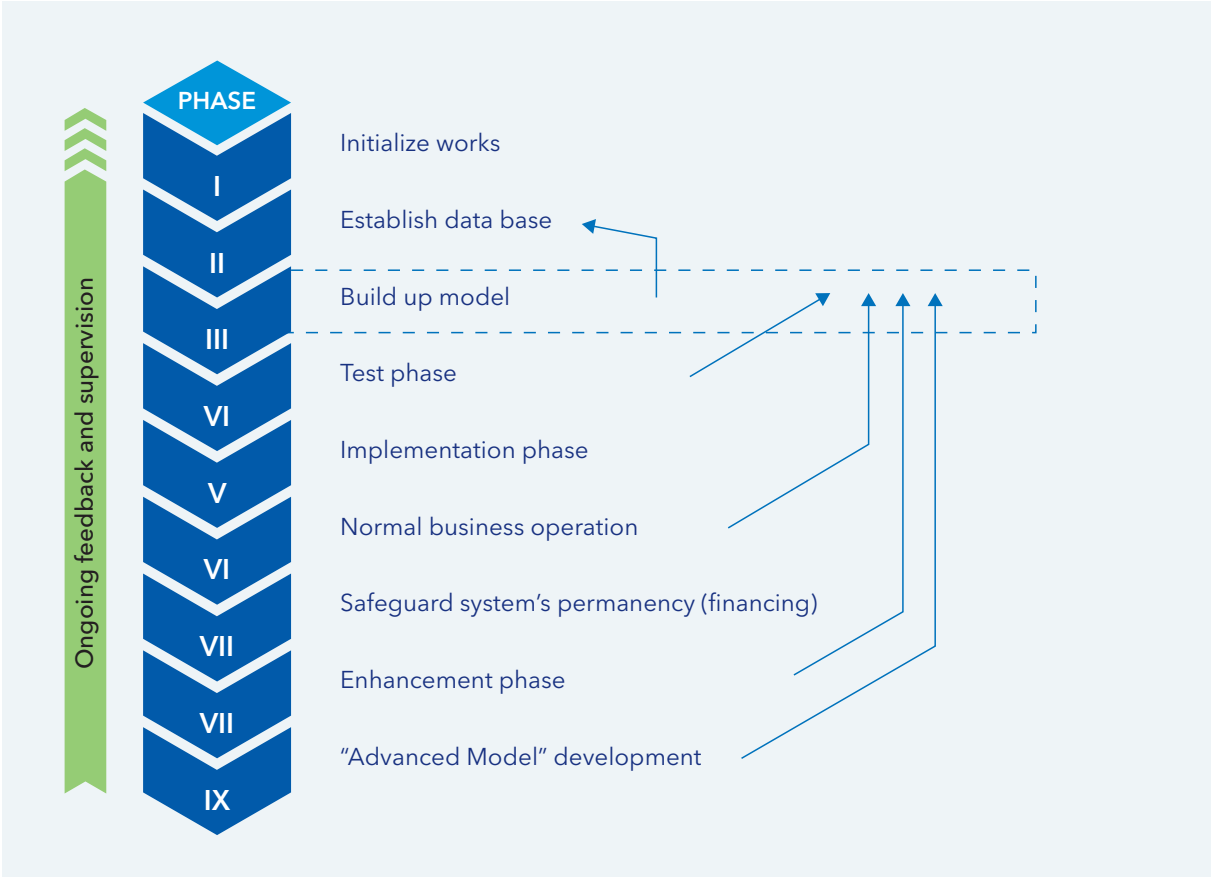
- Impact of external effects (markets, laws, etc.);
- Impact of DIS-internal effects.

Development of advanced approach

- Decision to expand the running standard approach (see evolutionary path figure 4, 4 Sector Approach);
- Additional figures/ratios;
- Qualitative criteria;
- Definition of relevant information sources/information channels.

The whole process to implement may be visualized at a glance like this:
With respect to the above outlined implementation process: It should be clear that introducing a risk-based premium system in a DIS takes time. The development of such a system will take months and work to ensure its effective operation will never end – but it is worthwhile doing! A sound and well-designed DIS with a proper risk-based premium methodology supports financial market stability and sustains consumer trust.

Figure 10:
Implementation process – steps at a glance



V. Summary/Conclusions

This guidance note focuses on relevant steps, parameters, practical evidence, and structured models to design a risk-based premium model for DIS. The main findings are summarized below:

- There is no one-size-fits-all DIS. Literature-based analysis and practical experience show that there are many important principles, elements, and first-hand notes worldwide (these are screened, bundled, and outlined in Chapter I.2). But it remains a challenging task to design an individual risk-based premium model. The key factor is to "keep it as simple as possible and as complex as necessary".
- A premium system can either be flat rate or differential (or more specifically risk-based). A flat rate system is easy to administer and could be a starting point for a newly established deposit insurance system, but really only the starting point, to be further developed when DIS and banks have gained experience with collecting premiums and assessing risks.
- When deciding to implement a risk-based system a DIS should work within a specified framework. The authors recommend the following cornerstones: accurate, reasonable, affordable and sustainable, flexible, open and transparent, and impartial.
- The basic considerations for establishing a risk-based premium system should comprise the analysis of the operating environment with the aspects of macroeconomic conditions, structure of the financial system, prudential regulation, supervision and resolution, legal and judicial framework, accounting and disclosure regime, as well as the mandate of the DIS and the aspect of mitigating the impact of moral hazard.
- To measure risk, a quantitative approach (relying on quantitative data and ratios), a qualitative approach (relying on qualitative factors and criteria); and a mix of quantitative and qualitative factors (combining quantitative data and ratios with qualitative criteria) can be distinguished. The advantage of using quantitative approaches is that they rely on relatively objective factors and data and are viewed as being transparent and less open to argument than more subjective approaches. On the other hand, this approach is not very suitable to consider such important qualitative factors of banks such as the quality of corporate governance and risk management. Combined approaches - using both quantitative and qualitative measures - are therefore the most common approach to differential premium systems.
- The risk for a DIS is not solely described by the probability of banks´ default. The amount of covered deposits which may need to be reimbursed and the loss a DIS may finally have to bear should also be considered by the risk-based premium formula. This requires a waterfall-type approach: a flat rate level standard premium is established based on the covered deposits of the bank and a premium factor of the DIS; then the additional premium for default risk is calculated; and then a loss exposure premium; which leads to the final risk-based premium.

- Aspects of homogeneity and the complexity of the environment of the DIS and its member banks should be considered when designing the risk-based premium model. The more complex and less homogeneous the environment is, the more complex the model should be. The authors recognized four standard cases (4 Sector Approach), again always bearing in mind "as simple as possible and as complex as necessary". The least complex model of the 4 sector approach is the Basic Ratio Model. It is a quantitative "one size fits all" approach. The more sophisticated Specific Ratio Model is a quantitative approach as well, consisting of "one size fits all" core indicators and a range of supplementary factors either for a drill down to better differentiate banks with the same risk structure or additional factors to better cover the scope of bank risk. The Flex-Model stands for a higher degree of flexibility. It is a mixture of quantitative and qualitative analysis, hence covering issues like corporate governance and risk management with the option of specific ratio weight structures for different business models. The Advanced Model is a mixture of quantitative and qualitative analysis and a high degree of bank specific weight structures particularly for the qualitative factors. The methodology is comparable or equal to a credit rating. The 4 sector approach provides a structure as well as an orientation framework to explore possible designs for a risk-based premium system, taking account of the operational environment and DIS mandate, and to guide efforts to further develop the system towards a more specific and early detection system (level of sophistication).
- The opinions & views expressed here are determined by the experiences of the authors. There is clear evidence, in our opinion, that a risk-based approach to calculate contributions for member banks of a DIS is developing into a "global standard" for an experienced DIS.

VI. Bibliography

AHWP on Strengthening the Banking Union, non-paper, Risk Based Methodology for the calculation of contributions under EDIS, 20 January 2017

BECK, Thorsten, Deposit insurance as a private club, 2001

Deposit Guarantee Schemes Directive (DGDS), http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014L0049

EBA, Guidelines on methods for calculating contributions to deposit guarantee schemes, EBA/GL/2015/10, May 2015

EBA, Guidelines on stress tests of deposit guarantee schemes under Directive 2014/49/EU, EBA/GL/2014/04, 24 May 2016

EFDI Research Working Group, Development of common voluntary approaches to include risk-based elements for Deposit Guarantee Schemes, September 2009

EFDI Research Working Group, Risk-based Contribution, May 2014

EU Commission, non-paper, Effects Analysis (EA) on the European Deposit Insurance Scheme (EDIS), Brussels, 11 October 2016

FSB, Thematic Review on Deposit Insurance Systems, Basel, February 2012

Garcia, Gillian G. H. (World Bank), Deposit Insurance - Risk-adjusted pricing, April 2005

IADI, Core Principles for Effective Deposit Insurance Systems, Basel, November 2014

IADI, Enhanced Guidance for Effective Deposit Insurance Systems: Ex Ante Funding, Basel, June 2015

IADI, General Guidance on Early Detection and Timely Intervention for Deposit Insurance Systems, Basel, June 2013

IADI, Enhanced Guidance for Effective Deposit Insurance Systems: Mitigating Moral Hazard, Basel, May 2013.

IADI, General Guidance for developing differential premium systems, Basel, October 2011

Joint Research Centre Economics and Applied Statistics Unit - European Commission, Possible Models for risk-based Contributions to EU Deposit Guarantee Schemes, June 2009

Junker, J.C., Tusk, D., Dijsselbloem, J., Draghi, M., Schulz, M., The Five President´s Report: Completing Europe´s Economic and Monetary Union, 22 June 2015

Sahajwala, R., Van den Bergh, P., Supervisory Risk Assessment and Early Warning Systems, Basel Committee on Banking Supervision Working Papers, No. 4, December 2000

INVESTING FOR THE BAD TIMES: HOW TO ACHIEVE A BALANCED INVESTMENT STRATEGY FOR A DEPOSIT INSURANCE FUND

Mirjami Kajander-Saarikoski

WORLD BANK GROUP
Finance & Markets
Financial Sector Advisory Center (FinSAC)

Contents

1. Introduction

There are only a handful of institutional investors whose mission is to fix "bad times" in the economy. A deposit insurer leads the pack: its mission is to rescue bank depositors upon a bank failure. In the meantime, its funds need to be replenished and invested in anticipation of the next failure. With constantly rising pre-funding levels, typically translating into hundreds of millions of dollars under management, deposit insurers are gradually emerging as important institutional investors. What are their special characteristics as investors?

The purpose of the deposit insurer's investment activities is to support its main task of protecting depositors upon bank failure. Accordingly, the objective of its investment strategy must be to have a maximum amount of assets available upon bank failure. As bank failures tend to occur following economic downturn, the investment activities of deposit insurers need to come with a twist.

According to Prof. Andrew Ang, "the two most important words in investing are bad times".[1] Each institutional investor has its own individual set of "bad times" determined by its mission, liabilities and other special characteristics. Investment activities of a deposit insurer should be based on defining its individual bad times and then choosing appropriate types of investments that match its needs.

For any institutional investor, bad times such as a financial crisis – the economic equivalent of a "cardiac arrest"[2] – are generally capable of affecting the value of its investments. A lengthy investment horizon, however, should enable a pension fund, a university endowment foundation, a family office, or a sovereign wealth fund to ride out a storm in the financial market. In contrast, for the deposit insurer, bad times such as a financial crisis – leading to bank failures – are perfectly capable of triggering its liabilities (in full or in part) at a rather short notice. Consequently, the investment performance of deposit insurers should never be benchmarked against the performance of other types of institutional investors, who are meant to play a different role. A somewhat more useful parallel might be drawn with the investment activities of investor compensation schemes, unemployment benefit schemes and – due to their task of supporting the liquidity of the banking system – central banks. In the end, however, only the performance of another fund explicitly earmarked for the management of banking crises – such as a bank resolution fund or a financial stability fund – is likely to serve as a useful point of comparison.

[1] Ang, p. ix.
[2] El-Erian, p. 6.

In spite of their special nature, it is vital for deposit insurers to keep themselves abreast with research in the field of investment markets and, whenever the opportunity presents itself, exchange ideas with other institutional investors. Financial markets evolve constantly, and the past may not be a good guide to the future; relying on asset classes or strategies that have been successful in the past is perhaps the most common investor mistake. The 1990s and 2000s were a benign period for fixed-income investors, with endless returns flowing from a constant downward trend in the interest rate levels in advanced economies. Today, however – in an environment of ultra-low or rising interest rates – it can be outright dangerous to stick to received wisdom on "risk-free" investments, and sitting idle might bring rather unpleasant surprises when rates rise. A couple of years ago, who would have imagined a world with sub-zero interest rates? Who would have thought that yields on a number of sovereign bonds and deposit rates at many key central banks would sink to negative territory (as has recently been the case in Europe and in Japan)? The concept "New Normal" – immortalized by Dr. Mohamed El-Erian – is used to imply that something which was previously abnormal has become commonplace, and this applies to the prospect of a prolonged era of ultra-low interest rates.[3] In these circumstances, conventional thinking might entail losses. On the other hand, chasing "hot" new investment products often is a five-star recipe for disaster too.

For these reasons, creating a balanced investment strategy for a deposit insurer has become more topical than ever. This guidance note attempts to uncover the key hurdles and biases that potentially jeopardize the creation of a balanced investment strategy for a deposit insurer. The viewpoint in this note is that of an asset owner. The aim is not to offer investment advice, but to provide food for thought only. The views expressed herein are those of the author herself, and do not necessarily represent the views of her employer or the World Bank. The scope of this note excludes the investment activities of Islamic deposit insurance schemes in anticipation of a separate set of IADI Core Principles for Effective Islamic Deposit Insurance Systems in due course.

First, this note will provide an overview of deposit insurers, with special emphasis on their mission and liabilities – the key factors that define their investment activities. Next, it will seek to outline a path towards a balanced investment strategy fit for bad times. All investing is about risk management: selecting investable risk factors suitable for deposit insurers and avoiding unsuitable risk factors in a systematic way. Accordingly, key asset classes will be examined in view of their underlying risk factors. Because diversification lessens the impact of bad times, it needs to considered whether it is sustainable to keep all eggs in the same basket, so to speak. Before finishing, the note will touch briefly upon potential structural solutions to organizing daily asset management. Finally, it will explore the interplay between investments and back-up funding.

[3] El-Erian, pp. 12, 14.

2. General Characteristics of a Deposit Insurer

2.1. Mandate and liabilities

The mission of a deposit insurer is to protect bank depositors upon a bank failure. Reimbursing depositors at the full face value of the insured deposit base uses up enormous amounts of cash in just a few days, whereafter the deposit insurer remains a creditor of the failed bank's estate for years. The toolkit of a deposit insurer usually contains an alternative technique of financing the transfer of deposits to another bank, as it tends to be less costly and enables an uninterrupted banking access for the depositors. A deposit insurer may also be called to finance the use of other resolution tools, as long as its contribution does not exceed the net cost of reimbursing depositors (i.e., the final loss after expected recovery it would have incurred in bankruptcy proceedings).[4]

The level, scope and trigger for deposit insurance are, as a rule, set out in legislation (in the EU, for example it is euro 100,000 per depositor per bank). Nevertheless, the liabilities of a deposit insurer vis-à-vis depositors do not easily translate into figures. While the statistics for aggregate insured deposits within the domestic banking sector are known (or can be estimated), and the aggregate insured deposits at a single bank are similarly known (or can be estimated), a deposit insurer cannot predict how many banks – and of what size – will fail during any particular year. Furthermore, in each case, the choice of tools to address the bank failure affects the cost of the rescue for the deposit insurer. The cost materializes in two dimensions as:

- immediate liquidity needs; and
- final net loss (depending on the recovery rate from the failed bank's estate).

Thus, typical outbound annual cash flows for deposit protection are difficult to predict. The issue is aggravated by stringent reimbursement timeframes set out in legislation. In order to contribute to financial stability, the IADI Core Principles place great emphasis on speed of reimbursement as follows:

> *"The deposit insurer is able to reimburse most insured depositors **within seven working days.**"*[5]

The timeframe might at times be even shorter if, depending on its mandate, a deposit insurer is expected to contribute to resolution financing. Whatever the timeframe, it inevitably has implications for the investment strategy of a deposit insurer as it needs to liquidate assets within the given timeframe.

[4] Essential criterion 8 (d) to Principle 9, IADI Core Principles, p. 30.
[5] Essential criterion 1 to Principle 15, IADI Core Principles, p. 39, emphasis added.

The currency of a deposit insurer's liabilities depends on the nature of the insured banking sector. Do domestic banks have extensive branch networks in foreign countries? In which currency denomination is the deposit base of each insured bank in its home country and in its foreign branch offices, respectively? Does local law allow deposit insurance to cover deposits in foreign currency?

Whenever foreign-currency deposits are insured, it needs to be set out whether these deposits are to be reimbursed in local or foreign currency upon bank failure. This issue is vital because it has implications as to who bears the foreign-exchange risk. If reimbursements are made in foreign currency, the foreign-exchange risk remains with the deposit insurer. If, on the other hand, foreign-currency deposits are converted into local currency before reimbursing depositors, the risk is transferred to the depositors at least for the waiting period between bank failure and the date of reimbursement. There should be a transparent rule establishing the date for the foreign-exchange conversion (usually, it is the date of the formal decision triggering deposit insurance). At a minimum, a system that offers to repay depositors in foreign currency must have access to sufficient foreign assets or other sources of foreign-currency funding to make this commitment credible.[6] To mitigate foreign-exchange risk, the deposit insurer should have in place sound policies and procedures to manage foreign-exchange risk. A currency mix within liabilities, in particular, needs to be reflected in the choice of investment assets.

The insured deposit base is not static, but instead tends to grow by a few percentage points annually. As a result, the aggregate liabilities of a deposit insurer are expected to grow accordingly.

What about the impact of inflation on the liabilities of a deposit insurer? In the short term, inflation is usually not relevant for a deposit insurer. In the long term, however, inflation may be capable of influencing its assets and – in particular – liabilities; for instance, the covered amount per depositor might need to be adjusted following inflation.

The liabilities – in view of their nature, development, trigger, timeframe and currencies – need to translate into investment implications.

[6] Financial Stability Forum Guidance, p. 25.

2.2. Funding

In view of the less than rosy circumstances where deposit insurance kicks in, a robust funding structure is key for any deposit insurer. The funding structure can be described as two-fold:

- *Internal funding* refers to internal sources of funds, primarily funds from the collection of premiums (usually referred to as "pre-funding") as well as returns generated from investments. It may also refer to post-funding, i.e., the collection of extraordinary premiums from member banks afterwards.
- *External funding* refers to external sources of funds such as borrowing from the government, the capital markets, or other sources (usually referred to as "back-up funding" or "liquidity funding").

Sound funding arrangements are integral to the credibility of the deposit insurance scheme, as they are essential aspects of its operational readiness. IADI Core Principles set the tone:

> *"The deposit insurer should have **readily available funds** and all funding mechanisms necessary to ensure prompt reimbursement of depositors' claims, including assured **liquidity funding** arrangements."*[7]

2.3. Internal funding

IADI Core Principles call for an ex ante mechanism of funding, i.e., pre-funding. Pre-funding refers to the regular collection of premiums with the aim of accumulating a fund to meet future liabilities. Globally, there is a general trend towards the establishment of a pre-fund: by 2014, the percentage of deposit insurers with pre-funding systems had increased to nearly 90 per cent.[8] Moreover, all deposit insurance schemes established since the year 2003 are pre-funded.[9] The target size of the fund may be set out in legislation. The optimal target size depends on a variety of issues (for further details see paper "Determining the Target Deposit Insurance Fund: Practical Approaches for Data-Poor Deposit Insurers"). A pre-funding approach consequently entails a constantly growing fund for years to come, with significant inbound cash flows to be invested every year.

Ex post funding (or post-funding) refers to collecting extraordinary premiums from surviving banks after a bank failure. In the event that pre-funding alone does not suffice to cover the deposit insurer's liabilities in the case at hand, member banks are often required to promptly fill the gap by way of extraordinary premiums. This is the case, for example, in the member states of the EU. In practice, however, there may at times be natural limits to the amount of post-funding immediately acquirable in an economic downturn, as huge extraordinary premiums from the banking industry might result in pro-cyclical effects capable of damaging the real economy.

---

[7] Principle 9, IADI Core Principles, p. 29, emphasis added.
[8] IADI Enhanced Guidance, p. 6.
[9] Global Overview of Funding Issues, p. 4.

2.4. External funding

The principle whereby the cost of deposit insurance is borne by the banking industry does not mean that all liquidity would necessarily be provided by banks at all times. The global financial crisis of 2007-2009 (GFC) showed that depositor confidence was partially dependent on knowing that adequate funds would always be available to ensure the prompt reimbursement of their claims.[10] For this reason, it is considered good practice to ensure immediate access to emergency funding.

A deposit insurer needs to have back-up funding arrangements in place at all times for the following reasons:

- Deposit insurers are not designed to single-handedly remedy a banking failure of systemic proportions, so back-up funding arrangements are necessary to reinforce public confidence in the deposit insurance system.[11]
- Secondly, pre-funding is designed to cover merely the *net losses*[12] of a bank failure, whereas an up-front gross reimbursement might exceed the level of pre-funding, thereby causing a gap between available resources and the financial obligations binding the deposit insurer.
- Thirdly, however prudently the pre-funding may have been invested, markets might temporarily become so dysfunctional at a critical point in time that it is best to avoid painting oneself into a corner by carrying out a fire-sale with intrinsic losses. In these circumstances, using alternative liquidity (secured with the investments as collateral) might make sense instead.

The importance of such back-up funding arrangements is highlighted in the IADI Core Principles:

> *"Emergency funding arrangements for the deposit insurance system, including pre-arranged and assured sources of liquidity funding, are explicitly set out (or permitted) in law or regulation. Sources may include a funding agreement with the government, the central bank or market borrowing.* ***If market borrowing is used it is not the sole source of funding.*** *The arrangement for emergency liquidity funding is set up in advance, to ensure effective and timely access when required."*[13]

IADI emphasizes the importance of advance work:

> *"Liquidity funding is a critical component of a deposit insurer's funding framework. Such liquidity funding arrangements should be explicitly set out* ***in law*** *or regulation, and appropriate arrangements should be* ***set up in advance*** *to ensure effective and timely access, when required."*[14]

[10] FSB Peer Review Report, pp. 21, 27.
[11] IADI Enhanced Guidance, pp. 6–7. See IADI Asia-Pacific Research Paper, p. 41.
[12] IADI Enhanced Guidance, p. 6.
[13] Essential criterion 4 to Principle 9, IADI Core Principles, p. 29, emphasis added.
[14] Guidance point 5 in IADI Enhanced Guidance, p. 2, emphasis added.

The Financial Stability Board's (FSB) Peer Review Report seeks to eliminate any ambiguity from the deposit insurer's funding sources:

> *"[U]nclear or informal standby funding arrangements that may require additional **approval before draw-down** is effected could jeopardize the speed of handling a depositor payout or bank resolution, impede the effectiveness of the deposit insurance scheme (DIS) in maintaining financial stability, and would not be consistent with the IADI Core Principles."*[15]

Thus, for funds to be readily available, even pre-funded deposit insurers should be supplemented by back-up funding arrangements whereby the deposit insurer has explicit powers to borrow or raise funds.[16] Back-up funding arrangements should never be limited to private sources alone as such sources might not be available during a financial crisis.[17] As back-up funding refers to the availability of liquidity, it is by no means intended to shift the final cost to the taxpayer. The deposit insurer is expected to pay back any public borrowing over time with money levied from the banking industry. Resorting to public funding sources for interim liquidity purposes is justified by the promotion of financial stability being an important government objective.[18] Stress testing would be a useful technique to assess how the ability of the deposit insurer to meet its liabilities is affected under a variety of scenarios. Deposit insurers use a number of options for back-up funding. The predominant source is borrowing from the government.[19] Some deposit insurers have a line of credit with the Treasury, or the government may play an indirect role by guaranteeing private sector borrowing by the deposit insurer.[20]

The central bank is another widely-used liquidity provider. However, this option is not always available for deposit insurers under applicable law. In the euro area, for instance, a prohibition against so-called "monetary financing" prevents the European Central Bank (and the national central banks belonging to the Eurosystem) from lending to public entities. In any case, liquidity is generally made available only against collateral in order to protect the balance sheet of the central bank (although in some jurisdictions the collateral may include a guarantee from the government).

Another option is to seek funding from private sources, for instance by issuing debt securities in the capital markets. It is often difficult to raise money in private markets during times of economic decline – unless a government guarantee is in place, a bond issue is feasible only when market conditions permit. Deposit insurer bond issues are usually accompanied by a government guarantee, which lowers the cost of funding by way of enhancing issuer creditworthiness and makes it possible to raise money in times of economic downturn. Due to the existence of a government guarantee, the deposit insurer does not need to seek an expensive credit rating of its own.[21]

---

15 FSB Peer Review Report, p. 30, emphasis added.
16 IADI Enhanced Guidance, pp. 7, 17.
17 Essential criterion 4 to Principle 9, IADI Core Principles, p. 29.
18 IADI Funding Guidance, p. 11.
19 IADI Enhanced Guidance, p. 7.
20 IADI Funding Guidance, p. 11.
21 IADI Asia-Pacific Research Paper, p. 32.

Sometimes, a deposit insurer might – in addition to the above-mentioned sources – maintain a line of credit with selected sound banks. In the absence of a government guarantee, however, the cost of borrowing might be prohibitive due to the regulatory treatment (in the bank's books) of a deposit insurer as its counterparty: the credit risk weight tends to depend on whether or not the government provides a guarantee.[22] Alternative structures inspired by so-called "catastrophe bonds" have also been envisaged.

An important option to consider is the repo, a repurchase agreement made with the central bank, market counterparty, or market platform. By way of the repo framework, a deposit insurer can quickly access liquidity using its portfolio of investments as collateral, enabling it to time the final securities sale to take place under as favorable conditions as possible. Collateral consisting of high-quality, highly-liquid instruments is nonetheless required.

At times the relevant government agencies can rely on back-up financing from international financial institutions (IFIs) either through a contingent line that can be drawn down as needed or through replenishment of a DIS funds once depleted. The World Bank has provided such financing recently in Serbia and Bulgaria.

2.5. Accounting & Tax Considerations

If applied, taxation of a deposit insurer's revenues would hinder the effective accumulation and reimbursement capacity of a deposit insurance fund.[23] This is the case especially for the premiums that banks are required to pay into the fund in order to build its capital base. In terms of investment income, taxation might seriously undermine the pay-out process. Should investment income constitute taxable income for a deposit insurer, the proceeds from liquidating the investments would no longer be usable for the purposes of reimbursing depositors, as the tax authority would take priority over the depositors. Furthermore, the portion to be set aside for tax purposes is challenging to estimate in advance, as the tax payable would depend on the value development of each investment instrument relative to its original purchase price. As the date of the next bank failure is beyond any control, a pay-out might, in fact, force the deposit insurer to liquidate its entire investment portfolio at a point in time that carries the most adverse tax consequences. Therefore, taxation of the revenues of a deposit insurer (whether they are premiums or investment income) is generally not recommendable. Nor is it absolutely necessary: in the Asia-Pacific region, for example, most deposit insurers – public, semi-public, or private corporations alike – are exempt from all taxes.[24] In return, any surplus from a financial year needs to be transferred into the deposit insurance fund.[25]

[22] IADI Asia-Pacific Research Paper, p. 27.
[23] IADI Enhanced Guidance, p. 17. See also essential criterion 9 to Principle 9, IADI Core Principles, p. 30. See also IADI Asia-Pacific Research Paper, p. 51.
[24] IADI Asia-Pacific Research Paper, p. 51.
[25] IADI Asia-Pacific Research Paper, p. 51.

Whether investing at home or abroad, a deposit insurer should be aware of the at-source tax treatment of cash flows related to investments. For instance, withholding tax is usually applied to interest coupon payments to investors, but its application may be fine-tuned in tax treaties applicable between different countries.

In terms of accounting principles, how should the book value of each investment be determined? The investments may be booked roughly in two alternative ways:

- at acquisition cost (i.e., original purchase price); or
- at fair value.

Accounting based on fair values is not necessarily a preferred choice for deposit insurers, as it is likely to entail constant fluctuation in financial results. In the case of acquisition cost, however, one should keep in mind the so-called *lowest value principle*, which calls for a write-down in the event that the fair value of an investment permanently decreases below the acquisition cost.

2.6. Investment activities

The investment policies of deposit insurance funds are generally characterized by an emphasis on capital preservation and liquidity. Generally, funds are held in low-risk, highly liquid assets. In most FSB member jurisdictions, investments are restricted to government or central bank instruments.[26] A number of deposit insurance funds can invest in a wider set of instruments such as money-market instruments, covered bonds and high-quality corporate bonds. Some deposit insurers also invest a portion of their assets into equities.

The EU, by way of the Directive on Deposit Insurance Schemes[27], has taken decisive steps to harmonize the permitted investment instruments for deposit insurers across its 28 Member States. The EU Deposit Insurance Directive calls for the assets to be invested "in a low-risk and sufficiently diversified manner".[28] Investment instruments are expected to be of a liquid nature, in order to enable a liquidation thereof within the pay-out deadline of seven working days.[29] Generally, creditworthiness corresponding to *investment grade* (BBB-) is required, with the notable exception of a somewhat higher A- for corporate bonds. In terms of asset classes, it limits the permitted investment instruments to the following:

- cash and deposits
- sovereign bonds and treasury bills
- instruments issued by local and regional authorities
- instruments issued by international organizations and development banks

[26] FSB Peer Review Report, p. 22.
[27] Directive 2014/49/EU on deposit guarantee schemes (recast).
[28] Article 9, Directive 2014/49/EU on deposit guarantee schemes (recast).
[29] Article 2, Directive 2014/49/EU on deposit guarantee schemes (recast).

- highly-rated corporate bonds
- highly-rated money-market instruments
- covered bonds
- any other assets which are considered to be "similarly safe and liquid" by the authorities.[30]

In a recent legislative proposal by the European Commission advocating a European Deposit Insurance Scheme (EDIS)[31], another type of legislative framework for the investment activities of a deposit insurer is envisaged. The EDIS proposal refers to a so-called "liquid asset approach", the Liquidity Coverage Ratio (LCR) framework introduced by the Basel Committee on Banking Supervision. In banking, the LCR framework obliges banks to maintain a reserve of liquid assets that is sufficient to meet liquidity outflows during a month-long stressed scenario. When applied to a deposit insurer, the LCR framework translates into a list of instruments largely resembling the one above, but with a particularly cautious approach to debt issued by the banking industry.

[30] Article 2, Directive 2014/49/EU on deposit guarantee schemes (recast).

[31] Proposal dated 24 November 2015 for a Regulation of the European Parliament and of the Council amending Regulation (EU) 806/2014 in order to establish a European Deposit Insurance Scheme, Article 75 thereof.

3. Governance and the Creation of an Investment Strategy

In a pre-funded system, a deposit insurer needs to establish a sound framework for investment activities in order to ensure that funds are well managed and readily available to meet deposit insurance liabilities. A written investment strategy forms the backbone of all investment activities.

3.1. Governance

Deposit insurance legislation usually sets out broad parameters within which the assets of a deposit insurer may be invested. It is within this legal framework that the deposit insurer's governing body (whose mandate and powers flow from the law) determines the investment strategy. This note assumes a governance structure that is composed of a governing body such as a Board of Directors.[32] The most important decisions on the investment activities of a deposit insurer belong to the Board of Directors.

The IADI Core Principles place great emphasis on the operational independency of the deposit insurer in fulfilling its mandate:

> *"The deposit insurer has **responsibility** for the sound investment and management of its funds."*[33]

> *"The deposit insurer should be **operationally independent**, well-governed, transparent, accountable, and insulated from external interference."*[34]

Operational independence enables the Board to create an investment strategy independently of political meddling. The composition of the Board needs to reflect the multiple facets of the operations of a deposit insurer. At least some of the Board members should have basic knowledge about investments, risk management, and funding issues. However, most Board members will not have professional investment experience. It might therefore be helpful to form an Investment Committee for the purposes of debating investment strategy and submitting informed proposals to the Board. Alternatively, the Board could delegate to the Investment Committee tactical decisions to be made within a framework and overall risk limit set by the Board.

[32] In reality, there are significant differences across jurisdictions in the governance frameworks of deposit insurers; see FSB Peer Review Report, p. 5.
[33] Essential criterion 6 to Principle 9, IADI Core Principles, p. 29, emphasis added.
[34] Principle 3, IADI Core Principles, p. 21, emphasis added.

The Board must own the investment strategy, but the agreed strategy will be implemented by the management who, in turn, is accountable to the Board. The Board must oversee and monitor the investment activities through regular management and compliance reports. It is paramount to have a clear division of responsibilities between Board, Investment Committee, and management.

An investment strategy is by no means meant to be a static document: it needs regular scrutiny at least annually. In the event of changes in a deposit insurer's liabilities or operating environment, or in the markets themselves, the investment strategy should be adjusted accordingly. It is advisable to document and archive the amendment proposals, their justifications, and the assessments made on the basis of those proposals. The Board is ultimately liable for the contents of the investment strategy, and such documentation may be needed to ascertain whether the Board was acting diligently.

Transparency is crucial in maintaining the legitimacy of investment activities and justifying the investment strategy to the public and the stakeholders (i.e., contributing banks). As a matter of good governance, a deposit insurer is expected to summarize and explain its investment strategy in its financial statements and annual reports.[35] Investment issues should, naturally, form part of the regular audit (both internal and external) of a deposit insurer's operations.

3.2. Investment objective

Seneca said: "If one does not know to which port one is sailing, no wind is favorable". It is of utmost importance for an institutional investor to explicitly define the goal of its investment activities. Investment objectives should be aligned with the deposit insurer's mission, mandate, and liabilities. The IADI Core Principles address the setting of investment objectives of a deposit insurer as follows:

> *"The deposit insurer has a defined investment policy for its funds that aims at ensuring:*
> *a) the **preservation** of fund capital and maintenance of **liquidity**; and*
> *b) that adequate risk management policies and procedures, internal controls, and disclosure and reporting systems are in place."*[36]

IADI states the following:

> *"The objectives and strategy for fund management should be clearly set out and aligned with the deposit insurer's mandate. It should be aimed at ensuring the value of the funds is preserved (capital preservation) and that such funds can be readily available to meet the deposit insurer's obligations, whether for the day-to-day operational needs or for funding a bank resolution or reimbursement."*[37]

[35] IADI Enhanced Guidance, pp. 14–16.
[36] Essential criterion 6 to Principle 9, IADI Core Principles, p. 29, emphasis added.
[37] Guidance point 6 in IADI Enhanced Guidance, p. 2.

The goal of the investment activities is to support the main task of the deposit insurer, so an investment objective flows from the deposit insurer's mandate and liabilities. One should start by defining the liabilities: their nature, currency, expected development (including but not limited to the expected growth of the insured deposit base, and a potential inflation linkage), trigger, and timeframe. These liabilities subsequently translate into investment implications.

Next, one should look at cash flows required in the operations of the deposit insurer. Unlike private foundations distributing grants, a deposit insurer does not necessarily need annual returns meeting a pre-defined percentage of the value of the investments. A number of deposit insurers cover their operating costs from investment returns, however, and for them it may be desirable to include investment objectives seeking a particular level of annual cash flows.

Since the general idea is to have the maximum amount of assets available upon bank failure, both **capital preservation** and **liquidity** should be highlighted among investment objectives. But what does capital preservation really mean in practice?

- In the short term, a positive return in nominal terms is sought.
- At all times, costs and fees should be taken into account so as not to let them consume fund capital.
- In the long term, inflation is capable of eroding the real value of investments in the years to come. Accordingly, seeking capital preservation in real terms in the long term would make sense.

What about liquidity? A liquid asset is generally defined as an asset that can be sold at any time, even during a period of stress, with little or no loss of value. Liquidity is by no means an absolute concept, and most investment instruments are at least somewhat illiquid at times. Notably, liquid assets include those that generally qualify for collateral purposes.

A **balance** must be struck between the various investment objectives. Literature to date has suggested that there is a trade-off between liquidity and return.[38] In this line of thinking, a strategy that leans too much towards liquidity forgoes potential returns. Correspondingly, a strategy that leans too much towards higher returns runs the risk that the funds are not available when needed. It can also lead to a loss if assets have to be sold at an inopportune time and this, in turn, could cause an erosion of public confidence in the deposit insurance system. It has been suggested that a deposit insurer's investment strategy should find a balance between higher rates of return, on one hand, and certainty of funds' availability when needed, on the other, while guarding against loss of principal.[39]

[38] IADI Funding Guidance, pp. 21–23.
[39] IADI Funding Guidance, pp. 21–23. See also IADI Asia-Pacific Research Paper, p. 50.

Returns are not important for a deposit insurer on a standalone basis, but merely in the context of its risk management. Hence an alternative approach based on the deposit insurer's liabilities could be envisaged. One should compare the expected development of the liabilities (including but not limited to the expected growth of the insured deposit base) with the expected returns on the assets. Next, the negative effects of costs and inflation on the capital should be observed. Returns are needed to counter-balance the factors eroding capital or decreasing the proportion of assets to liabilities. This should lead a deposit insurer to strive **for capital preservation in real terms and net of costs**. This approach emphasizes the role of returns merely as a facilitator of genuine capital preservation.

Yet, a caveat is necessary. The balanced approach envisaged above needs to adapt to prevailing market conditions flexibly. In certain market conditions the only way to earn positive real returns is to significantly increase the risk level of the investments. Unless such risk-taking is appropriate under the deposit insurer's risk management policy, it may be better to keep one's head down for a while, be satisfied with capital preservation in nominal terms, and simply wait for more favorable market conditions. On the other hand, returns should be avidly harvested whenever market conditions are benign, as reaping additional returns helps build a buffer and, in the long term, contributes to capital preservation in real terms. Therefore, it might be reasonable to set return objectives of the investment activities along the following lines:

- in the short term: positive nominal returns;
- in the long term: positive real (inflation-adjusted) returns.

3.3. Towards an Investment Strategy

An investment strategy depicts the means through which investment objectives shall be pursued. There are two decisions in particular that cannot be delegated by the Board, and they are the two most important decisions in asset management:

- the level of risk to be taken;
- where risks should be taken. [40]

This top-down choice on asset allocation is by far the most important decision the Board makes and will explain most of the fluctuation in the value of the investment portfolio going forward. Asset allocation refers to the practice of choosing appropriate asset classes, risk factors, and strategy styles for an investment portfolio.

A strategic benchmark index that pins down the desired risk level and facilitates the assessment of portfolio performance is often designated. A strategic benchmark, if any, should be chosen with great care. In view of the mission and liabilities of a deposit insurer, few existing benchmarks are likely to behave "right" upon bank failure, and beating such a benchmark is hardly meaningful for a deposit insurer. Besides, all investors following the

[40] Ang, pp. 510, 517.

same benchmarks may lead to herding and bubbles in the market. Instead, it might be desirable to construct an individual, "smart" benchmark to reflect the investment objectives of a deposit insurer, incorporating risk factors that are inversely related to its liabilities and thereby beneficial for a deposit insurer to invest in. The Norwegian deposit insurer, for instance, has adopted this course of action by constructing its own strategic benchmark. Its objective was to create a customized benchmark that performs well in stressed markets and that has a risk profile that is negatively correlated with bank risk. The investments included in the benchmark are selected based on creditworthiness, fundamental analysis and market liquidity. In order to reduce risk, there is a cap on how much can be invested in any single country as an issuer of sovereign bonds. A currency hedge is in-built.

In contrast, some deposit insurers have abandoned the idea of beating benchmarks altogether, opting to seek absolute returns within an overall risk budget instead. "Absolute" refers to genuinely positive returns, as opposed to merely "relative" performance when following a benchmark. In France[41] and in Finland[42], for instance, the investment activities of the deposit insurer have been based on a risk budget rather than any strategic benchmark. A *risk budget* refers to a model according to which the maximum aggregate risk (or, in other words, the expected maximum loss) of the investment portfolio can be assessed at any given point in time. This is known as *Expected Shortfall or Maximum Drawdown*. For this purpose, one needs to identify the applicable frequency of truly bad times – for instance, the worst that can happen once in every 40 years in the markets.[43] The current portfolio would then be measured on a daily basis against how it would perform in such scenario. If the risk budget was set at five per cent, for example, then the permitted maximum loss in such scenario would be five per cent. Should the results exceed the risk budget, the risk level would need to be adjusted immediately. In order for the model to work reliably, however, the data used for modelling purposes must cover an adequately long historical period so as to include the relevant types of bad times. A note of caution against an over-reliance on models is necessary, though; to cite the statistician George Box, "Essentially, all models are wrong, but some are useful".

An investment strategy should set out, inter alia:

- investment objectives
  - ▹ short-term
  - ▹ long-term
- maximum risk level
  - ▹ risk budget; or
  - ▹ customized benchmark
- permitted types of investments
  - ▹ asset classes
  - ▹ risk factors
  - ▹ strategy styles (if applicable)

[41] In France, the risk budget applies to some of the asset classes only.

[42] Data for Finland is only available until 1 January 2015, i.e., the date of introduction of a new resolution authority with mandate for deposit insurance.

[43] Conditional Value-at-Risk 1Y 97.5%.

- industry-specific constraints
  - ▹ excluding or at least firmly limiting investments into the banking sector
- key limits
  - ▹ credit risk (creditworthiness)
  - ▹ interest-rate risk (duration)
  - ▹ currency risk
  - ▹ illiquidity risk
- asset allocation (or its range)
- diversification principles
- governance and division of tasks
- principles for selecting and monitoring asset managers
- compliance and audit arrangements.

For asset allocation purposes, it is useful to document the intended function of each instrument in the investment portfolio:

Chart 1:
Primary function of an investment (example)

Asset class	Key risk factor	Purpose	Instruments	Constraints
Cash	(Credit risk)	Liquidity Shielding against a rise in interest rates	Deposits with central bank Treasury bills Other money market instruments	Avoid or firmly limit exposure to banking sector
Sovereign bonds	Interest-rate risk	Liquidity Capital preservation during market stress	Sovereign bonds	Require high creditworthiness
Corporate bonds	Credit risk	Building a buffer during periods of economic growth Some shield against a rise in interest rates	Corporate bonds	Require high creditworthiness Limit exposure to banking sector
Real assets	Inflation risk	Shielding against inflation	Inflation-linked bonds	

Furthermore, it may be worthwhile to use stress testing – for loss of value and liquidity, respectively – as an additional design tool in order to understand how the assets would be affected under a variety of scenarios.

Finally, although the characteristics of individual assets are important, the key is how they perform in the context of the entire investment portfolio. This, too, is a question of balance.

4. Investing for the Bad Times

Asset management is about defining the "bad times" of an investor.[44] Each institutional investor is characterized by a unique set of "bad times", as determined by its mission and liabilities.

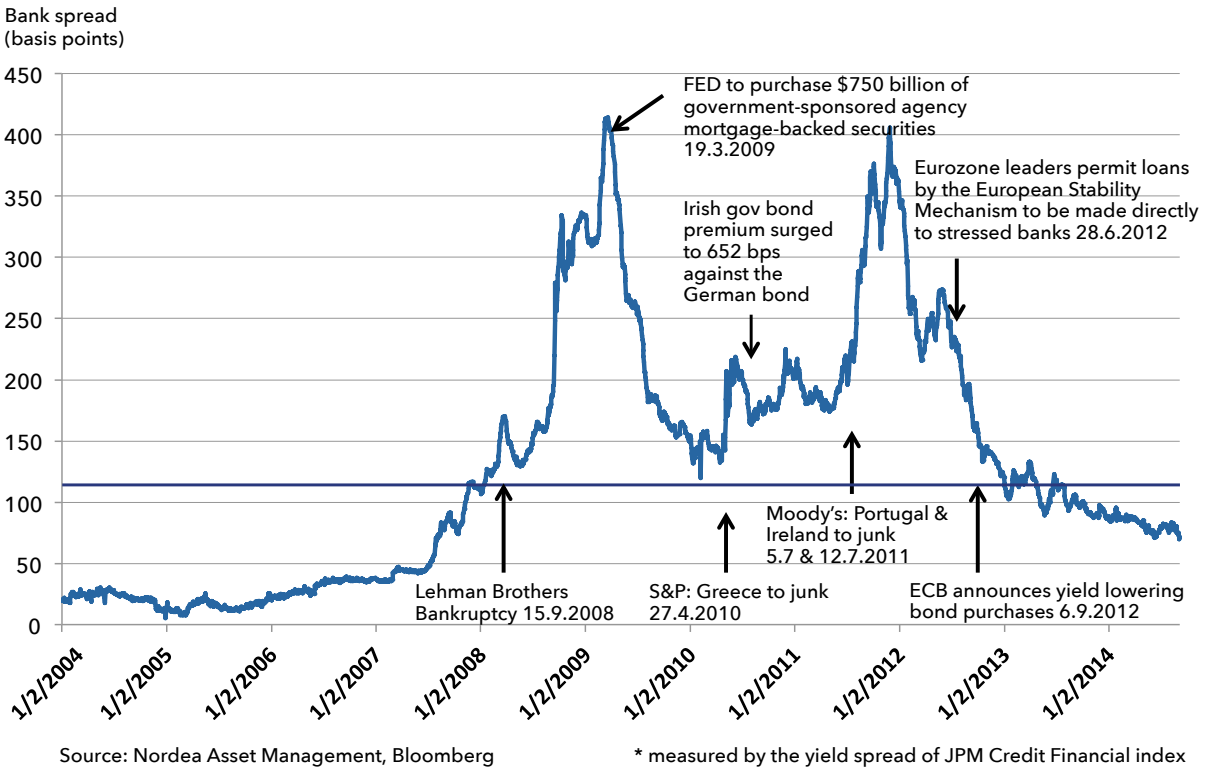
Correspondingly, each type of investment embodies a particular set of bad times.[45] Hence the idea is to compare how the bad times encapsulated in various assets compare to the bad times of a particular investor.[46] The main thing is to avoid a collision between the bad times of an investor with bad times embodied by a particular asset. Asset allocation – the practice of choosing appropriate asset classes and investments – is thus about selecting suitable risk factors for an investment portfolio.

4.1. Bad times of a deposit insurer

For a deposit insurer, bad times are predominantly linked to the health of the banking industry. Its bad times typically refer to circumstances where a bank failure is most likely, as a bank failure triggers the deposit insurer's liabilities *vis-à-vis* those insured – namely, the depositors. A bank failure would typically be most likely whenever times are bad for the banking sector. For modelling purposes, the development of the so-called *bank spread* (i.e., the difference in yield between bank bonds and risk-fee sovereign bonds) may be used to indicate bad times of a deposit insurer:

[44] Ang, p. x.
[45] Ang, p. 450.
[46] Ang, p. 463

Chart 2:
The bank spread as an indicator of bad times for a deposit insurer



The definition of bad times may differ from one deposit insurer to the other, depending on how local banks are interconnected with other financial markets. For instance, a geographical area might be a net exporter of banking services, with the majority of its banks incorporated under its national law. The typical trigger would thus be connected to its national economy. On the other hand, an area might merely be served through branch offices of foreign banks and thus be a net importer of banking services, in which case the typical trigger for bank failure might not be linked to the national economy at all. Accordingly, when formulating the key scenarios to be addressed in the investment strategy, one should pinpoint whether the relevant banking sector undergoing bad times is merely national or regional, or rather continental or even global. An investment solution capable of maintaining its value when the national banking sector is in trouble might materially differ from an investment solution that shields the investor against a global financial crisis.

4.2. Investing is always about risk management

The uncomfortable truth is: there is no risk-free investment. This is the case even if a deposit insurer, by definition, is a highly risk-averse investor. Different investors simply need different risk factors to invest in. All investing is essentially about risk selection and risk management.

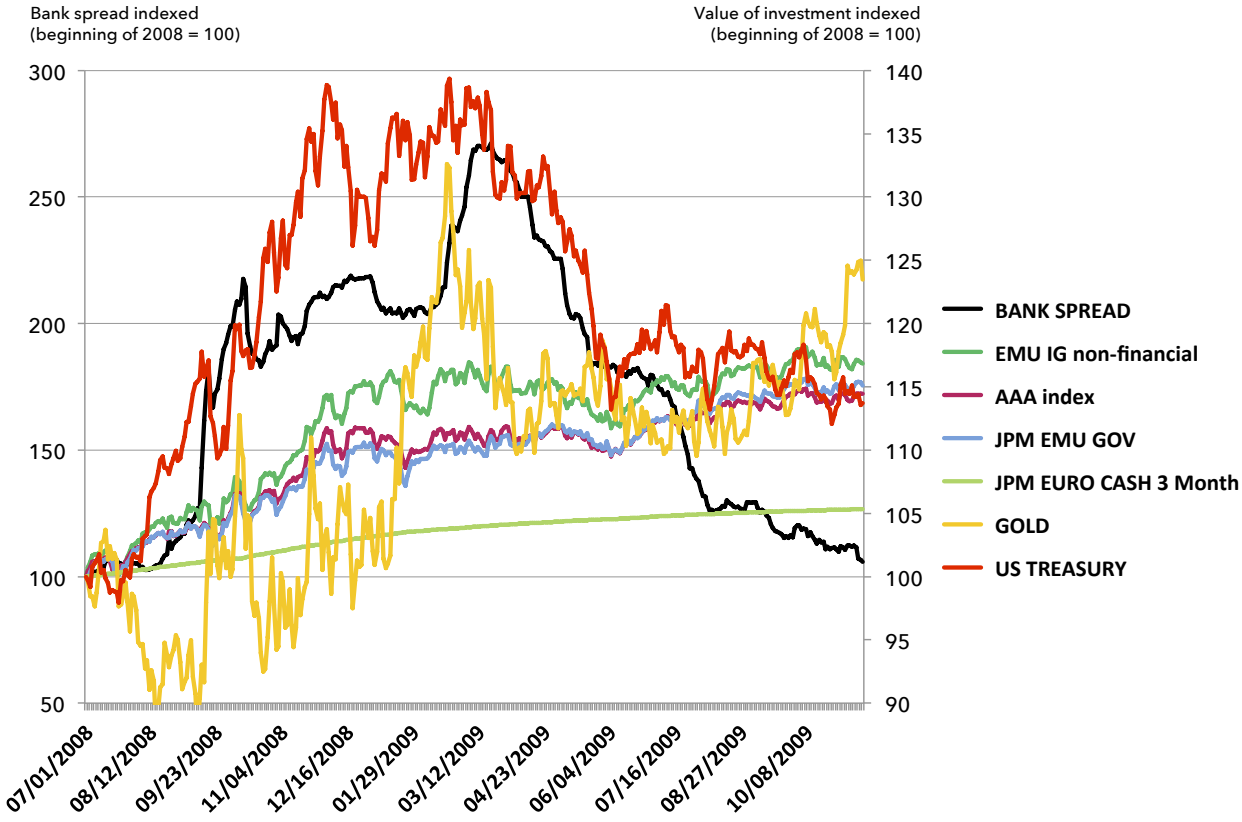
There is no reason why a "bubble" could not, at times, develop even within investments usually referred to as risk-free. Many asset classes traditionally considered risk-free have, for example, lately provided negative yields. This means that a bondholder would make a guaranteed loss by holding the bond to maturity. For instance, the deposit rate of the European Central Bank has been in the negative territory since June 2014, followed by the central banks of Denmark, Switzerland, Sweden and Japan. At the same time, a number of sovereign governments have been able to issue bonds with a negative interest rate for a while now: negative yields have lately accounted for a significant share of the global index for sovereign bonds, and this applies especially to safe-haven bonds. In addition, sovereign bonds also entail a high interest-rate risk due to their considerable duration, capable of bringing significant losses in an environment of rising interest rates.

While risks can never be fully excluded they should always be well identified and adequately managed. Marie Curie, the Polish-born nuclear scientist and double Nobel Prize winner, crystallized this idea in her time by claiming: "Nothing in life is to be feared. It is only to be understood". The key question thus reads: Which investment risk types tend to be favorable for a deposit insurer? On the other hand, which investment risk types tend to be unfavorable for the deposit insurer?

Since a deposit insurer's bad times refer to circumstances where a bank failure is most likely, a deposit insurer should focus on investment types that correlate negatively with the typical trigger event for its liabilities; in other words, investments that are likely to perform well when the times are bad for the banking sector. Correspondingly, a deposit insurer should be cautious of investments that lose value when the times are bad for the relevant banking sector. A typical example would be an exposure to the relevant banking sector itself. The performance of selected asset classes when times have been bad for a deposit insurer have been highlighted as follows:

Chart 3:
Performance of assets classes when the bank spread is on the rise

Value preservation by asset class over the financial crisis*



Source: Nordea Asset Management, Bloomberg

*Measured in the EUR, no currency hedging assumed

4.3. What can we know about risk?

Risk, like all things, has its Knowns and Unknowns – the things we know and the things we don't, or even can't, know.[47] Organizing our thoughts around those concepts may be a helpful starting point for understanding risk:

Chart 4:
The Knowns and the Unknowns

	Knowns	Unknowns
Knowns	***Known / Knowns*** Things that we know we know	***Known / Unknowns*** Things that we know we don't know
Unknowns	***Unknown / Knowns*** Things that we don't know we know	***Unknowns / Unknowns*** Things that we don't know we don't know

Known knowns are risks that can be identified at the outset, with outcomes that can be more or less reliably predicted. Rising interest rates are a typical example of such risks. For instance, in the current ultra-low interest rate environment, interest rates are bound to rise at some point in the future, and this will hurt long-dated bonds.

Known unknowns are risks that can be identified, but the outcome of which may not be initially clear. These are risks that have not been accurately measured but are expected to exist. These risks may flow from expected imperfections in the risk measurement model. From a deposit insurer's viewpoint, illiquidity risk is a highly relevant example: if a large order has been placed to trade a specific asset (especially if it is not traded frequently), the price of the asset might move to an unknown extent. Furthermore, regulatory changes in recent years have certainly impaired liquidity in the corporate bond market, but the extent of the weakening is difficult to quantify and may depend on prevailing market conditions.

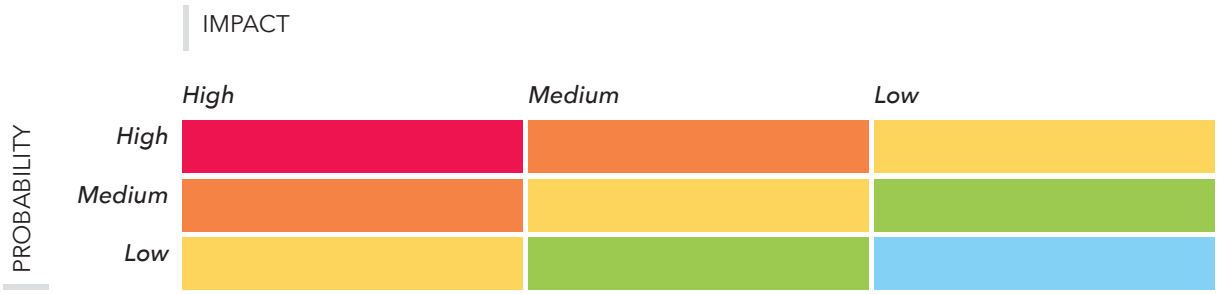
Unknown knowns are risks flowing from our beliefs, emotions, and biases – things we do not like to know. Behavioral Finance is a field of science dedicated to explaining how psychological factors influence investors' decision-making, causing investors to behave in irrational ways. The best-known implications of investor irrationality are speculative bubbles in the market resulting from various psychological factors including the herding instinct.

[47] The theory of the Knowns and the Unknowns – widely used among the investment community – is understood to have been based on the concept of "Johari Window" applied in the field of psychology. See Luft, figure 1.

Unknown unknowns are risks that cannot be foreseen. John Maynard Keynes once said: "The inevitable never happens. It is the unexpected always". These risks flow from factors that cannot be identified, let alone estimated in terms of impact. Typically, these include events of a geopolitical, technological, or environmental nature. For a number of asset classes, illiquidity risk might qualify for the status of an *unknown unknown* especially during extreme market turmoil if liquidity suddenly vanishes for asset classes normally regarded as liquid. The GFC is a relatively recent example of times when illiquidity rose to abnormally high levels.

Furthermore, it is indispensable to distinguish between the probability and the impact of a particular risk:

Chart 5:
Probability vs. Impact



Inspired by Nassim Nicholas Taleb's book *The Black Swan*, a highly improbable event with a massive impact is now generally referred to as a "Black Swan".[48] The moral of the story is that there has been plenty of empirical evidence to convince us that swans are white – until we finally see one that is not.

[48] Taleb, p. xvii.

4.4. All eggs in one basket?

Having all of the eggs in one basket refers to concentrating one's investment exposure into one asset, typically the domestic sovereign bond. This practice is based on the perception that sovereign debt would be default-free. How safe is this practice in light of the "negative feedback loop", i.e., the nexus between the government and the banking sector?

> *"In recent years, the timing of sovereign crises has coincided or has directly followed banking crises. The link between sovereigns and banks tightened as the contingent liability that the banking sector represents for the sovereign grew."*[49]

Sovereign–banking links were at the heart of the euro area sovereign debt crisis from 2010 onwards. The crisis highlighted that government debt is not risk-free even in advanced economies.[50] A buildup in government debt has been a defining characteristic of the aftermath of banking crises for over a century.[51] The two legs of the "doom loop" are as follows:

- When the banking system needs public support to avoid a financial meltdown, stress in the banking sector is transmitted to the public sector.
- Conversely, sovereign bonds on the balance sheets of banks are the main transmission channel through which weak government finances may affect the banking system and can constitute systemic risk. [52]

The exposure of deposit insurers to debt issued by their own governments remains a source of potential vulnerability. A home bias, where an investment portfolio is heavily tilted towards the domestic government as issuer, results in a significant concentration of counterparty risk.

Chart 6:
All eggs in one basket?

[49] Correa – Sapriza, p. 2.
[50] European Political Strategy Centre, p. 3.
[51] Reinhart – Rogoff, p. 231.
[52] European Political Strategy Centre, p. 3.

This exposure could be reduced through diversification of sovereign bond portfolios. Large exposure regimes limit exposure to any single counterparty; the purpose of a large exposure regime is that even the safest of counterparties can experience a prohibitive *unforeseen* event.[53] A well-diversified government debt portfolio is potentially less risky as a result.[54] The downside of diversifying away from domestic government bonds is that it may feel unpatriotic. For counterbalance, it is useful to observe what happens to domestic sovereign bonds in the event of a national banking crisis:

Chart 7:
Performance of a sovereign bond in a domestic banking crisis: Case Spain
(N.B. Bond price moves inversely to yield).

Spanish 10-year sovereign bond yield. Source: Bloomberg.

As illustrated in Chart 7, a banking crisis is capable of destroying the value of domestic sovereign bonds, because bond prices move inversely to interest rates *(yields)*. Diversification lessens the impact of bad times because there is a possibility that some assets perform well when they hit. Even more importantly, in the event that a certain asset becomes illiquid, other assets could be expected to remain liquid. No wonder, then, that deposit insurers from countries as diverse as Colombia, Greece, Norway, and Finland[55] have significantly limited their exposure to a single counterparty, in particular domestic sovereign bonds.

The EU's Deposit Insurance Directive calls for the assets to be invested in a "sufficiently diversified manner".[56]

[53] European Political Strategy Centre, p. 9.
[54] European Political Strategy Centre, pp. 8–9.
[55] Data for Finland is only available until 1 January 2015, i.e., the date of introduction of a new resolution authority with mandate for deposit insurance.
[56] Article 9, Directive 2014/49/EU on deposit guarantee schemes (recast).

5. Charting the Key Risks

Before selecting investment instruments, a deposit insurer should pause to identify the key risks that it is likely to face as an investor, and reflect on how to best mitigate or exploit these. For the investment activities of a deposit insurer, the most relevant risk types – along with their potential pros and cons – include the following:

Chart 8:
Key risk types in the investment activities of a deposit insurer.

Investment risk type	Benefits	Disadvantages	Asset class to be envisaged	Key limitations
Industry risk	–	A deposit insurer's liabilities depend on banks' health. Exposure to banks in the investment portfolio would multiply a deposit insurer's total exposure to the banking industry.	–	Avoid or firmly limit exposure (whether investments or deposits) to banks
Concentration risk	–	Having all of the eggs in one basket may bring unforeseen risks. The value of domestic government bonds may suffer in a banking crisis.	–	Observe the principle of diversification in the investment portfolio. Diversify investments away from the domestic sovereign bond
Currency risk	The currency of investment assets should reflect the currency mix of a deposit insurer's liabilities	Currencies are very volatile, so any additional currency risk is likely to dominate the aggregate risk of the investment portfolio and thereby impact the annual results of the deposit	Sovereign bonds in currencies reflecting the currency mix of a deposit insurer's liabilities	Undesirable currency risk should be hedged
Illiquidity risk	–	Illiquidity might prevent a deposit insurer from liquidating its investments when its liabilities are triggered upon pay-out	–	Safe-haven sovereign bonds are usually the most liquid instruments even in market crisis

Investment risk type	Benefits	Disadvantages	Asset class to be envisaged	Key limitations
Credit risk	Enhancing returns of an otherwise well-diversified investment portfolio	Possibility of losing value or liquidity in a market crisis. A weaker creditworthiness tends to result in more volatility, loss of value and loss of liquidity.	Corporate bonds	Require a high creditworthiness in order to reduce the sensitivity of the portfolio to an economic downturn.
Interest rate risk	This risk type may be beneficial for a deposit insurer in a scenario where the likelihood of its liabilities being triggered is at its greatest. Bond prices are inversely related to interest rate developments, and usually (but not always) interest rates tend to decrease in a financial crisis.	In a scenario of rising interest rates, a high interest rate risk may translate into significant losses.	Sovereign bonds	Set a stringent maximum limit for portfolio duration in order to reduce the sensitivity of the portfolio to rising interest rates.
Inflation risks	Seeking returns that, by nature, are capable of maintaining the real value of the deposit insurer's assets with respect to its liabilities.	Inflation is capable of damaging the value of nominal bonds such as sovereign bonds	Inflation-linked bonds, (money-market instruments)	Inflation-linked bonds are probably not as liquid as normal sovereign bonds, so they should be used only in an otherwise well-diversified portfolio.

5.1. Industry risk (and other concentration risks)

Concentration risk refers to the risk of losses arising from a heavily lopsided exposure to a particular counterparty or group of counterparties. In other words, having all of one's eggs in one basket. It appears in any heavily tilted exposure to particular countries or regions, sectors, industries, or markets. A case where concentration risk manifests itself in concentrations into a particular sovereign bond (usually the home government) was discussed in section 4.4 above.

For a deposit insurer, industry risk is of particular relevance; a deposit insurer is always heavily exposed to the banking sector, as all of its liabilities are connected to the financial condition of banks. Accordingly, any meaningful exposure to the banking sector in its investment activities would multiply its total exposure to the banking sector. The IADI Core Principles state the following:

> *"The deposit insurer may hold funds in the central bank. The deposit insurer establishes and complies with rules to **limit significant investments in banks**."*[57]

Placing funds with the banking sector cannot be considered sound practice for a number of reasons:

- If the bank fails, a deposit insurer might lose access to the funds just when they are needed.
- If the bank fails, a deposit insurer may face losses regardless of its seniority in creditor hierarchy *(bail-in)*.
- If a member bank fails, a deposit insurer will have supported one of its member banks at the expense of others.
- Selling an investment on the basis of non-public information (which the deposit insurer may gain via its exchange with the bank resolution authority, the bank supervisor or the central bank) could constitute a breach of insider dealing legislation.
- Withdrawing funds from a fragile bank to cover for the pay-out of deposits from a third bank may aggravate its liquidity issues.

As a result, a deposit insurer should avoid holding significant deposits with banks as well as equities or bonds issued by banks. Sometimes such a restriction has been interpreted to apply to member banks only; in view of a deposit insurer's mission, however, non-members can seldom be considered more appropriate counterparties. As a result, a deposit insurer should open a deposit account with the central bank for the purposes of holding the occasional larger amounts of cash.

Yet, for day-to-day operational cash management (e.g., paying salaries or rent), a deposit insurer needs to have banking arrangements in place. In addition, a deposit insurer may

[57] Essential criterion 7 to Principle 9, IADI Core Principles, p. 29, emphasis added.

also need to temporarily maintain funds with banks acting as its payment agents in order to facilitate reimbursement to depositors. It would be prudent to set a limit on the amount of funds placed with member banks for such operational purposes.[58]

Furthermore, a well-diversified exposure to short-term money-market instruments issued by the banking sector might also be viable simply because banks account for a significant part of the money market. Another asset class consisting of covered bonds might be appropriate as well – regardless of its close linkage to financial institutions – as this asset class is robustly backed by collateral.

5.2. Currency risk

Currency risk refers to a risk that arises from the change in price of one currency against another. Dramatic swings are a typical feature of the currency market and, in an investment portfolio, currency risk often has the tendency of becoming a dominant risk.

Yet, the assets of a deposit insurer should reflect its liabilities, i.e., the currency mix of the insured deposit base:

> *"In circumstances where foreign exchange deposits are part of a deposit insurer's scope of coverage, depositors can be reimbursed in either foreign or local currency, using, in the case of the latter, the conversion rate prevailing on the date of the filing of the petition for winding-up. In this context, the investment strategy should take into consideration the impact of foreign exchange risk. The deposit insurer may want to consider hedging this risk by* ***investing in the respective foreign currency investments*** *in accordance with its approved risk appetite."*[59]

Whenever a deposit insurer has potential liabilities in foreign currencies, it needs to define its approach to currency risk and its investment implications. Given that fluctuations in exchange rate may be significant, it is necessary to establish the accounting treatment of investments denominated in foreign currencies right at the outset.

Furthermore, there may be other factors which favor investments beyond home currency. In a national banking crisis, for instance, own currency may lose value against other currencies. Furthermore, in the case of a small home market characterized by low liquidity and scarce depth, there may be merit in investing in a high-quality basket of foreign securities (with or without hedging the inherent currency risk). The deposit insurers in Colombia and Norway, respectively, have chosen to invest most of their assets in sovereign bonds issued in foreign currencies. In view of the nature of their respective liabilities, the Colombian deposit insurer has chosen to leave some currency risk unhedged, while the Norwegian deposit insurer carries out complete hedging arrangements.

[58] IADI Enhanced Guidance, pp. 14–16.
[59] IADI Enhanced Guidance, pp. 14–16, emphasis added.

5.3. Illiquidity risk

Illiquidity risk refers to the difficulty of disposing of an investment at a decent price – or at all – in a timely manner. At worst, illiquidity risk may lead to unusually large price movements especially to the downside, and anyone needing to sell a large piece of investment quickly may thus end up "moving the market" against himself. Almost all assets are at least somewhat illiquid, but there are marked differences between asset classes. Illiquidity manifests itself as infrequent trading: the rule of thumb is that the smaller the size of the issue, issuer, or market, the scarcer the liquidity. Deposit insurers are advised to shy away from the potentially attractive economic rewards that an illiquidity premium offers to other investors with a longer investment horizon. According to the EU Directive on Deposit Insurance Schemes, investments are expected to be of a liquid nature, in order to enable a liquidation thereof within the pay-out deadline of seven working days.[60]

In general, highly-rated sovereign bonds represent a primary liquid asset source. Some securities benefit from a so-called *safe haven* status; more often than not, these are sovereign bonds denominated in an official reserve currency. Before the recent addition of the Chinese renminbi into the SDR basket of currencies, these included the US dollar, the Japanese yen, the euro, and the British pound. Traditionally, two of the most liquid bond markets in the world have comprised US Treasuries and German Bunds.

Since deposit insurers mostly invest in fixed-income asset classes (i.e., debt instruments), it is essential to understand the particular characteristics of bonds. In the stock market, a company usually only has one share class outstanding: in other words, all its equities are identical and thereby simple to buy and sell. Bonds, however, are not at all identical; two bonds sold from the same issuer each have different characteristics in terms of size, maturity and structure, and are therefore not interchangeable. One issuer may have dozens, if not hundreds, of different bond issues outstanding. As a result, bonds are more complicated to buy and sell, as their terms and conditions differ.

In the past, financial intermediaries used to provide a cushion for fixed-income markets by way of maintaining an inventory of bonds in their books. Post-GFC banking regulation has resulted in it having become more capital-intensive for financial intermediaries to act as middlemen between investors and absorb large orders. Consequently, it nowadays takes a longer amount of time to execute larger bond trades.

Liquidity varies on a daily basis, however, according to the prevailing market sentiment. Consequently, even normally liquid assets markets may periodically become illiquid: liquidity tends to dry up during periods of severe market distress. In market turmoil, a domestic market may lack depth, i.e., counterparties willing to trade larger amounts. The GFC was characterized by sharply reduced liquidity, and at times only safe-haven sovereign bonds were tradeable in the markets. The key questions that a deposit insurer should ask include:

[60] Article 2, Directive 2014/49/EU on deposit guarantee schemes (recast).

- Which types of investment instruments have in the past remained sufficiently liquid during periods of market stress?
- Has liquidity evolved since, particularly as a result of regulatory changes or technological developments?

Notably, liquid assets include those that generally qualify for collateral purposes. Hence, for the purposes of understanding prevailing perceptions on liquidity, it might be helpful to find out which assets tend to qualify for collateral purposes in the global context: this exercise may bring surprisingly bleak results.

5.4. Credit risk

Credit risk refers to the default risk of a counterparty, i.e., the risk of loss of principal stemming from a borrower's failure to repay a loan or otherwise meet a contractual obligation. However, an issuer need not necessarily go bankrupt in order for the credit risk to materialize, as even just a rating downgrade (or its anticipation) may increase the credit spread for the issuer in question, thereby lowering the value of its bonds.

Creditworthiness is usually measured in terms of credit rating. Even in spite of global efforts to avoid over-reliance on credit ratings, credit ratings have significant ramifications and there are, in practice, two types of investments: those that are investment grade and those that are not. Deposit insurers should be constrained to holding *investment grade* only, although a more granular approach (as adopted for instance in the EU Directive on Deposit Insurance Schemes[61]) according to asset class is recommendable for risk-management purposes.

5.5. Interest rate risk

Interest rate risk is a major risk for any bondholder, and in particular for one who does not plan on holding the investment until maturity (or, in the case of a deposit insurer, who may need instant access to liquidity). In a global financial crisis scenario, interest rates have often had a tendency to come down, thereby increasing the value of long-term bonds. For this reason, interest rate risk is (at least in principle) a potentially suitable risk type for a deposit insurer – albeit not necessarily in the current environment of ultra-low interest rates where a rate rise would damage the value of the investments! Moreover, one should also take into account a domestic or regional scenario where rising interest rates (i.e., sinking bond prices) collide with a banking crisis triggering a deposit insurer's liabilities.

Rising interest rates mean falling bond prices, while declining interest rates mean rising bond prices. This is because the coupon on bonds is generally a fixed one. Interest rate risk refers to the risk that already held bonds will lose market value if new bonds with a higher interest rate enter the market. As interest rates rise, bond prices fall, and vice versa. The

[61] Article 2, Directive 2014/49/EU on deposit guarantee schemes (recast).

rationale is that an existing bond offering a fixed 3% interest coupon is less attractive once interest rates have risen to a higher level, since its holder continues to receive less interest – for years to come – than is available on the current market. Correspondingly, an existing bond offering a fixed 5% interest coupon becomes more attractive if interest rates sink to a lower level, since its holder continues to receive more interest than what is available on current the market. Moreover, buying a negatively-yielding bond will guarantee a loss if held to maturity.

The extent to which a rise in interest rates hurts bond investments depends on the speed of the rise. If, on the one hand, the rise is of a gradual nature, interest payments should cushion the impact of the rise over time at least to an extent. If, on the other hand, the rise is very sudden and steep, more damage is likely to be incurred by bondholders.

Interest rate risk is measured in terms of an indicator called the *duration*, expressed as a number of years. The higher the duration number, the greater the interest rate risk. Duration represents the sensitivity of the value of a fixed-income investment to a change in interest rates. For instance, a modified duration of 3.5 means that if the interest rate level changes by one percentage point, the value of the portfolio changes an average of 3.5 per cent into the *opposite* direction.

Given that its liabilities may be triggered at a short notice, it is not necessarily viable to assume that a deposit insurer might always hold bonds to maturity (known as the *Buy and Hold* principle). A deposit insurer should therefore always define its approach to interest rate risk e.g., by setting an explicit maximum limit for portfolio duration in order to make it less sensitive to interest rate movements. This way, a deposit insurer would hold short and intermediate-duration (rather than long-duration) bonds.

5.6. Inflation and deflation risks

Inflation refers to upward changes in the general price level, whereas deflation refers to downward changes. High inflation, then, is good for those who owe and bad for their creditors (including a deposit insurer as an investor). In a world of negative real rates, investors must be prepared to see safe investments decline in purchasing power.

In the short term, inflation is seldom relevant for a deposit insurer, so a positive return in merely nominal terms is acceptable. In the long term, however, inflation is capable of both increasing the liabilities of a deposit insurer and eroding the value of its investments. In order to minimize the difference between assets and liabilities, a deposit insurer may wish to avoid its capital being eaten up by inflation. Even in the current low-inflation environment there is no guarantee that the situation will not change in the future. Rising inflation hurts nominal bonds especially, and deposit insurers tend to have a lot of them in their portfolios (e.g., sovereign bonds). For this reason, inflation definitely is a risk to consider at least in the long term. Ideally, investment choices should thus enable real (inflation-adjusted) returns over the long term.

Inflation hedging is about the co-movement of asset returns with inflation.[62] Many asset classes that are considered good hedges against inflation are, unfortunately, far too illiquid for deposit insurers. Those potentially appropriate for deposit insurers include, at least, the following:

- Inflation-linked bonds (also known as "linkers" or "TIPS"), i.e., a sovereign bond whose principal or coupon is indexed to inflation.
- T-bills (treasury bills), an instrument having had the highest correlation (co-movement) with inflation as monetary authorities have responded to expected inflation in setting the short-term interest rate.[63]

Deflation is generally a challenging risk for investors because it hurts all assets except nominal bonds. Sovereign bonds are considered a great deflation hedge, and deposit insurers usually have a lot of nominal sovereign bonds in their portfolios.

[62] Ang, p. 351.
[63] Ang, pp. 346, 351.

6. Asset Classes and Their Underlying Risk Factors

Each investable risk factor embodies a different set of bad times.[64] Asset allocation, the practice of choosing appropriate asset classes and investments, is about selecting the suitable risk factors for an investment portfolio. An asset owner should take a stand on the risk factors it considers appropriate to invest in and then implement those factor exposures with appropriate assets.[65] In this chapter, asset classes typically utilized by deposit insurers will be considered in light of their underlying risk factors.

Even if sophisticated investors spend a lot of time and effort in chasing *alpha* (i.e., the surplus return resulting from pure investment skill), in reality it is quite difficult to outsmart the market. As a result, the most reliable path to success may be simply to bear a particular investable risk that markets reward with a premium; in other words, the *beta*.

6.1. Where do returns come from?

Assets earn returns because they are exposed to underlying risk factors.[66] Risk factors, in turn, explain the drivers of an investment's risk and return. Each asset class offers returns based on risk premiums. Investing requires looking through asset class labels to understand their contents, i.e., the bundles of risk exposures inside. In the following, each asset class will be explained in view of a risk premium that typically embodies it. For the purposes of simplification, the author has disregarded the fact that every asset class consists of different underlying risk factors; sovereign bonds, for instance, also entail credit risk even if classified as interest rate risk bearing instruments in the following.

The key questions to ask are:

- Why is there a positive expected return for a particular asset in the first place?
- Would you still sleep well knowing that reason?
- What should be the role and purpose of this asset class in your portfolio?

An advantage of this approach is that one gets to know the fundamental drivers behind one's investments and understand the circumstances in which one's portfolio may fare badly.[67] One should rather attempt to recognize these risk exposures beforehand than be surprised by the outcomes afterwards.[68] A risk factor based approach is useful for defining the primary function of each asset class in a portfolio: sovereign bonds for liquidity provision and deflation hedging, money-market instruments for interest-rate and inflation hedging, corporate bonds (if any) for benefiting from economic growth, and so on. A risk factor based approach is also useful for diversifying across different economic scenarios. It automatically forces an investor to do at least some forward-looking thinking.

[64] Ang, p. 450.
[65] Ang, p. 458.
[66] Ang, p. 455.
[67] Ang, p. 462.
[68] Ang, p. 462.

Risk factor premiums are rewards for investors enduring certain types of losses. According to Dr. Antti Ilmanen, expected returns have little to do with an investment's standalone volatility and more to do with the correlation of its losses with typical bad times.[69] As a result, investors require high risk premiums (high returns) for assets that tend to fare poorly – or lack liquidity – during recessions and financial crises. In contrast, safe-haven assets (such as sovereign bonds) that smooth portfolio returns in bad times deserve low or even negative risk premiums (in other words, returns).[70]

Under the multi-dimensional approach designed by Dr. Ilmanen[71], return expectations arise from three distinct kinds of risk exposures:

- investing in asset classes;
- exposing a portfolio to economic risk factors; and
- engaging in specific investment strategy styles.

Dr. Ilmanen suggests that the next generation of best practice in investing might involve pursuing several of these paths in parallel, and uses a three-dimensional cube to complement the asset class perspective with the viewpoints of risk factors and strategy styles.[72] Thereby, investment returns can be viewed from many angles: which asset classes earn them, what strategy styles deliver them, and which underlying risk factors explain them:

Chart 9:
The Cube: Three perspectives on investments

Source: Ilmanen 2011, p. 6.

Since research on strategy styles for fixed income is still in its early stages, strategy styles will in the following only be addressed where relevant.

[69] Ilmanen 2012, p. 4.
[70] Ilmanen 2012, pp. 4, 11.
[71] Ilmanen 2011, p. 6.
[72] Ilmanen 2011, p. 6.

6.2. Cash (money-market, deposits)

Cash means short-dated assets. Cash has the capacity to preserve capital in bad times, but it does not entail the kind of upside that longer-dated bonds delivered during the GFC (see Chart 3). In the absence of any risk premium, cash has low returns, and is therefore not likely to preserve capital in real terms over the long term.

In view of its special vulnerability towards the banking sector, a deposit insurer should not just park cash with a commercial bank. For making significant deposits, it is advisable to open an account with the central bank.

While deposit rates with a number of central banks have recently been negative, it is worthwhile to consider the various money-market instruments. In addition to a large number of instruments issues by the banking sector itself, money-market instruments include short-dated instruments issued e.g., by the Treasury, local and regional authorities, and corporations. Again, a granular approach to take a view on the various types of issuers might make sense.

6.3. Sovereign bonds (treasuries)

Sovereign bonds are considered a defensive asset class; their attractiveness is based on their perceived creditworthiness, flowing from the right of a government to tax its citizens. In times of crisis, high-quality sovereign bonds usually form a reliable store of value with superior liquidity. In market turmoil, investors flock to safe havens – usually top-rated sovereign bonds – and push up their value; this safe-haven feature is particularly valuable for a deposit insurer. Furthermore, a recession or a financial crisis may bring falling interest rates, which further enhances the value of sovereign bonds. Sovereign bonds also represent a key source of collateral.

During the GFC, there was a pronounced "flight to safety" as many investors moved into safe-haven sovereign bonds and sold off riskier assets. Assets with such safe-haven characteristics are highly relevant for a deposit insurer, as they are likely to retain their value and can be sold to willing buyers on the market. In 2008, safe-haven sovereign bonds not only retained their value, but significantly increased in value (see Chart 3). This can be explained by falling interest rates and the safe-haven feature. Note, however, that the safe-haven qualities of sovereign bonds may evolve over time, and during good times such safe-haven bonds may be loss-making investments due to their negative yields (as has lately been the case in Europe and in Japan). In an environment of rising interest rates, they may become significantly loss-making.

Sovereign bonds are mostly about interest rate risk, compensated to investors in the form of *duration premium*. The duration premium is the expected return advantage of longer sovereign bonds over cash. In other words, duration premium refers to the excess return of a long-term bond over holding a sequence of short-term instruments. In historical

perspective, average returns have increased in line with duration.[73] Over the past 20 years, higher interest rate risk has contributed to higher average returns.

The disadvantage of sovereign bonds may be their susceptibility to losses at times of rising interest rates because of their typically longer duration. An index investor, i.e., someone investing into a fund tracking a known benchmark, typically gets a duration of 5 to 7 years. For this investor, a rate rise of just one per cent would typically entail losses amounting to 5 to 7 per cent. In an environment of ultra-low interest rates and an upward pressure flowing from inflation expectations, even more violent moves are not unthinkable. A cap on duration is most advisable to manage this risk. Furthermore, in good times sovereign bonds may bring modest losses also due to their negative yields, as has lately been the case in Europe and in Japan.

Bonds issued by international organizations and international development banks largely correspond to sovereign bonds. Bonds issued by state, regional or local administrations may also qualify as investment targets for a deposit insurer.

6.4. Inflation-linked bonds ("linkers" or "TIPS")

An inflation-linked bond is a sovereign bond whose principal or coupon is indexed to inflation. In other words, it is about *inflation risk premium*. However, it is crucial to avoid a mismatch in the measure of inflation embodied in investments, on one hand, and the inflation embodied in a deposit insurer's liabilities, on the other.

Since linkers are not necessarily as liquid as nominal sovereign bonds, it may be prudent to use them as part of an overall portfolio, rather than basing an entire investment strategy on linkers.

6.5. Covered bonds ("*Pfandbriefe*")

Covered bonds are a rather stable asset class, highly regulated and robustly backed by collateral. No particular risk premium seems to dominate in this asset class. This asset class consequently continues to be relevant for many deposit insurers as part of an overall portfolio.

A covered bond is typically issued by a specific type of financial institution, a mortgage bank. Since covered bonds are usually governed by national laws, they do not comprise a fully standardized type of investment instrument, which may potentially hurt their attractiveness in a market crisis. For these reasons, it may be prudent to use them as part of an overall portfolio, rather than basing an entire investment strategy on them.

[73] Ilmanen 2012, p. 47.

6.6. Corporate bonds (credits)

Corporate bonds are mostly about *credit risk premium*; about default risk. In order to materialize, however, an issuer need not necessarily go bankrupt, as even just a rating downgrade may increase the credit spread for the issuer in question, thereby lowering the value of its bonds. Exposure to the risk of defaults or downgrades means that investors require a cushion over sovereign bonds to offset the expected losses. For this reason, corporate bonds almost always have higher yields and – in good times – somewhat higher expected returns than comparable sovereign bonds. The credit spread of investment-grade corporates over sovereign bonds has averaged over 100 basis points (equal to one percentage point) in recent decades.[74]

The timing of losses is quite unfortunate, however: defaults tend to cluster in times of recession. Furthermore, in market turmoil, credit spreads tends to increase, bringing down the value of corporate bonds. During the GFC, even corporate bonds nose-dived. What is worse, corporate bonds are exposed to a degree of illiquidity risk, and this development has in recent years been aggravated by bank regulation.

In view of their weaker liquidity and poor timing of losses, why would anyone invest in corporate bonds? At times, it has been impossible to achieve positive returns from an investment portfolio with only sovereign bonds, and corporate bonds have therefore been called to the rescue. Adding to the picture the prospect of rising interest rates, sovereign bonds are often worse hit than corporate bonds in an environment of rising interest rates for two reasons: firstly, corporate bonds have typically had a shorter duration than sovereign bonds and secondly, even if interest rates rise, the credit spread may come down, balancing the end result.

Reverting to Chart 3, one may observe an interesting detail: corporate bonds issued by companies *other than* financial institutions (as indicated by the green line on Chart 3) increased in value during the GFC. In fact, the value development of non-financial corporate bonds of high creditworthiness was quite favorable from a deposit insurer's perspective. This is a further argument supporting the exclusion of bank bonds from a deposit insurer's investment universe.

[74] Ilmanen 2011, p. 14.

6.7. Equities (stocks)

Some deposit insurers include equities in their investment portfolios and, for the sake of comparison, it is interesting to note how a number of central banks have recently been taking steps to include at least a modest allocation of equities within their investment universe. In theory, a small portion of equities is capable of decreasing the overall risk level of an investment portfolio otherwise consisting of debt instruments. Moreover, blue-chip stocks are rather liquid instruments (and nowadays probably more liquid than corporate bonds).

Equity risk premium, the excess return of equities over "risk-free" assets, flows from the low position of a shareholder in creditor hierarchy: in bankruptcy, a shareholder is a residual claimant to the company's assets after bondholders. Correspondingly, equities can bring huge losses; typically with the poorest possible timing for a deposit insurer. Therefore, equities are far from being an ideal asset class for deposit insurers. Furthermore, equities are not mentioned on the list of permitted investment instruments, as enumerated in the EU Directive on Deposit Insurance Schemes[75].

Should a deposit insurer nevertheless insist on maintaining a modest allocation into equities in a well-diversified investment portfolio, it should at least consider a choice of strategy styles that entail less downside risk than equities in general. Obviously, investing in bank stocks is hardly a good idea for a deposit insurer. Strategy styles that potentially mitigate downside risk include approaches based on cash flows, dividends or low volatility, for example.

6.8. Alternative asset classes

All other investments are often grouped under the heading of "alternative asset classes", and may include real estate, infrastructure, commodities, hedge funds, as well as private equity and private credit. These are generally inappropriate for a deposit insurer on account of illiquidity issues; in fact, *illiquidity premiums* are one of the main reasons for the attractive returns of most alternatives. Furthermore, no alternative asset class is mentioned on the list of permitted investment instruments, as enumerated in the EU Directive on Deposit Insurance Schemes[76].

But could a case, in theory, be made for precious metals such as gold – the ultimate safe-haven asset also referred to as "catastrophe insurance"[77]? Traditionally, central banks have been well-known investors into gold, and some investors have in recent years opted for gold as a perceived long-term store of value in an environment of ultra-low interest rates or in anticipation of rising inflation expectations. Chart 3 shows that over the GFC, the quintessential bad times, gold – even if extremely volatile – did well overall. In the case of

[75] Article 2, Directive 2014/49/EU on deposit guarantee schemes (recast).
[76] Article 2, Directive 2014/49/EU on deposit guarantee schemes (recast).
[77] Ang, p. 373.

gold, an upside is likely in a global crisis but it is by no means guaranteed. Even if gold were capable of retaining its value amid a currency crash resulting from a national banking crisis, the same end result could just as well be achieved by way of diversifying bond investments away from domestic sovereign bonds.

In addition, the disadvantages of gold weigh heavily. First of all, nerves of steel are needed – gold prices fluctuate more than most deposit insurers could tolerate, so one would need to prepare for major turbulence along the way. Second, timing (the principle of "buying low, selling high") is everything with gold, and timing is notoriously difficult. Third, precious metals are usually not held physically by an investor because of storage costs; crates and crates of gold bars would require a safe vault! Instead, investors may hold gold via investing through gold-backed ETFs or gold futures. Fourth, gold offers no yield: no interest coupons, dividends, or other regular cash flows are available. Finally, gold has been a poor inflation hedge, too, as while gold does track inflation over centuries, such horizon is far too distant for most investors.[78]

[78] Ang, pp. 371, 372.

7. Daily Portfolio Management

An asset owner may choose to outsource the implementation of its investment strategy – wholly or partially – unless it considers portfolio management to be among its core tasks. In practice, an asset owner often delegates its portfolio management to one or more external asset managers. The nature of each mandate may be based on the area of specialization of each manager, or the mandates may be identical.

Selecting and monitoring external asset managers is a key task. Sometimes an independent consultant assists a deposit insurer in the selection process. It is most important to agree on a balanced set of selection criteria at the outset. An expert-made Request for Proposal is paramount for the purposes of enabling an informed comparison of offers received. Otherwise one may end up comparing apples and oranges.

It is inadvisable to just place the funds with external managers without understanding or learning how these assets are managed. When choosing an external manager, it is of benefit if the manager is prepared to act as a sounding board for the deposit insurer's own Investment Committee. It is also a good idea to ensure that the deposit insurer's staff receive regular training for instance by way of seminars and regular face to face portfolio updates.

There is a well-known book from the 1940s entitled *Where are the Customers' Yachts?*[79]. The title of the book refers to an anecdote about an out-of-town visitor to Wall Street who admired the yachts belonging to bankers and broker-dealers. Naively, he asked where all of the customers' yachts were? The moral of the story is that an asset owner should be aware of the potential for "agency conflicts", i.e., inherent conflicts of interest between principal and agent involving a potential misalignment of incentives and horizons. What is best for an asset owner (principal) is not necessarily best for an external asset manager (agent). For instance, from the viewpoint of asset manager, it might be desirable if asset owners invested in more expensive instruments, even if these are often riskier at the same time. In the mutual fund industry, there may be several layers of intermediation between the asset owner and the ultimate portfolio manager, and each layer brings additional agency conflicts. The investment objectives of the asset owner carry less and less weight going down the chain of agents. To counterbalance the potential for agency conflicts, an asset owner should formulate its investment objectives and investment strategy with great clarity in order to enable an asset manager to fully understand what is expected from portfolio management.

Fees are very important: high fees are capable of resulting in lower returns for an investor, and it is the net returns after fees that matter. Management fees are usually based on assets under management. As fee structures tend to be rather complicated and sometimes opaque, an institutional investor needs to make an effort to understand any "hidden" fees and should, preferably, require absolute transparency in terms of direct and indirect fees and

[79] Schwed, Fred Jr. 1940. Where are the Customer's Yachts? John Wiley & Sons, Inc.

potential rebate structures. In order to enable an objective comparison of prospective asset managers, it is advisable to require that offers are based on the Total Expense Ratio (TER), which includes management fees and other annual recurring expenses, and is a measure of the total cost to the investor.

An asset owner needs to make a choice between active and passive management. "Passive" refers to simply tracking a benchmark *(beta)*, whereas "active" strives for performance exceeding a benchmark *(alpha)*. Active management can reliably implement all of the constraints set out in an investment strategy, but passive solutions may represent a more cost-effective way of accessing the chosen asset classes.

Structural choices may have important repercussions for liquidity. In co-investment vehicles such as mutual funds and ETFs, an investor needs to take the other investors' behavior into account. In the midst of market turmoil, everyone may simultaneously attempt to "rush for the door" in order to redeem (or, in the case of an ETF, sell) their fund units. A mutual fund generally has the right to suspend redemptions in certain market situations and – in a worst-case scenario – this could happen just when a deposit insurer's liabilities are triggered because of a bank failure! In view of a deposit insurer's mission to "fix bad times", co-investment solutions are thus not necessarily desirable. In the case of ETFs, one should furthermore ascertain that the fund fully owns the underlying assets, and does not just use derivatives to mimic a certain asset mix.

Instead of co-investment structures, directly owned securities may be more straightforward to dispose of in market turmoil. Other options include a so-called segregated mandate (being a separately managed account opened exclusively for the investor) and a so-called dedicated fund (being a mutual fund set up for one institutional investor only, as is customary in the investment activities of the French deposit insurer).

Some deposit insurers have appointed a central bank as their asset manager. The apparent advantage of this kind of arrangement is the ability of the central bank to liquidate, on behalf of a deposit insurer, large positions in the markets in connection with its regular daily operations. Large-scale liquidation of investments by a deposit insurer may send the market a signal about an upcoming bank failure, and transacting through the central bank might mitigate such signaling issues.[80] Using private asset managers is likely to bring equivalent benefits, however, as asset managers usually do business in the bond markets for the account of unidentified clients. The choice of asset manager depends of the individual characteristics of each deposit insurer and their chosen asset classes.

[80] IADI Enhanced Guidance, pp. 14–16.

8. Interplay Between Investments and Back-up Funding

A deposit insurer's investment activities and its back-up funding arrangements are closely intertwined. It is the task of the Board of Directors to oversee the entire funding and investment process:

> "*Regardless of the specifics of fund management, it is critically important that the* ***governing body of the deposit insurer have clear oversight over the funding process and investment strategy***."[81]

Back-up funding arrangements were outlined in section 2.4 above. Even if it is sometimes needed only for the purposes of covering a funding gap, back-up funding should by no means be understood in the narrowest sense. Its interplay with investment activities is two-fold:

- In the event that back-up funding is accessed by means of a repo transaction, investments may potentially be used as collateral. The collateral qualities of various assets should therefore be taken into account already when creating an investment strategy, preferably overweighting qualifying instruments.
- Past liquidity is not a guarantee of future liquidity. Even for highly liquid investments, liquidity may at times evaporate in the middle of extreme market distress, as happened in the darkest hours of the GFC. In these circumstances, unwinding a large position is likely to have some market impact that leads to potentially violent price swings. Being a forced seller in a weak market may entail significant loss of value at a critical moment, eroding the deposit insurer's capacity to meet its liabilities. In such circumstances, it would be economically more viable to temporarily use the investments as collateral and unwind the position in a somewhat more gradual manner.

In a nutshell, back-up funding should be understood relatively broadly as a way to mitigate unforeseen events, including extreme liquidity events of a passing nature in the market. In the event of a Black Swan event, pre-arranged back-up funding arrangements help avoid an unnecessary fire sale with intrinsic loss of value. To borrow from George Friedman, "Be practical, expect the impossible".[82]

[81] IADI Funding Guidance, pp. 21–23, emphasis added.
[82] Friedman, p. 10.

9. Recommendations and Outlook

With constantly rising pre-funding levels, deposit insurers form an emerging class of institutional investors. The investment strategy of a deposit insurer needs to reflect its mission, mandate, and liabilities.

The past three decades have been benign for an investor – such as a deposit insurer – that typically invests in fixed-income asset classes such as bonds. Financial markets evolve constantly, however, and the past may not be a good guide to the future. A prolonged era of ultra-low interest rates – sooner or later to be followed by rising interest rates – is one of the great investment challenges of our era. Relying on asset classes or strategies that have been successful in the past is perhaps the most common investor mistake. In these circumstances, past performance is certainly not a guarantee of future performance, and an investment strategy that does not address the current risks of various types of investments (even those traditionally referred to as "risk-free" investments) might bring losses.

Even if there is no risk-free investment, a deposit insurer nevertheless needs to invest its assets somehow and somewhere. A deposit insurer should not just park its funds in a bank account, given its fundamental exposure to the banking sector that flows from its mission and liabilities. Depending on local circumstances, other solutions involving a significant concentration risk might be problematic as well.

An asset owner such as a deposit insurer should always prepare for a number of different scenarios in its investment activities. Preparing for a broad range of potential outcomes requires a balanced, diversified investment portfolio that is designed to weather multiple scenarios. Firstly, one should prepare for a prolonged scenario of ultra-low interest rates at least in some advanced economies. In this scenario, asset classes traditionally considered risk-free (such as sovereign bonds) would continue to provide ultra-low or even negative yields, thereby potentially causing loss of value. Secondly, a scenario of rising interest rates is likely in the future, and it is capable of bringing significant losses for "risk-free" investments such as sovereign bonds. Thirdly, adverse economic scenarios such as a fully-fledged deflation might be favorable for sovereign bonds as investments, but less so for the real economy on which the health of the banking sector and the liabilities of a deposit insurer depend. One should bear in mind that development in different parts of the world may not be at all synchronized, though.

The following recommendations are meant to encourage deposit insurers to pay attention to some of the key issues:

1. A deposit insurer should have in place a written investment strategy, with a systematic process for reviewing and updating it regularly.

2. An investment strategy should be aligned with the deposit insurer's mission, mandate, and liabilities. A deposit insurer should identify and define its individual "bad times", and create a corresponding investment strategy. For a deposit insurer, "bad times" generally refer to circumstances where bank failure is most likely, as it could trigger the deposit insurer's liabilities. A bank failure would typically be most likely when times are bad for the banking sector. A deposit insurer should thus focus on investment types that perform well when the times are bad for the relevant banking sector. Correspondingly, a deposit insurer should eye with suspicion investment types that tend to lose value or liquidity when the times are bad for the relevant banking sector. A typical example would be exposure to the relevant banking sector itself.
3. A deposit insurer should define and document its investment objectives. The purpose of the investment activities of a deposit insurer is to support its main task of protecting depositors upon bank failure. Since the general idea is to have the maximum amount of assets available upon bank failure, both capital preservation and liquidity should be highlighted among investment objectives. In practice, returns are also necessary to facilitate a genuine capital preservation, i.e., to counter-balance costs and factors eroding asset value either in real terms or in proportion to liabilities. Therefore, a careful balance must be struck between the various investment objectives.
4. A deposit insurer should define and document the role of each type of investment in the portfolio, since investing is fundamentally about selecting and managing risks. Asset allocation refers to the practice of selecting appropriate investments – risk factors and asset classes – to invest in. It is useful to look beyond asset class labels in order to understand the dominant risk factor in each type of investment. An asset owner should take a stand on which risk factors are appropriate and then implement those factor exposures with appropriate asset classes.
5. The planned investment choices should also be evaluated by way of stress-testing for both loss of value and for liquidity.
6. A risk budget or a smart benchmark designed for the needs of a deposit insurer might be an idea worth considering, in order to set an overall risk limit for the portfolio.
7. A deposit insurer should not keep all the eggs in one basket, so to speak. Since concentration risk may give rise to unforeseen risks, deposit insurers should be aware of the benefits of diversification. Diversification helps prepare for various outcomes and is capable of lessening the impact of "bad times", because there is a likelihood that at least some of the assets will perform as intended when the bad times arrive. It may also be wise to avoid a significant home bias, since a national banking crisis is likely to have a negative effect on the market value or liquidity of sovereign bonds issued by the affected country. A diversified investment solution capable of maintaining its value when the national banking sector is in trouble should be devised instead. Ideally, a deposit insurer should place a cap on how much can be invested in bonds issued by any single country.

8. It is a particular characteristic of a deposit insurer that its investment portfolio should be liquid enough to enable a swift sale of all or some of the investments at a decent price once needed. Adequate liquidity flowing from appropriate investments gives a deposit insurer significant resilience. However, past liquidity is not a guarantee of liquidity at any given moment in the future, and liquidity may – against all odds – temporarily dry up in the market. For this reason, contingency arrangements for liquidity purposes are key.
9. Back-up funding (contingency funding) is paramount to safeguard the credibility of a deposit insurance scheme and the confidence of the public in the cover it provides. Back-up funding requires planning for the unexpected – even for a so-called Black Swan, an event with low probability and high impact – and should be pre-arranged so that it is available as soon as needed. Back-up funding should be understood relatively broadly to include also liquidity funding. This way, it would serve to mitigate unforeseen extreme events in financial markets, passing liquidity issues included, and would thus help avoid an unnecessary fire sale with intrinsic loss of value.

Literature

A Handbook for the Assessment of Compliance with the Core Principles for Effective Deposit Insurance Systems, March 2016 (International Association of Deposit Insurers) (www.iadi.org)

Ang, Andrew. 2014. *Asset Management: A systematic Approach to Factor Investing.* Oxford University Press. ("**Ang**")

Correa, Ricardo - Sapriza, Horacio. 2014. *Sovereign Debt Crises*, Board of Governors of the Federal Reserve System, International Finance Discussion Papers, Nr. 1104. ("**Correa - Sapriza**")

El-Erian, Mohamed A. 2010. *Navigating the New Normal in Industrial Countries.* Lecture by Dr. El-Erian for the Per Jacobsson Foundation. ("**El-Erian**")

European Political Strategy Centre: Severing the 'Doom Loop': *Further Risk Reduction in the Banking Union*, Five Presidents' Report Series, Issue 03 / 2015, November 2015 ("**European Political Strategy Centre**")

FSB Peer Review Report: *Thematic Review on Deposit Insurance Systems*, February 2012 ("**FSB Peer Review Report**")

FSF Guidance for Developing Effective Deposit Insurance Systems (Financial Stability Forum), September 2001 ("**Financial Stability Forum Guidance**")

Fan Yvonne, *Global Overview of Funding Issues for DIS*, Presentation on 3 September 2015, Research & Guidance Committee, International Association of Deposit Insurers (the "**Global Overview of Funding Issues**")

Friedman, George. 2009. *The Next 100 Years: A Forecast for the 21st Century. Doubleday* ("**Friedman**")

IADI Core Principles for Effective Deposit Insurance Systems, November 2014 (International Association of Deposit Insurers) (the "**IADI Core Principles**")

IADI Enhanced Guidance for Effective Deposit Insurance Systems: Ex ante Funding, June 2015 (International Association of Deposit Insurers) ("**IADI Enhanced Guidance**")

IADI Funding Mechanisms of Deposit Insurance Systems in the Asia-Pacific Region, Research Paper, July 2011 (International Association of Deposit Insurers) ("**IADI Asia-Pacific Research Paper**")

IADI Funding of Deposit Insurance Systems, May 2009 (International Association of Deposit Insurers) ("**IADI Funding Guidance**")

Ilmanen, Antti. 2011. *Expected Returns: An Investor's Guide to Harvesting Market Rewards.* John Wiley & Sons Ltd. ("**Ilmanen 2011**")

Ilmanen, Antti. 2012. *Expected Returns on Major Asset Classes.* John Wiley & Sons, Inc. ("**Ilmanen 2012**")

Luft, Joseph. 1961. *The Johari Window: A Graphic Model of Awareness in Interpersonal Relations.* Human Relations Training News, 5(1), 6 - 7. NTL Institute ("**Luft**")

Reinhart, Carmen M. – Rogoff, Kenneth S. 2009. *This Time is Different: Eight Centuries of Financial Folly*. Princeton University Press. ("**Reinhard – Rogoff**")

Schwed, Fred Jr. 1940. *Where are the Customer's Yachts?* John Wiley & Sons, Inc. Edition 1995.

Taleb, Nassim Nicolas. 2007. *The Black Swan: The Impact of the Highly Improbable*. Allen Lane. ("**Taleb**").

Acknowledgements

A special debt of graditude is owed to Jan Nolte and Isfandyar Zaman Khan for being among the first to see the value of an in-depth analysis of the investment activities of deposit insurers, and for making this piece of writing possible. The author would also like to express her deepest gratitude to Esko Haavisto for his pioneering work on using the bank spread as an indicator of bad times for a deposit insurer, and for modelling potentially suitable asset classes accordingly (as in Charts 2 and 3) together with Joonas Parjanne. The author is also grateful to Harri Luhtala and his fellow Board members, Maarit Säynevirta, Raimo Husu and Tuija Taos for though-provoking discussions over the years on the investment activities of a deposit insurer.

The author would like to thank Timo Löyttyniemi, Janne Kainu, Juan Carlos Quintero Valdivieso, Tanja Log, Tomas Hildebrandt, Ann-Cathrine Kilpi, Arto Björklund, Jorma Saine, Marjo Grandell, Sirpa Koskela, Pasi Vuorinen, Pirjo Saarelainen and Esko Kivisaari for their invaluable comments.

Among those who helped were also Arnaud Schangel, Thierry Dissaux, Theo Kiriazidis, Riccardo de Lisa, András Fekete-Györ, Gail Verley, Helena Persson, Sonja Lill Flø Myklebust, Thomas Moltke Thybo, Brynjar Kristjánsson, Roman Kahanek, Tim Hermansson, Julia Molin, Jussi Kanerva, Minna Metsävirta-Lassila, Timo Hovi, Ari Kiiskinen, Tomi Eliasson, Veli-Matti Mattila, Jari Virta, Markku Savikko, Taina Ahvenjärvi, Lea Mäntyniemi and Piia-Noora Kauppi. Anu Lampinen and Susan Schroeder provided useful linguistic observations.

DEPOSIT GUARANTEE SCHEME CONTINGENCY PLANNING AND STRESS TESTING

Alex Kuczynski

WORLD BANK GROUP
Finance & Markets
Financial Sector Advisory Center (FinSAC)

Contents

1. Introduction - Stress Testing under the EU Deposit Guarantee Schemes Directive and the IADI Core Principles for Effective Deposit Insurance Systems

The Deposit Guarantee Scheme (DGS) "should have in place effective contingency planning and crisis management policies and procedures to ensure that it is able to respond effectively to the risk of and actual bank failure" (International Association of Deposit Insurers (IADI) Core Principle 6).[1]

There is no excuse for a DGS not to be ready - its function and purpose to protect depositors should be clear; its focus on responding to "trigger" events must be sharp; and its staff ready to deliver its mandate (and even look forward to (and relish) doing so). To be confident of this success, requires planning and testing - a DGS cannot rely on circumstances affording it time.

As a "paybox", IADI Core Principle 15 requires the DGS to be capable of (or aspire to) pay out for most depositors within 7 days. In order to have considered and to complete this process, a clear plan needs to be effected - who is to be paid? how much? how? with what funds? But the delivery plan is only half the story - the DGS must seek to foresee what might impede or prevent that plan - and remedy in advance, where reasonably possible, these flaws or difficulties.

As such, the contribution of the DGS to the financial safety net and to financial stability is not just from delivery - from responding to actual trigger events - but also from being demonstrably ready. This reassures the public - and allays the risk of panic. It bolsters the Authorities - giving optionality and confidence in resolution planning, and allowing the application of wider public policy objectives. If the DGS is not ready, the Authorities will be reluctant to allow institutions to fail, either at all or without unnecessary and undesirable intervention and cost.

Trust is at the cornerstone of the DGS existence and role – to be trusted by consumers to pay out, be trusted by the Authorities to deliver its roles and function, and be trusted by member banks not to abuse its position or information. But trust needs to be earned and unless proven by actual (and recurring) experience can only be won by planning and testing - and such testing is not just 'pass/fail', but are exercises to challenge and enhance planning.

All DGSs are encouraged to be prepared for failure of protected banks and for payout. This is the need to have in place the necessary policies and procedures, ensure the mandate and powers (and tools) correspond, secure funding arrangements, and have the necessary human and business resources to hand. Scenario testing both supports readiness and also identifies gaps for remedy and to enhance capability.

---

[1] International Association of Deposit Insurers Core Principles for Effective Deposit Insurance Systems. These are explained in detail in the "Relevant Guidance" part of this Note.

2. Deposit Guarantee Scheme Contingency Planning and Testing

The DGS is one part of the financial safety net - along with the Ministry of Finance/Treasury, the Central Bank, the regulator or supervisor, any resolution authority, and the conduct regulator ("the Authorities"). The DGS mandate can vary.[2]

All models require contingency planning and testing - but this Note focuses on the universal role of the "paybox".

Whatever its role, the DGS must first understand its mandate and powers - these should be stated clearly, publicly, and in law (IADI Core Principle 2). The mandate and powers are the framework and "tools" for the DGS.

The DGS should be assisted in shaping its understanding of its role and mandate, and powers, by the public policy objectives - of the DGS and the safety net (IADI Core Principle 1). These provide important context, they will indicate when a DGS may be triggered, and the intent or spirit (as opposed the strict definition) of its purpose and contribution.

From this position, the DGS should explore the nature of what it might be called upon to do and when - the 'universe' of its potential activity. This will scope the tasks that the DGS will stand by, ready to deliver. This should be discussed and agreed with the Authorities - the partners in the financial safety net. In the event of any uncertainty as to the expected role of the DGS in a crisis, the DGS should clarify (and record) the expectations with the Authorities. The advance planning and testing must be a comprehensive assessment against this setting.

This Note looks at the approach to the preparation of a contingency plan, and then how that can be tested to give the necessary assurance.

The planning concept is straightforward. Against the mandate of the DGS, identifying its powers (and the expectations), can be set out, step by step, how the DGS will react to identified trigger(s). For example:

(i) the warning and notification of failure will be received from/by whom/when…,

(ii) the depositor data/claims will be received from/by whom/when/how…,

(iii) the process for receipt and processing of data is…,

(iv) the necessary funds will be calculated, and accessed from/by whom/when…,

(v) payment will be made when/how…

[2] Commonly, 4 types of DGS are identified: risk minimizer; loss minimizer; paybox plus; and paybox

But any plan needs to look wider than the exercise of the paybox, for example to include communications - who says what/when. Messages and tools need to be prepared and the separation (or allocation) of responsibilities with the Authorities understood. Conflicting or uncoordinated actions or communications can fail to reassure and undermine an otherwise smooth operation.

Experience suggests that high level directional plans are more useful than an encyclopedia - top line actions and responsibilities need to be assessed but a lengthy manual is unlikely to be referred to in a crisis or can quickly become redundant. The detailed operational procedures should be kept separate from the plan. It is better to identify clear responsibilities for trained or experienced staff as part of a more agile and effective philosophy to crisis management. Although this Note raises issues of detail, which can be explored at length by the DGS, the final product should not be a lengthy, unwieldy manual. Particular elements of planning and testing are examined further in this Note.

Finally, alongside its operational readiness and technical capacity to payout, the DGS should also have Business Continuity (or "disaster recovery") plans in place. These are important to any business - not unique to a DGS - but are also critical to a DGS's reputational risk. The issues can be wide and varied, and ever changing, and might address, for example:

(1) denial of access to premises e.g., natural event (flood), human intervention (terrorism, other intrusion), loss of supplies (electricity, water);

(2) information technology e.g., equipment functionality, cyber attack; or

(3) staff disruption e.g., transport, health pandemic outbreak, etc.

There is published guidance for such planning, and both national (for example UK BS25999) and international standards (ISO22301). There are of course a number of bodies which are considered to be leaders in the business continuity arena, including but not limited to the Business Continuity Institute[3], the Disaster Recovery Institute International[4] and at a national level, for example in the UK the National Resilience Capabilities Programme housed within the UK Civil Contingencies Secretariat[5]. These matters are beyond this Note, but these issues should not be ignored. Regular review and testing of plans to address such issues is equally essential - the best payout planning can be in jeopardy if the data processing fails or the DGS premises cannot be accessed and payout cannot be handled remotely or from an alternative site. These measures, messages, and actions are often self-evident and should flow from any proper risk management exercise - how can risks to delivery be identified, managed, and controlled - and tested/exercised by the DGS.

[3] www.thebci.org

[4] www.drii.org

[5] https://www.gov.uk/guidance/preparation-and-planning-for-emergencies-the-capabilities-programme

3. Relevant Guidance for Deposit Guarantee Schemes

The leading source of guidance for DGS practitioners and policymakers worldwide are the IADI Core Principles for Effective Deposit Insurance Systems.

IADI Core Principle 1 for a deposit insurance system requires clear public policy objectives; and Core Principles 2 and 3 recommend clear mandate and powers, and independent, accountable governance. Adherence to these Core Principles will allow the DGS to plan from a secure foundation.

Core Principle 4 requires a "formal and comprehensive framework in place for the close coordination of activities and information sharing" within the financial safety net; and further - that 'ongoing information sharing and the coordination of actions is explicit and formalized" (Essential Criteria 1).

Under Core Principle 6, the "deposit insurer should be a member of any institutional framework of ongoing communication and coordination among safety net participants related to system-wide crisis preparedness and management". Such channels should remove any uncertainty in the roles of the DGS and its safety net partners.

The key reimbursement objective is at Core Principle 15:

> *"The DIS[6] should reimburse depositors' insured funds promptly, in order to contribute to financial stability. There should be a clear and unequivocal trigger for insured depositor reimbursement."*

Essential Criteria

1. The DI[7] is able to reimburse most insured depositors within seven working days. If the DI cannot currently meet this target, the DI has a credible plan in place to do so.
2. To be credible, the reimbursement plan:
   a. has a clear time frame for implementation (e.g., within two years);
   b. is supported by relevant laws, regulations, systems and processes (e.g., intervention and resolution manuals); and
   c. has clear and measurable deliverables.
3. In situations where reimbursement is triggered and there may be extended delays in reimbursements, the DI may make advance, interim, or emergency partial payments.

[6] Deposit Insurance System

[7] Deposit Insurer

4. In order to provide depositors with prompt access to their funds, the DI:

   a. has access to depositors' records at all times, which includes the authority to require banks to maintain depositor information in a format prescribed by the DI in order to expedite insured depositor reimbursement;

   b. has the authority to undertake advance or preparatory examinations (e.g., on-site and independently or in conjunction with the supervisory authority) on the reliability of depositor records and has tested member institutions' IT systems and data to ensure the capability to produce such records; and

   c. has a range of reimbursement options.

5. The DI has the capacity and capability to promptly carry out the reimbursement process, including:

   a. adequate resources and trained personnel (in-house or contractor) dedicated to the reimbursement function and supported with reimbursement documentation or manuals and information technology;

   b. information systems to process depositor information in a systematic and accurate manner;

   c. pre- and post-closing activities specified in closing documentation or manuals; and

   d. scenario planning and simulations, including simulations on bank closings with supervisory and resolution authorities.

6. A review (e.g., post mortem) following a bank failure is performed to determine and analyze elements of the reimbursement process (including the resolution procedure where applicable) which were successful or unsuccessful.

7. An independent party conducts a periodic audit of the reimbursement process to confirm that appropriate internal controls are in place.

[IADI Handbook note: Every few years, the DI should conduct a thorough review of the entire disbursement process, and take appropriate corrective actions. Such reviews (also known as program audits) should be conducted by an external independent organization and should particularly focus on the effectiveness of internal controls built into the reimbursement process. The scope, frequency and independent nature of the review should guide the assignment of a compliance rating.]

8. If set-off of insured deposits against past due claims (e.g., debt service and arrears) or matured loans is applied, such application is timely and does not delay prompt reimbursement of insured depositors' claims or undermine financial stability.

9. Working arrangements and/or agreements are in place with relevant clearing and settlement system agencies and liquidators, to ensure that transit items are dealt with in an appropriate, consistent and timely manner.

10. In cases where the DI does not have the authority to act as a liquidator, the liquidator is obliged by law or regulation to cooperate.

IADI's Core Principles explicitly require contingency planning - Core Principle 6; Essential Criteria 2 adds that the DGS develop and regularly tests its own contingency planning and crisis management plans. This is not limited to the DGS - "the [DGS] participates in regular contingency planning and simulation exercises related to system-wide crisis preparedness and management involving all safety-net participants" (Essential Criteria 4).

This is endorsed by Paragraphs 5 and 7 of Core Principle 15 (above).

In its recently published Handbook, IADI's guidance on Essential Criteria 2 and 4 of Core Principle 6 is as follows:

> "Plans should be tested on a regular basis. Testing is particularly important in systems where there have been few, if any, failures. Under such conditions, testing is the only means of ensuring that procedures and systems are effective. Such testing can take a variety of forms, from simple scenario planning and table top exercises to a comprehensive test of preparations for failure and other events and the collection of any necessary information. Not all systems need to be tested at once. For example, the DI can opt to test separately elements of its monitoring, such as the early warning system and payout procedures. Some testing of some components should be conducted every year, with a full test of all components every five years; the incidence of any actual reimbursement counts in lieu of a full test. Systems will be graded [Compliant] if they have a regular process of testing sub-systems and, occasionally, the full system. Systems that test irregularity may be graded [Largely Compliant] and those that do not test [Materially Non-Compliant] or [Non-Compliant]"; and
>
> "The DI should participate fully in coordination or contingency planning exercises on a system-wide scale. The assessors will have to determine if the DI is routinely included in all exercises, has full access to preparations and review of the results, and participates in the development of follow-up action plans".

The Core Principles, and Essential Criteria, make clear that planning must also include communications "in the development of pre and post crisis management plans involving the safety-net participants….", as further elaborated in the Handbook (at Essential Criteria 5):

"The DI should participate in the development of communication plans that are part of the contingency planning process for all its banks. The DI has special knowledge of depositor behavior and issues determining private sector confidence. The insurer should be frequently consulted, have input into communication strategies, and ensure a consistent communications strategy for a [Compliant] rating."

The 2009 Core Principles were applied by the Financial Stability Board (FSB) in its Thematic Review on Deposit Insurance Systems - Peer Review Report (8 February 2012) as a benchmark[8]. As well as endorsing the Core Principles themselves, the Report noted

[8] www.fsb.org

the "need to strengthen the degree of coordination between the [DGS] (irrespective of its mandate) and other safety net players to ensure effective resolution planning and prompt depositor reimbursement".

Noting that some countries had not carried out a payout at all or for the same time, the FSB Report recommended "the conduct of simulation exercises to ensure readiness and effectiveness of the payout process", particularly if a jurisdiction "has not triggered its [DGS] for some time".

The Report recommended that IADI, with the Basel Committee on Banking Supervision and others, develop additional guidance for "conducting regular scenario planning and simulations to assess the capability of making prompt payout". IADI subsequently updated the Core Principles - and issued the Handbook.

On the payout process, the FSB noted that access to funding needs to be assured and also that "adequate and timely access to information" "from supervisory authorities and/or directly" is a "good international practice" - as are preparatory examinations of bank data and audits of databases - "practices [which] can assist in ensuring depositors have prompt access to their insured funds in the event of a failure".

The FSB also endorsed as further "good practice" the establishment of formal coordination and information sharing arranging with other agencies - and cross border with other DGSs.

4. Deposit Guarantee Schemes' Experiences

DGSs across the world have been and are responding to the failures of banks and paying out depositors' claims. On each occasion, the payout 'tests' the plans and the planning operation. This opportunity for learning lessons and making improvements, whether to address real incurred problems or "near misses", should not be lost. Even better, the responses should be shared in the DGS community.

Both IADI and the European Forum of Deposit Insurers (EFDI) hold regular meetings of members where payout experience has been shared by DGSs. Such practical learnings are vital to allow other DGS to identify issues that they may also have to address in their own plans.

One example is from the National Deposit Insurance Fund of Hungary (NDIF). It published two "Summary of the Experiences and Lessons Learnt"[9] papers on its payout experience of "Jogazda" Savings Cooperative Bank in 2011 and of Soltvadkert Savings Cooperative Bank in 2012. The practical learning these contain is highly informative.

In the Jogazda case, NDIF divided the lessons into:

(i) "inter-institutional",

(ii) IT,

(iii) payout, and

(iv) communication,

noting for each:

(i) the importance of early notification, and the availability of documents on an ongoing basis;

(ii) the need for 'regular data cleansing' of depositor data;

(iii) the postal envelope format - so documents posted have the addressee at the appropriate place for the window of the envelope; and that

(iv) "successful payout depends at least to 50% on successful communication".

NDIF formed an action plan to address the lessons learnt. Early notification and data quality are not surprising - but the focus on the practical (i.e., envelope format) and communications show the value of experience.

In the Soltvadkert case, the NDIF benefited from a cooperation agreement with the regulator - keeping NDIF informed and allowing for joint onsite examination of data

[9] www.oba.hu

to improve quality. The report included further lessons on data quality and depositor information, and the practical lessons on the use of an 'agent bank' for payout (to ensure coordinated communication and messages).

The practical experience that can be usefully shared was also illustrated at the IADI conference in May 2016 ("Diversity and Harmonization of Deposit Insurance"). In a presentation on behalf of the Philippines Deposit Insurance Corporation (PDIC), its Chief Executive, Cristina Orbeta, noted how PDIC, when covering such a large and diverse nation, subject to extreme weather events (such as hurricanes), had learnt to equip its staff with cash, medicines and sources of backup power supply; satellite phones and spare clothes are also supplied; and, to deal with the unexpected, the value of trained and experienced staff.

The IADI has published relevant guidance and research. In November 2012, IADI published a Guidance Paper - "Enhanced Guidance for Effective Deposit Insurance Systems: Reimbursement Systems and Processes"[10]. Collated from the payout experience of members, including during the 2008/09 crisis, the Paper sets out relevant criteria for an effective payout - a source of highly relevant material from which to draw a plan for a depositor payout. It identifies key impediments to a payout:

(1) lack of access to deposit records in advance of a failure;

(2) poor quality of depositor records at banks;

(3) inability of banks to provide depositor records within desired time frames;

(4) determining depositor claims and dated loans/liabilities for complying with netting requirements;

(5) lack of unique identifier [for depositors]; and

(6) lack of appropriate IT system reimbursement plans to deal with different size banks.

Annex I to the IADI Guidance Paper sets out the actions taken by DGSs to address impediments and challenges to an effective reimbursement system. As well as highlighting such issues and remedial measures for a payout, which will assist the development of a payout plan, the IADI Paper also identifies two important issues relevant to planning and testing. First, an effective payout requires 'skilled human resources with expertise in carrying out reimbursement functions'. This can be internal staff and external service providers. Secondly, the importance of coordination with other safety net participants - and across jurisdictions.

Finally, the IADI Paper stresses the need for simulations. Although established infrastructure is important, it is equally important for a deposit insurer to be confident that reimbursement processes will perform as expected in a "live" scenario. The IADI Paper advocates "periodic testing of operational readiness through simulation exercises of all or some aspects of the reimbursement function, including readiness of banks to provide accurate depositor information within targeted timeframes". The key objectives are to involve and train all

[10] www.iadi.org

personnel, including external suppliers, test reimbursement processes and procedures (against standard and unusual scenarios to assess foreseeable and unforeseeable risks), and apply lessons learnt.

In addition to the expectations within the global safety net, as evidenced by the IADI Core Principles and FSB report, in Europe, legislation now requires 'stress testing' (and therefore planning) of the DGS.

Article 4(1) of the Deposit Guarantee Schemes Directive (DGSD) obliges member states to ensure that DGSs perform stress tests of their systems, such tests to take place every 3 years and more frequently where appropriate. Further, the European Banking Authority (EBA) is to conduct peer reviews of EU DGSs every 5 years - assisted by the results of the testing - to examine the resilience of DGSs.

To support this DGSD requirement and seek consistency of interpretation and approach, in May 2016 the EBA published "Guidelines on stress tests of DGSs under the Directive".[11] In anticipation of the DGSD requirement, EFDI had also worked on its own Explanatory Note of guidance. EFDI established a working group of DGS from 9 EU member states who pooled experience and know how to devise a practical guide to stress testing of a payout operation, identifying key issues and risks for a DGS in its reimbursement planning and delivery. The report was recognized in the EBA Guidelines, which are an important contribution to guidance for any DGS (including those outside the EU) when establishing, maintaining, and testing its contingency plans.

[11] EBA Guidelines, EBA/GL/2016/04 (www.eba.europa.eu)

5. Planning for the Paybox

In order to identify risks, develop policies and procedures, establish controls, and to set a plan and carry out testing, the aims of the DGS must be identified. The basic aims of the paybox DGS are set out below - planning can be assessed against these accordingly.

These aims of the paybox may be summarized as follows:

(1) to payout the correct, protected balances to depositors of a failed bank, or

(2) to transfer those deposits of protected depositors to another bank, and

(3) to have funding in place for both ongoing 'business as usual' activities, and funds (or access to funds) for a payout,

(4) to ensure depositors are aware of the DGS, not just in a payout scenario but at all times,

(5) to secure and maintain staff resources, and an operational infrastructure for a payout. Infrastructure includes premises, expertise and advice, and technology and tools e.g., for data receipt and handling, and the payout demands.

As noted, IADI Core Principle 15 describes in more detail the reimbursement criteria for an effective DGS. Funding and Public Awareness are addressed by Core Principles 9 and 10. "Funding" identifies the need for liquidity of funds and investments - and the need for emergency backup funding - both of which underpin plans for effective and timely reimbursement.

Each of these aims of the paybox are part of its contingency plans and testing.

Planning and testing are two sides of the same coin. Planning leads to and supports actual performance and, if not, better testing. The results of either performance or of testing are recycled into updated planning and further testing.

A plan should record this evolution - it will set down each step of the process. It will also identify where unintended (even unforeseen) events may arise and how they will be addressed.

For a paybox DGS, the starting point is to carry out the paybox functions set out above. The path should be signposted along the way:

(1) How is the DGS triggered?

(2) If triggered, is this a payout case?

(3) How will depositors' eligibility be verified? From what information and by whom? Will this rely on delivery of a "single customer view (SCV)" file; claims assessment by DGS or outsourced staff, use of pre-drafted application forms etc?;

(4) How will payment be made? Does the DGS have an appointed cheque partner? Or website portal? Or electronic payment channel? Or a roster of agent banks?

(5) Will the DGS be in funds? In part or in full? How will funds be accessed or from where or whom and how quickly?

(6) Are there clear communications messages - for the public generally and for the instruction of depositors?

All steps need to be supported by identified trained and qualified staff and/or external resources - third party suppliers, who could include, in the EU context, another EU DGS as payout agent in a host member state.

6. Testing - the Operational Principles

There are different approaches to carrying out testing of a DGS - which provide different levels of challenge and learning. The overriding need is to develop and test plans - exactly how plans are tested can be flexible to reflect resources, time, availability, and degree of partners' engagement, and of course real life experience - there is less need to test operations which have been invoked for real (although, as noted above, any real cases should then be analyzed for lessons learnt - and the results used for enhancing the readiness and resilience of the DGS).

The test can be a 'desk top' walkthrough, or a full simulation. The former is useful to clarify individual roles and dependencies - who is expected to do what, when, with whom, and how. The latter is more challenging - actual output is required - e.g., depositor data transmission and analysis, funding drawdown, the issue of payment instruments etc.

Operational principles for contingency tests are listed below. They are drawn from or are consistent with the EBA Guidelines and the EFDI Stress Test group conclusions.

1. Independence/separation of duties

To ensure that the test provides challenge and does not allow "easy" answers or solutions, an 'independent facilitator' can be used. The facilitator avoids compromise of outcome and compels participants to confront what might otherwise be ignored - either for convenience or simply because those involved are too 'close' or are blinkered by their own experiences.

This "independent" role and challenge can be provided internally from the DGS - by an internal resilience or testing team - or externally by consultants or by staff from other safety net authorities - or both. It is described by the EBA as a 'steering team or steering officer'.

External observers, from another DGS, are another good source of challenge and insight - and offer the chance to share learnings and build relationships useful for future engagements (e.g., a cross border failure).

2. Time and Resources

The steering team needs time and resources to develop the right level of test and to ensure an effective exercise. Access to information and management are vital to develop a credible test. The team needs to be allowed to iterate draft proposals, and validate its approach to the aims of the exercise. Different turns of events and responses in the exercise need to be foreseen and worked through - although not all need to be addressed in the exercise itself - some can be 'logged' for future exercises or follow up action. During the exercise, it is a common technique to assign issues to a "parking lot" as they arise to ensure the momentum and focus is not lost, and to return to these issues at a future point.

The other side of 'time and resources' are the actual DGS participants in the exercise - to ensure realism and effect, participants must be prepared to clear diaries and be committed. Distractions will undermine focus and lessen impact. It can be difficult to find uninterrupted time for decision makers, so advance planning and clear prioritization is essential.

In the event of a real crisis coinciding with a test, the test should be deferred - both to avoid any confusion of the 'factual' matrices, and also not to jeopardize the engagement and contribution of the participants.

Pre-reading for participants is a matter of taste – a little can help but extensive, directed pre-reading is not always beneficial - it can undermine realism and condition the mind set of participants.

3. Conduct and the Cast List

The test should be arranged (by the facilitators) to a predetermined program. A timetable needs to guide the test - to ensure that the objectives are addressed. Even if new and relevant issues are identified, these can be 'parked' for another day. Otherwise the time can be lost in interesting but unfocused discussion or unproductive debate. The facilitators may have to curtail such digressions to ensure the participants (and the test) remain on track.

The assembled cast for a test must include those who represent decision makers relevant to the exercise plan, some assumptions may be appropriate. A focused payout channels test is unlikely to require the Ministry of Finance (as funding might be assumed) but would require the decision owner for the type, terms, and timing of the payout.

However, even if not a player in the exercise, under the Core Principle of close coordination within the safety net, the fact of the exercise should be reported in advance, and the results shared, with the Authorities. This ensures 'buy in' to the exercise and reinforces the important mutual trust objective. The Authorities can be invited to observe in any event.

The planning of the scenario can draw in non-staff or those not with the Authorities too - for example key suppliers or insolvency practitioners, due to their insights and role as partners in any actual event response.

4. Governance

Once a test is established, alongside the steering team, a high level oversight group (of DGS Principals) is required to approve the objectives, the test plan, and to review the results and any actions to be taken. Members of the group must include senior representation - probably at board or executive level. This ensures oversight and credibility to the exercise, staff buy in, and authority for the steering team (who depend on DGS staff and resource for a successful test).

5. Objectives, scale and scope

The test objectives need to be agreed. What is to be tested? What are the success criteria for the test? A clear scope and range, and timetable, for the test must be set. It can be limited and proportionate. It should be realistic. Participants will recoil from extreme or implausible scenarios or tests.

Proportionate tests are a sensible staggering of the process, especially as testing should be regular and continuous - not a one-off. A series of tests, of increasing complexity or rigor, are a good option. The 'big bang' full test has a role to play - to provide real stretch - but DGSs should not be deterred from smaller, targeted testing. The EBA Guidelines suggest a "performance of test exercise… over a period which is not less than two to five years…", and each test should take into account 'the results of previous stress tests'.

Under the headline of testing processes for timely and effective payout, the governance process needs to set particular objectives. Existing contingency plans and planning assumptions, and previous tests, are a base to work from but need to be validated. Are these still accurate? Where might assumptions be out of date with the market? Do plans still align with the DGS's mandate or conflict with others in the safety net? This might include what size of institutions are to be paid out in insolvency and not otherwise resolved.

6. The Results - recording, reporting and remedying

The steering team will manage and observe the test and record the results. The results must be 'relevant' to the DGS - recognizable and intelligible. The results are then reported to the 'Principals', with recommendations for action. The Principals may reject or revise the recommendations, but the results should be received and recognized, whether or not they are wholeheartedly adopted.

A remedial action list should be agreed - with outcomes and timescales. This can be reviewed from time to time by the internal audit function to ensure operational management do not allow agreed remedial work to become overlooked or delayed. Alternatively, the steering team can also oversee implementation.

Principals and management should welcome the reporting and the recommendations. Key operational vulnerabilities, and risks, can be addressed. Operational planning assumptions and risk oversight can be recalibrated to correct shortcomings.

The EBA Guidelines include a template for reporting (Annex 1) - this is required if the EBA is to compare results and analyze peer review on a consistent basis, but it provides a useful starting point for any DGS.

Peer review and comparability are useful for a DGS - not just in the EU. This supports best practice. Indeed inviting other DGS colleagues to observe or participate in a stress test (and offer insights from their own experience) can be rewarding - and promote common and higher standards.

7. Risks

There are risks created by a test, which need to be in the minds of Principals and the steering team. As noted, coincidence with a 'real life' event should be avoided - not just to ensure managerial attendance and focus, but also to avoid any internal confusion of facts or resource planning - or any external miscommunications.

Many tests will require external engagement. Use of dummy/code names (not real bank names) will assist to manage inadvertent 'leak' risk and market or public concern. Clear labelling to any third parties that "this is a test" is a sensible precaution.

Needless to say, the security of personal data is paramount. Confidentiality of real data must be preserved. Real (not dummy) data of depositors can be a legitimate ingredient of the test - for example use of dummy data or partial data may not fully test a data transfer or integration process. However, such data must be protected and preserved without compromise as long as (but no longer than) required for the test - and then promptly (and securely) destroyed.

8. Reverse Stress Test

The common direction of testing is to develop and run a scenario - and observe if and where the contingency plan is exposed. An alternative - and useful counterpoint from time to time - is a "reverse stress test".

The reverse stress test identifies where the DGS has failed to meet its objectives and works back to identify where that failure can occur. This can usefully inform the DGS's own risk assessment and tolerance - as to the point at which the DGS does not expect to have to respond (if any) e.g., as to scale of bank failure or timing of reimbursement or self-funding needs.

7. The Test Framework

The basis for the stress test will be a range of (i) common/foreseeable and (ii) extreme/ unexpected scenario events. These will be plausible and high impact events.

The scenarios will be used as the trigger events to identify under what circumstances the DGS would find that the execution of payout starts to become difficult. The base scenario will be created by each DGS, using some or all of the categories described below, and enhanced by additional detail relevant to the test objectives and to an individual DGS. As part of the stress test, the DGS should make the scenarios progressively more testing e.g., to extend the complexity of the case study, consider any risks identified by testing, aim for high stress (e.g., high impact, low probability outcomes), and challenge any underlying assumptions.

The scenario can be further enhanced by selecting appropriate inputs from case studies and experiences of other DGSs.

The framework for the test must align with the DGS's institutional and legal framework. For the DGS, these reference points and parameters will comprise:

(1) its governing legislation and public policy objectives;

(2) its legal powers and obligations (e.g., access to data);

(3) the scope of protection and depositor coverage (limits, timescales, eligibility);

(4) funding (ex ante, ex post, borrowing);

(5) the DGS's information requirements and entitlement (depositor data); and

(6) its third party dependencies for payout scenarios (IT systems, cheque providers, agent banks, communication (and call centre) resources).

The framework for the test also needs to identify the material external factors (for which certain factual assumptions may need to be set):

(1) the trigger for the DGS (e.g., court order of bank insolvency);
(2) the test bank corporate overview (e.g., business model, balance sheet, market position, geographical locations etc);
(3) key features of the deposit book (number, value, protected/unprotected, account types); and
(4) access to data - whereabouts, transferability and format (including IT systems).

The test bank overview needs to represent a relevant or typical bank scenario and to be challenging. The scale of depositors and balances should stretch the capacity of the DGS, incrementally if necessary, to make that number of payments, and have funds for that amount.

The scenario can be developed - by type and scale of firm - in size and complexity, and through the test narrative, using rising severity of impact and accelerated timescales for example moving from:

(i) early identification of concern as to viability; to

(ii) highlighted risk of failure and escalated planning; and then to

(iii) accelerated deterioration and insolvency (e.g., bank run).

The test framework can take the DGS through each stage of its planning (for (i), (ii) and (iii)) - or fast forward to the event of failure and its required response.

The EBA Guidelines identify 2 main "risk areas":

(i) "operational risks" (processes, staffing and systems); and

(ii) "funding risks" (funding sources to meet liabilities).

These cover the principal risks to the delivery by a DGS of its particular paybox function.

Operational capabilities are broken down by the EBA into different categories:

(1) access to data - information on the institution, access to and testing of depositor data (the SCV), and the arrangements for early warning of problems to the DGS;

(2) staff and operational resources;

(3) communication with depositors and the wider public (e.g., website, call centers);

(4) payment instruments (processes and instruments);

(5) repayment and contribution periods (time to payment); and

(6) home-host cooperation (payment to depositors at branches in other EU member states).

EBA put forward a cycle of testing for each EU DGS as follows:

(1) SCV file tests (formal, routine checks of SCV files);

(2) an operational capability test - a payout scenario against "a credit institution with a number of depositors of no less than the second quartile" of institutions (excluding those institutions to be subject to resolution);

(3) an operational cross border cooperation test; and

(4) a funding capability test (for a single or multiple failure).

Funding capabilities assess adequacy of the ex ante funding, including liquidity, and adequacy of extraordinary ex post contributions and alternative funding means to meet any shortfall. The details can be found in the EBA Guidelines.

As noted, the DGS (as any other business) also needs to prepare for the other external factors that can impact effective operations.

8. Testing: 8 Key Impacts

The substance of the stress test will be an analysis of the ability of the DGS to execute its paybox function under the given scenario(s): primarily in relation to operational processes for payment.

That impact analysis will be based around the chosen case study firm, and consider the impact on the DGS through relevant channels - on operations and funding. It should also test and challenge any DGS assumptions, either pre-existing about DGS capability and/or those made for the purpose of conducting the stress test.

Examples of 8 key impacts are outlined below, together with brief descriptions of the expected channels and some key questions/issues that the DGS should consider as part of a stress test. The 8 impacts are all from part of the reimbursement operation and "unpack" the "operational risks" and "funding risks". These should not be regarded as comprehensive lists, and DGS should consider any other impact channels that are relevant to executing statutory obligations to make payments.

1. Pre-default planning.

a) Examples of impact channel:

- The relevance and importance of this impact channel will reflect the extent to which an individual DGS is required to undertake work prior to a firm's failure.
- Most DGS, at a minimum, will require access to the firm's data file that contains information on depositor balances e.g., the access that the DGS may require to the failed firm including via any insolvency practitioner (liquidator, administrator, etc.) in-waiting.
- Drafting media and depositor communication messages, including those for handling depositor queries (relevant to DGS, insolvency practitioner, agent bank, and service providers).
- Ability to accelerate pre-default planning work.

b) Issues for consideration:

- What are the DGS's main pre-default planning actions, key timings, and requirements?
- How were these impaired by the scenario/firm case study used in the stress test?
- Consider specific examples that would have impaired the ability of DGS to prepare for making a payout, in particular access to and quality of the information required from the failing firm.
- DGS should consider any other pre-default contingency planning activities that are relevant to the other impact channels listed in paragraphs 2 to 8 below.

2. Operational processes.

a) Examples of impact channel:

- Data transfer. The timely provision of the data file from the failed firm to the DGS within required timeframes (e.g., within 24 hours for UK deposit takers).
- Data processing. Utilizing the datafile, including the calculation of compensation amounts.
- Call handling. Customer service capacity to deal with a high level of queries from claimants / depositors, including instances where no/incorrect compensation has been paid by the DGS.
- Claims processing. Resolving questions raised by depositors, including checking and explaining where incorrect compensation has been made.
- Payout methods e.g., cash, over the counter/at a branch, cheque, electronic transfer (and any other methods used); and use of systems / branches of the failed bank.
- Use of agent banks to make payments. Utilize the existing payment channel relationship with the failed bank, or the need to put in place a new arrangement.

b) Issues for consideration:

- What are the key operational processes that the DGS would need to complete in order for a compensation payout to be successful?
- For each of these processes, what were the key vulnerabilities, weaknesses, and stress points identified by the stress test?

3. Capacity to execute a payout.

a) Examples of impact channel:

- Each DGS will have a maximum capacity for making compensation payouts e.g., by value of payments, volume of depositors, and resources required to execute payments.
- There will be internal / external dependencies and pinch points.
- Concurrent failures that stretch the capacity of the DGS to carry out its functions (and for others e.g., insolvency practitioners, regulatory authorities, and third party service providers).
- Multiple calls on the DGS (and the others) e.g., co-ordination required with the Insolvency Practitioners dealing with different aspects of the same firm.

b) Issues for consideration:

- What are the capacity boundaries of the DGS for making compensation payouts?
- When does the scenario/case study start to act as a capacity constraint on the ability of the DGS to execute its statutory responsibilities?
- At what operational capacity point(s) would the DGS be unable to execute its responsibilities?

4. Funding of the payout.

a) Examples of impact channel:

- For a pre-funded scheme: investment of funds; change in fund value or liquidity; access and ability to realize these funds, e.g., liquidity to sell assets or enter into a repurchase agreement.
- Post insolvency/trigger levy: method, capacity, and speed to raise funds from the industry.
- Commercial facilities e.g., terms and availability of commercial loans, whether guaranteed etc.
- Use of public funds from Ministry of Finance e.g., procedures to provide the public backstop.
- Some DGS can issue their own bonds: timeframe required for preparation and to raise funds.

b) Issues for consideration:

- What are the key constraints on the ability of the DGS to fund a deposit payout?
- At what funding thresholds does the DGS become unable to fund a deposit payout?

5. Timeframes for executing a payout.

a) Examples of impact channel:

- Compensation payments not made within designated timeframes; or failed/ made incorrectly.
- Whether the DGS can cope with different timeframes e.g., if the timeframe is shortened because of late notification by the prudential supervisor / resolution authority to the DGS.
- Flexibility of the DGS's model to vary payments to selected groups e.g., hardship or interim payments made earlier than statutory timeframes, assessment of additional coverage for 'temporary high balances', continuity of service for transactional accounts etc.

b) Issues for consideration:

- Identify the key risks to the DGS making compensation payouts within the designated timeframes.
- To what extent does the DGS have any flexibility to shorten or vary the timeframes, and in what circumstances?

6. **DGS governance / decision making.**

   a) Examples of impact channel:

      - DGS's own decision making process - and dependency on other domestic/ overseas authorities for decisions / ratification etc.
      - Differentiate between the nature and importance of impact from home authorities and overseas DGS/authorities.

   b) Issues for consideration:

      - What are the DGS' key governance and decision making processes?
      - How were these impacted by the conditions used in the stress test?

7. **Third party stakeholder management** (i.e., service dependency external to the DGS).

   a) Examples of impact channel:

      - DGS key dependencies: external to DGS/the failed firm, such as key service providers (agent banks etc), suppliers, and data/system hosting.
      - Where service level agreements (SLAs) are in place, impact status in stressed conditions and whether the agreement ceases under the stress test scenario.
      - Utilize information about impact channels gained from any previous testing of stakeholder relationships e.g., on key terms and conditions, backup plans etc.

   b) Issues for consideration:

      - What are the main third party / external dependencies that are critical to the ability of the DGS to execute its responsibilities?
      - In what circumstances during the test were these dependencies impacted?
      - At what point would the service agreements have ceased operating?
      - How well would backup plans / service level agreements etc. have held up given the conditions of the stress test?

8. **Communications.**

   a) Examples of impact channel:

      - Effectiveness and consistency of messages to media and depositors, and by what delivery method or communication tool.
      - DGS reputational damage e.g., from failed payout/unable to execute statutory responsibilities.

   b) Issues for consideration:

      - What key communications were required, with whom, and how were these developed?
      - How and why would ineffective messages have impaired the DGS, given the circumstances used in the test?

9. Testing: 8 Additional Impacts

The "operational risks", the "funding risks", and the key impacts, are areas central to the role of the DGS. All should form part of the DGS planning - and be kept under review. But the risks to the DGS are not just from payout of a bank failure.

There are another category and range of scenarios and "impacts" for the DGS. These are events that the DGS needs to be ready for but may be less foreseeable - and less under the more direct or immediate control of the DGS.

These scenarios can be developed from the 'Key Impacts' and can cover: operational business disruption; data issues/data errors; multiple firm failures; adverse media coverage; cross border complexity; inadequate cooperation with other organizations; payment scheme access; and legal issues. These can be added into the test scenario. Each is considered in more detail below.

1. Operational business disruption.

- A failure or weakness in the firm's, or the DGS, system hardware or software; or inadequate risk management and controls.
- Similarly, an interruption in a critical service provided by a third party, or failure of a critical external supplier e.g., agent bank, call handling, claims processing, payment provider, etc.
- Resource constraints. For example:
    - Crystallization of key person risk and/or inadequate resources within the DGS and any third party service on which the DGS relies e.g., call handlers, claim processors;
    - Unable to retain key people in the failed bank and/or staff refuse to cooperate with the liquidator/DGS (especially relevant/testing if the bank is reliant on relatively few people);
    - Inability to retain sufficient operational staff at the failed firm such that they cannot scale up to provide the resources to deliver the payout e.g., to open bank branches to make payouts, handle calls, deal with processing of claims, calculate compensation, etc.
- Postal strike: notification letters and/or cheque payments are delayed/not received by claimants.
- Business continuity/disaster recovery event[12] (and therefore invocation of business continuity procedures) occurs at the same time as the depositor payout, and the DGS's recovery plan is inadequate to deal with the operational disruption. The event could be, for example, the loss of access to a primary operating site at the DGS, failed bank, or an external provider of critical services (on which the DGS/payout is reliant).

[12] Caused by a natural event such as a flood, earthquake, tsunami, or pandemic illness leading to significant staff absences; or other factors such as an IT infrastructure failure, electrical power outage, or act of terrorism

2. Data issues/data errors.

- A weakness in the firm's underlying data storage and extraction systems, leading to data inconsistencies and errors (e.g., dealing with joint accounts). The DGS cannot trust data extracted from systems e.g., causing inaccurate calculation of compensation amounts.
- Underlying data issues may be caused by: inaccurate information e.g., records not kept up to date; unable to access data e.g., system failure; inadequate legal obligations e.g., firm not required to provide data to the DGS (or other safety net participants/insolvency practitioner) or the DGS not allowed access to the firm; no formal SCV requirements in place etc; fraudulent activity at the firm pre-failure.
- Inability to remedy the firm's data errors; failure to meet statutory timeframe requirements.
- Delay in the provision of the datafile from the failed firm e.g., due to system errors or lack of available expertise to produce the file.
- High levels of customer activity in the days immediately prior to failure, leading to very high volumes of in-flight transactions that must be settled before the data file is produced (and therefore a delay before the file can then be verified).
- Information processing errors within the DGS or at a third party dependency, causing a significant number of incorrect payments, which come to light post failure as the DGS is about to make payments.
- Incorrect calculation/application of accrued interest to the accounts of eligible depositors, leading to the calculation and payment of incorrect compensation amounts.
- Complexity of calculation for net payments versus gross compensation, resulting in incorrect payments being made.

The precise scenario for data may be dependent on the respective legal requirements around data provision in each jurisdiction.

3. Multiple firm failures.

- Caused by a short burn scenario due to a macroeconomic/financial sector shock e.g., equity market crash, GDP contraction, or sharp changes in interest rates etc.
- Concurrent failures causing pressure on staff resources, processing capacity, and ability to make payouts. For example: multiple deposit taking firms, a firm with more than one compensation product class (e.g., deposits and investments), or a combination of both multiple firms and multiple products. Examples of non-deposit compensation classes will only be relevant to schemes that cover more than deposit products (e.g., FSCS in the UK which covers, for example, deposits, investments, and insurance products).
- Knock-on effect from macro scenario: crash in equity market values leads to a sharp fall in the value of ex-ante fund (and therefore ability to fund a payout).

4. Adverse media coverage.

- News shock impacting the DGS preparations e.g., the unexpected failure of a large deposit taking firm that adversely impacts confidence of the general financial sector: higher likelihood of failure for "at risk" institutions; closer proximity to failure; need to accelerate contingency planning; etc.
- Pre-default leak of confidential information about the firm leading to a retail deposit run, an acceleration of contingency planning, and/or bringing forward of failure date.
- Failure of the DGS's key communications messages (or, where relevant, those of other safety net participants) e.g., media spreading false information and planned media advertisements are ineffective. Cross border deposit insurance arrangements are confusing for customers.
- Adverse press reaction to the firm failure e.g., the DGS cannot fund the payout; causes the DGS reputational damage; and impairs the ability to execute statutory responsibilities.
- Social media challenges. Potential for adverse messages about the firm / DGS trending on Twitter / Facebook etc: leading to a run on the bank, undermining public confidence that the DGS will pay out compensation within announced timelines.

5. Cross border complexity.

- Failed firm has depositors not covered by the domestic DGS e.g., branch of overseas residents: requires pan Authorities coordination to resolve cross-jurisdictional issues.
- Differences in legal jurisdiction, bank resolution, and corporate insolvency regimes between countries relevant to the firm's failure, in particular, where these differences create competing statutory obligations (e.g., between the domestic/foreign DGS or respective resolution regimes).
- Dependency on external third party firms that operate under a different legal jurisdiction (e.g., company or employment law) to the DGS. For example, an overseas parent of the failed firm that provides a critical service from an overseas location (e.g., maintenance of critical system architecture and storage of databases containing depositor information).

6. Inadequate co-operation with other organizations.

- Disagreements, lack of clarity, or ineffective communication between domestic safety net participants. For example, a late notification to the DGS by the prudential supervisor or resolution authority about a problem bank, which causes a material delay in the payout processes.
- Inadequate information exchange between stakeholders e.g., confidentiality restrictions, weak inefficient processes, lack of co-ordination.
- Lack of cooperation with the DGS at an operational level by external parties such as the failing firm or insolvency practitioner etc (pre or post default).
- Political intervention (e.g., sudden increase in the scope and/or level of coverage): each DGS to consider if this can be planned for, and how to model it.

- Disagreements or lack of cooperation between the DGS and any commercial bank (if used) acting as its treasurer to manage the movement of funds required to make depositor compensation payouts.

7. Payment scheme access.

- Failed bank uses an agent bank relationship to settle all of its domestic payments; servicing/agent bank (or has direct payment scheme membership) and/or payment scheme unable or unwilling to clear outstanding payments after the point at which the firm has failed.
- The DGS is unable to use the firm's pre-existing payment scheme access / relationship to make compensation payments to eligible depositors.
- Failure of electronic transfer systems to make compensation payments e.g., caused by inadequate agreement with the servicing/agent bank/payment scheme, failure of IT systems, or link between failed bank/agent bank.

8. Post-default legal issues.

- Extended time elapses between firm failure and start of payout. For example: due to delays in the legal resolution/insolvency process or unexpected problems finalizing compensation data.
- Potential legal impediments that arise immediately after the problem bank is declared in default (e.g., DGS is not "triggered" to start payout). For example: a challenge from shareholders to the insolvency process with the determination of the insolvency trigger deemed invalid by a court. This may result in a suspension of or a delay to the payout process.
- Whether insolvency constitutes an automatic trigger of contract default for the provision of those third party outsourced services (e.g., IT support, website operations, and data management) that are required in order to undertake the payment process.

10. Lessons Learnt by the UK Financial Services Compensation Scheme

The Financial Services Compensation Scheme, the UK DGS, carries out stress tests on its deposit guarantee scheme capability and capacity from time to time. FSCS is an integrated scheme, which also protects investors and insurance policyholders.

FSCS is active each year dealing with the failures of small credit unions. The payouts are usually limited to a few hundred or few thousand in number. The failures are low profile. But each does test the continued working of FSCS's deposit payout system - giving confidence that FSCS can receive, and assimilate, the depositors' data and generate payments. FSCS's record is that such payments meet its 7 day target.

However, FSCS also stress tests its contingency planning - both internally and with its partners in the safety net. This is regarded as crucial to FSCS effectiveness. As noted, it is vital that all parties understand each other's roles and expectations. Testing is also central to establishing operational and personal relationships. It is easy to overlook the importance of personal relationships - facilitating ease of contact, knowing who to call, and also helping smooth discussion and dialogue which is harder if the individuals are strangers to each other.

FSCS has carried out a couple of significant exercises in the last couple of years. Both required detailed planning. FSCS developed and administered the tests using a separate steering team. The team devised and tested the scenario itself, and planned the detailed order and timing of the exercise to ensure clear objectives and their delivery.

One test involved the Board only - inviting the Board to consider and decide how to react to the failure of a deposit taker with cross border branches. The exercise, over half a day, required the Board to face challenges of information, funding, and communication. The Board took away not just an insight into what decisions to make and how to do so - but it provided useful training and sharing of knowledge and experience by the executive.

Participants in the other exercise included the FSCS executive, but not its Board, with counterparts at the resolution authority and finance ministry. Again the half day exercise was carefully planned and controlled. As with the FSCS internal Board exercise, the 'authorities' exercise was prepared by discreet steering teams with representation from all participating bodies. Its objective was to explain to or remind all parties of the steps to a bank payout and each party's procedures and timescales, identifying what each expected or required at each stage. The output was renewed appreciation of the factors relevant to the decision making and of FSCS's operational capacity and constraints.

Following both tests, it was important to agree the outcomes, identify action points, and also record issues emerging but not processed at the time.

FSCS also looks to review and update its contingency plans on a regular (usually annual) cycle. Operational teams, assisted by the business resilience team, will ensure the plans are still current. The teams will also collaborate on testing of the plans. Commonly this may be a 'walkthrough' involving all relevant teams or functions at FSCS. Testing may be focused on one or two particular risks.

For example, aside from the depositor payout walkthrough, FSCS tested by simulation the exchange of a data file with another EU DGS - with whom cross-border payments may need to be delivered. Following extension of 'temporary high balance' coverage, to be handled outside the usual data file and automation process, FSCS ran training and testing sessions with its claim handlers who would have to assess such claims. Recognizing the explosion in social media and the risks to the DGS, FSCS developed a social media led crisis scenario to test the communications response. This took the communications team through an unfolding event requiring deliverables, such as press statements, responding to journalists, giving interviews etc, under pressures of time and imperfect information. The outputs included improved templates for communication messages and responses but also useful learning as to the accessibility and relevance of the team's own contingency plans.

11. Conclusion

This Note is designed primarily for DGSs in developing and carrying out contingency plans and testing. It is also relevant to others in the safety net - both Authorities and other "partners" (third party providers, insolvency practitioners etc). Whilst a DGS can test in isolation - and it is worthwhile doing so - to be fully mature, testing will need to involve partners.

But the testing needs to be flexible and proportionate - adapted to the circumstances of the DGS. The important outcome is for the DGS to make an assessment about its overall capability and capacity - including in stress circumstances:

(1) when it is difficult for a DGS/when it would be unable to meet its obligations;

(2) highlight operational and financial weaknesses, risk issues and stress points;

(3) challenge existing business contingency plans and operational capacity assumptions; and

(4) identify improvements to the DGS operational (and risk management) framework.

All this needs to be subjected to good governance - how the test is developed, implemented, and received. The test should have specific objectives and measurement criteria. And testing is not a one off pass/fail process - but an ongoing program of challenge (internal and external) to enhance the resilience and effectiveness of the DGS. By using the results proactively and constructively, the readiness of the DGS to execute its statutory objectives can only be strengthened.

AUTHORS

Alex Ufier, Financial Economist in the Division of Insurance and Research, U.S. Federal Deposit Insurance Corporation.

Since joining the FDIC in 2015, he assists in bank examinations by reviewing quantitative models and model policy governance, including measures of credit risk, net revenue, and stress testing. Mr. Ufier also maintains statistical models for the FDIC and participates in technical assistance programs with the World Bank. He has published articles on the value added tax and is currently developing research on the topics of deposit insurance internationally, determinants of bank failure, and account-level studies of customers at failed banks. Prior to arriving at the FDIC, Mr. Ufier taught statistics and economics at the University of Oklahoma for two years while earning his Ph.D. of Economics there.

John O'Keefe, Senior Economist in the Division of Insurance and Research, U.S Federal Deposit Insurance Corporation.

Mr. O'Keefe conducts examinations of banks' risk measurement models, i.e., models for credit risk, interest-rate risk, liquidity risk, capital planning, stress testing and Basel II capital requirements. Mr. O'Keefe also develops financial and statistical models for the FDIC and participates in technical assistance programs with the World Bank. Mr. O'Keefe has published numerous articles on commercial banking, particularly on the causes of financial distress. Prior to working at the FDIC Mr. O'Keefe taught economics and finance at Boston College and Simmons College and has a Ph.D. in Economics from Boston College, Boston Massachusetts.

Dr. Ralf Benna, Head of Department Institutional Protection Scheme, National Association of German Cooperative Banks(BVR).

Since 2003 Dr. Ralf Benna is Head of Department of the National Association of German Cooperative Banks Institutional Protection Scheme (IPS), based in Bonn and Berlin. He is responsible for international affairs of the IPS and in his "day-to-day" business for questions of prevention management and bank restructuring measures of cooperative banks. As a specialist for controlling, strategic developments, deposit protection and institutional protection schemes he is author of numerous scientific papers, lecturer and speaker for many universities and academies and at national and international conferences. After his professional education as banker at the Deutsche Bank AG in the mid 80es, he studied economics, finance and banking at the University of Muenster/Westphalia from 1986 to 1991 and graduated as Doctor of Economics at the University of Duisburg in 1996. He worked in the headoffice of Deutsche Bank AG in Frankfurt at the controlling department, followed by his time as management consultant at zeb in Muenster. From 1998 until 2002 he was head of department controlling and accounting at norisbank AG / Hypovereinsbank AG-Group.

Bernd Bretschneider, Managing Director, GBB-Rating – The rating agency of the deposit protection structure of German private banks.

Bernd is responsible for the rating of banks, the methodology of risk-based premium and the support of risk management issues within the deposit protection scheme and for his parent company, the Auditing Association of German Banks. For nearly ten years he is, together with Dr. Ralf Benna, chairperson of the Research Working Group on risk-based Contribution of the European Forum of Deposit Insurers (EFDI). During his time as chairperson of the working group two framework papers and on risk based premiums had been published.The first framework paper was written in cooperation with the Joint Research Centre of the European Commission. Bernd is author of a range of papers on risk-based premium and speaker at international conferences.

Since 2010 he has been involved in the discussion and later in the transposition of risk-based premium models based on the EU Deposit Guarantee Scheme Directive and EBA Guidelines.

After his professional education as a banker at a German bank in Frankfurt, he worked several years for one of the major German banks in Berlin during the German reunification.
Bernd holds a master degree in General Management from Cologne University, Germany and a master degree in Financial Management from the University of Bradford, UK.

Mirjami Kajander-Saarikoski, Director, The VTS Fund.

Mirjami manages The VTS Fund, which is a former Finnish deposit guarantee fund nowadays serving as a buffer fund for the new Finnish deposit insurance scheme. She is responsible for developing and monitoring the investment activities of the fund, with an investment portfolio worth approximately € 1 billion. She is also responsible for the management of the Finnish investor compensation scheme. She furthermore serves as a member of the Board of Directors of the Finnish Financial Stability Fund.

In her previous roles in the field of bank failure management, Mirjami lead the Finnish deposit insurance scheme during the period of 2010 – 2014 and helped wind up a Finnish branch of a failed Icelandic bank in the years 2008 – 2009. Previously, she acted as an Attorney-at-Law specialised in Capital Markets, Banking & Finance as well as Mergers & Acquisitions, along with sporadic in-house positions as a Legal Adviser for the banking industry.

In her native Finland, she has also served as member of the Securities Law Committee (2010 – 2011), member of the Committee on Bond Market Development (2016 – 2017) and member of the Securities Complaints Board (2009 – 2010). Mirjami holds a Master's degree in Law from the University of Helsinki, Finland.

Alex Kuczynski is the Director of Corporate Affairs and a Board member of FSCS in the UK.

FSCS is established under statute as a unitary, integrated scheme protecting depositors, investors and policyholders. As Director of Corporate Affairs, Alex Kuczynski is responsible for the areas of legal (and recoveries), policy and international affairs, communications, risk management and company secretarial/corporate governance. Alex Kuczynski has extensive experience in deposit insurance both from the crisis in 2007/08 and subsequent legislative and policy initiatives. Alex is active in the International Association of Deposit Insurers and the European Forum of Deposit Insurers. He has delivered many presentations on the work of FSCS and deposit insurance. Alex is qualified to practise law as a solicitor in England and Wales.

Jan Philipp Nolte, Senior Financial Sector Specialist, The World Bank Group.

Jan works in the Finance and Markets Global Practice of the World Bank Group. He specializes in deposit insurance and bank resolution. Jan participates regularly in IMF – WB FSAP missions (Financial Sector Assessment Program), most recently in Tajikistan, Montenegro and Belarus. Furthermore, Jan is actively involved in Technical Assistance projects of the WB in Africa, Asia, Europe and Central Asia and Latin America. For the World Bank he liaises with the International Association of Deposit Insurers (IADI) and the Financial Stability Board (FSB) as a member of the Cross-border Crisis Management Group. Jan was a member of the working group that drafted the IADI "Core Principles for Effective Deposit Insurance Systems", its methodology and assessors' handbook.

Prior to joining the Bank in 2014, Jan worked as a Director at the Deposit Protection Fund of German Banks. He holds the First and Second State Examination in law and studied at the universities of Freiburg and Münster/Germany. He has working experience within the United Nations in New York, the European Commission in Brussels and the German Federal Foreign Office.

Isfandyar Zaman Khan, Program Leader, European Union Member States, The World Bank Group.

Based in Brussels, Isfandyar, he coordinates the Bank's programs in the Financial Sector, Competitiveness and Innovation. His area of expertise includes competitiveness, financial sector crisis management, capital markets, deposit insurance and access to finance. He has represented the World Bank in a number of international fora including those that relate to deposit insurance. He has worked in a number of countries such as in Bosnia, Croatia, India, Kosovo, Moldova, Pakistan, Poland, Turkey and has taught at Berkeley University, Columbia University and the Frankfurt School of Business. Prior to the Bank, Mr. Zaman Khan worked for the Investment Bank of Salomon Smith Barney in New York. Mr Zaman Khan holds a degree in Economic Policy Making and International Finance from Columbia University in New York.

THE WORLD BANK
1818 H STREET NW
WASHINGTON DC 20433
WWW.WORLDBANK.ORG

FINANCIAL SECTOR ADVISORY CENTER (FINSAC)
PRATERSTRASSE 31, 19TH FLOOR
1020 VIENNA, AUSTRIA
WWW.WORLDBANK.ORG/FINSAC

WORLD BANK GROUP
Finance & Markets
Financial Sector Advisory Center (FinSAC)