Proceedings of the Technical Briefing on Financial Modeling for Deposit Insurance

With Technical Assistance from the World Bank and Financial Sector Reform and Strengthening (FIRST) Initiative

June 19, 2013
Rizal Ballroom, Makati Shangri-La, Makati City
Philippines

Hosted by the Philippine Deposit Insurance Corporation

IADI International Association of Deposit Insurers

Proceedings of the Technical Briefing on Financial Modeling for Deposit Insurance

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Executive Summary

The Philippine Deposit Insurance Corporation (PDIC), with the assistance of the World Bank (WB) and Financial Sector Reform and Strengthening (FIRST) Initiative, conducted the Technical Briefing on Financial Modeling for Deposit Insurance on June 19, 2013 at the Makati Shangri-La, Makati City, Philippines. It was participated by around 50 representatives of deposit insurance agencies around the world including officers from PDIC.

The briefing was an opportunity to share the preliminary results of the financial modeling project with the following components: the Bank Failure Prediction Model and the Stress Testing Model. Both are aimed at improving PDIC's oversight functions over member banks and thereby help maintain stability in the Philippine financial system.

PDIC Board Director Protacio T. Tacandong delivered the Opening Remarks by citing the importance and highlights of the collaboration between the PDIC and WB/First Initiative on the financial modeling project.

To provide an overview of PDIC's Risk Management Framework, Ms. Imelda S. Singzon, PDIC Executive Vice President, laid out the authorities and mandates of PDIC provided in its charter in relation to examination and monitoring of member banks, and attendant coordination with the Bangko Sentral ng Pilipinas. She also shared the highlights of the recent rural bank strengthening programs. The focus of the technical briefing essentially, EVP Singzon underscored, is its usefulness in the risk management of the deposit insurance fund, and how appropriate fund estimation methodology will ensure fund adequacy.

Dr. Steven Seelig, Principal and CEO, Financial Stability Associates, gave an overview of Risk Management Systems for deposit insurance, citing the types of risks faced by deposit insurers, and the circumstances by which these risks are triggered. Dr. Seelig also offered how deposit insurers may address such risks through mitigating measures, and the importance of an effective and appropriate risk management system such as stress testing and failure prediction models, which are the models for PDIC in evaluating sufficiency of the DIF and assessing solvency risks.

World Bank Consultant, Mr. Murat Arslaner discussed the Stress Testing Model for Banks. He underscored the importance of financial forecasting in developing realistic financial plans and making strategic decisions. In discussing the Financial Projection Model (FPM) for PDIC, he noted the importance of having a model that reflects the existing prudential, regulatory and accounting practices in the Philippine banking sector, and its readiness to be integrated into the risk assessment process of the PDIC. He then expounded on the process PDIC has gone through, in collaboration with the World Bank, in integrating this model into its processes namely, Data Collection, Scenario Analysis with the Examination and Resolution Sector, and stakeholder management which includes Informing the Decision-Making Process, and Communication with the Banking System. Arslaner also walked the participants through the roles and responsibilities of the PDIC management and its stakeholders in implementing and sustaining the implementation of the stress testing model.

Mr. John O'Keefe, Senior Economist of the Federal Deposit Insurance Corporation presented "General Framework in Modeling Bank Failure Prediction", which offered a bank failure prediction model for the Philippines that can be used to determine Deposit Insurance Fund. The study, O'Keefe explained, emanated from a recommendation by the World Bank for PDIC to develop a bank failure prediction model to estimate the likelihood of failure within one year. The model was developed using data from the number of bank failures that happened between 2008 and 2012. He tackled an appropriate model selection process and discussed some models used for the program namely PDIC's Financial Ratios Model, Asset Composition and Portfolio Concentration Models, and Resident Loan Payment Status Model. The study concluded with what will be the most appropriate model for PDIC. He recommended for PDIC to determine an acceptable trade-off between failed and non-failed bank predictive accuracy and to use a failure probability cut-off value, and engage experts to further limit loss exposure estimates.

In closing, World Bank Country Director Mr. Motoo Konishi said that the tools presented in the technical briefing and workshop are cutting-edge solutions in risk management for deposit insurance, representing frontier knowledge in modeling and forecasting. He added that the World Bank looks forward to continued and closer cooperation with PDIC as the work on the technical assistance program progresses. He noted the strong economic performance of the Philippines in recent years and PDIC's role in this. Mr. Konishi reiterated the World Bank's commitment to support knowledge exchange in the area of deposit insurance.

PROFILE OF THE SPEAKERS

PROTACIO T. TACANDONG
Member, PDIC Board of Directors

Mr. Tacandong is currently a member of the PDIC Board of Directors, where he chairs the Audit and Good Governance Committees. He is the Co-founder and Chief Operating Officer of the Reyes, Tacandong & Co. He was formerly a partner of SyCip Gorres Velayo & Co. (SGV & Co.). Mr. Tacandong is a Certified Public Accountant with expertise in Financial Audit, Due Diligence, Agreed-Upon Procedures, Compilation and Review Services, Accounting & Audit Consultation. In 2012, he was named as the "Outstanding Professional of the Year" in the field of Accountancy by the Professional Regulation Commission (PRC). The Ernst & Young recognized him as one of the Far East Asia (FEA) Ten Values Champions in 2007. In 2005, he received the "Most Outstanding CPA in Public Practice" from the Philippine Institute of Certified Public Accountants. Mr. Tacandong was involved in the business development of Mindanao by serving key positions in various trade and business associations such as being the president of Davao City Chamber of Commerce & Industry, Rotary Club, Mindanao Business Council and Philippine Business for Social Progress (PBSP). He obtained his Master in Management degree from the Asian Institute of Management and Bachelor's Degree in Commerce, Major in Accounting from the University of San Carlos, Cebu City.

IMELDA S. SINGZON
Executive Vice President
Philippine Deposit Insurance Corporation (PDIC)

Ms. Imelda S. Singzon is the Executive Vice President of the Philippine Deposit Insurance Corporation (PDIC) who oversees and directs bank examination and bank resolution. Currently, she is an Independent Director of the Philippine Bank of Communications. Prior to her present assignment, Ms. Singzon steered the Corporation's insurance and claims settlement operations. Under her leadership, PDIC embarked on a number of significant reforms in insurance claims processing and payout operations. She also streamlined operations in the area of receivership and liquidation. Before joining PDIC, Ms. Singzon has had 21 years of experience in commercial banking in various management positions in the areas of corporate planning and economic research, budget, product development, loans evaluation, branch expansion studies, training, general services and administration, and public relations. She is a graduate of the University of the Philippines with a Bachelor of Science degree in Statistics and a candidate for a Master's degree in Demography. She also completed with distinction, under the University of Wisconsin-University of the Philippines Program, a one-year certificate course in development economics.

DR. STEVEN A SEELIG
Principal and Chief Executive Officer
Financial Stability Associates, LLC

Dr. Steven A. Seelig serve as a member of the Board of Directors, chair of the risk management committee and member of the audit committee of National Asset Management Agency (NAMA), the one responsible for the restructuring of the banking sector in Ireland. NAMA was established as part of the government's program to deal with its financial sector crisis. Dr. Seelig is also the Principal and CEO of Financial Stability Associates, a consulting firm specializing in the spectrum of financial stability issues. Prior to establishing Financial Stability Associates, Dr. Seelig worked as Advisor in the Monetary and Capital Markets Department of the International Monetary Fund (IMF) where he had primary responsibility for the financial sector restructuring and resolution activities of the department. Dr. Seelig spent a number of years of his professional career at the Federal Deposit Insurance Corporation (FDIC), holding a broad range of positions, including Chief Financial Officer. Dr. Seelig also worked as an Economist at the Federal Reserve Bank of New York and as an Associate Professor of Economics at Fordham University. He completed his Ph.D. in Economics in 1971 from Clark University, Worcester, Massachusetts.

MURAT ARSLANER

Financial Sector Specialist
Financial Architecture & Banking System
Financial and Private Sector Development
The World Bank

Mr. Murat Arslaner is a Financial Sector Specialist at the Financial Architecture & Banking System Department at the World Bank. He joined the Bank in October 2008. He has been working on various bank supervision and regulation issues with a focus on bank risk assessment and problematic bank resolution. He is one of the three developers of the Financial Projection Model (FPM), which can be used to make projections and implement scenario analysis/stress tests over banks. He has also developed the Least Cost Test Model (LCTM), which can be used to simulate the cost of various bank resolution options to the tax payer. Prior to joining the World Bank, he worked as an on-site Bank Examiner at the Banking Regulation and Supervision Agency of Turkey for 7 years and for 2 years as an assistant economist at the State Planning Agency in Turkey. He acquired his MBA in Finance degree in 2008 from Johns Hopkins University.

JOHN O'KEEFE

Senior Economist
Quantitative Risk Analysis Section
Division of Insurance & Research
Federal Deposit Insurance Corporation (FDIC)

Mr. John O'Keefe is a Senior Economist in the Quantitative Risk Analysis Section, Division of Insurance and Research, U.S Federal Deposit Insurance Corporation. Mr. O'Keefe conducts examinations of banks' risk measurement models, especially models for credit risk, interest-rate risk, liquidity risk, capital planning, stress testing and Basel II IRB models. Mr. O'Keefe also develops financial and statistical models for FDIC and external requestors. 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 and has a Ph.D. in Economics from Boston College, Boston Massachusetts.

MOTOO KONISHI

Country Director
World Bank

Mr. Motoo Konishi assumed his post as World Bank Country Director for the Philippines on February 1, 2012. Prior to his assignment in the Philippines, he was appointed World Bank Country Director for Central Asia on January 15, 2009 covering five Central Asia countries: Kazakhstan, Kyrgyz Republic, Tajikistan, Uzbekistan and Turkmenistan. Between 1997 and 2009, Mr. Konishi joined the Infrastructure and Energy Services Department of Europe and Central Asia Region as the Principal Economist (Water Supply), Sector Manager for Water Supply and Sanitation, and Sector Manager for Transport. He later became Principal Country Officer for Kazakhstan from 1995 to 1997, where he was directly involved in the planning of the Bank's cooperation strategy with Kazakhstan. He was instrumental in the preparation and implementation of the Treasury Modernization Project in Central Asia and the Legal Reform Project in Kazakhstan. Motoo Konishi received his B.S. in international economics from the Clarement McKenna College (USA) and his M.A.L.D. in development economics, international law, and international business from the Fletcher School of Law and Diplomacy (USA).

Financial Modeling Workshop on Risk Management

19 June 2013

Program of Activities

Opening Remarks	**Mr. Protacio T. Tacandong** Member, PDIC Board of Directors
Overview of PDIC Risk Management Framework	**Ms. Imelda S. Singzon** Executive Vice President, PDIC
Overview of Risk Management Systems	**Dr. Steven Seelig** Principal and CEO Financial Stability Associates
Break	
Stress Testing Model for Banks	**Mr. Murat Arslaner** Financial Sector Specialist, The World Bank
General Framework in Modeling Bank Failure Prediction	**Mr. John O'Keefe** Senior Economist US Federal Deposit Insurance Corporation
Open Forum	
Closing Remarks	**Mr. Motoo Konishi** Country Director, World Bank

Jose G. Villaret, Jr.
Master of Ceremonies

OPENING REMARKS

by Mr. Protacio T. Tacandong, Member of PDIC Board of Directors

Mr. Protacio T. Tacandong opened the Technical Briefing on Financial Modeling Workshop on Risk Management by thanking the participants of the workshop as well as the Speakers and Consultants.

He said that it is most fitting to celebrate PDIC's 50th anniversary by hosting not only the 39th Executive Council Meeting and International Conference on Financial Inclusion, but also by sharing its efforts to enhance its risk management system through the conduct of the workshop seminar on PDIC's Financial Modeling Projects, specifically on bank failure prediction and stress testing of banks.

The project, which is in cooperation with the World Bank with funding from Financial Sector Reform and Strengthening (FIRST) initiative, aims to improve PDIC's oversight functions over member banks and thereby maintain stability in the Philippine financial system.

In behalf of PDIC Board of Director and Officers, he thanked the consultants – Mr. Seelig, Mr. O'Keefe and Mr. Arslaner – for the valuable technical support. He also appreciated the administrative and technical assistance of the World Bank Team – Ms. Claire McGuire, Ms. Nataliya Mylenko, and Country Director Mr. Motoo Konishi.

Dr. Tacandong expressed his hopes that the workshop will serve as an inspiration for other countries to manage the challenges and issues to the deposit insurer.

Overview of PDIC Risk Management Framework

by Ms. Imelda S. Singzon, PDIC Executive Vice President

Ms. Imelda S. Singzon gave an overview of PDIC's Risk Management Framework, citing the PDIC Charter as its basis. She said that the Charter provided for a range of risk management tools, such as examination, investigation, determination of certain bank examination findings as unsafe and unsound, exclusion of certain deposit products from deposit insurance, and various resolution tools, among others, that PDIC may use to carry out its examination and resolution authorities.

Ms. Singzon stressed that the subject of risk management cannot be discussed without mentioning the Bangko Sentral ng Pilipinas, the Philippine central bank. She cited that the Central Bank implements a number of risk management tools, one of which is enforcement of prompt corrective action as soon as a bank's condition indicates higher than normal risk of failure. "Risk management as it contributes to financial stability and depositor protection, in the bolder sense, internally impacts the deposit insurance fund," she stressed.

The focus of the workshop, Ms. Singzon said, was the deposit insurance fund, and how, as part of risk management, PDIC has continually improved its estimation procedure for fund adequacy.

"The deposit insurance fund is the capital account of PDIC. It is funded ex-ante by assessments on banks at a fixed rate of 1/5 of 1% or 20 basis points of total deposits. Prior to 2012, the measure of fund adequacy was the ratio of deposit insurance fund to insurance reserve target," she explained. In 2012, however, she recounted that World Bank FIRST Project Consultant Dr. Steve Seelig recommended to change the measurement to the ratio of the deposit insurance fund to the total estimated insured deposits, instead. Dr. Seelig at the time of his review further recommended that it would be desirable to have the fund adequacy ratio more forward looking to ensure that future funding requirements may be appropriately anticipated.

PDIC, according to Ms. Singzon, assesses the risks to the deposit insurance fund through the Offsite Bank Rating Model (OBRM). The OBRM generates periodic risk ratings of individual member-banks from banks' financial statements using prudential ratios and indicators, examination findings of both the Central Bank and PDIC and other market information. Aspects of banks' performance and condition that are risk rated follow a set of criteria, which include capital adequacy, asset quality, management and governance, earnings, liquidity and sensitivity to market or what is called "CAMELS". The results of the OBRM become PDIC's preliminary screen for assessing banks' performance and condition. The OBRM exercises have become the basis of the list of banks to be examined by PDIC, and those that are encouraged to participate in the PDIC's SPRB Plus or the Strengthening Program for Rural Banks, in the estimation of insurance reserves target and its impact on the Deposit Insurance Fund.

She said that PDIC would like to share in this workshop current initiatives to further enhance the estimation methodology for fund adequacy. This initiative is with the support of the World Bank and funding from the FIRST Initiative. The project is called "Financial Modeling for Deposit Insurance" and has two components: the Bank Failure Prediction Model and the Stress Testing Model.

Ms Singzon reiterated PDIC's appreciation to the consultants and the World Bank team for the generous technical and financial support to the undertaking.

For the slides presented by Ms. Singzon during the Briefing, please refer to Annex A.

Overview of Risk Management Systems

by Dr. Steven A. Seelig, Principal and CEO, Financial Stability Associates

In his overview of the risk management system for deposit insurers, Dr. Steven A. Seelig identified the four types of risks faced by deposit insurers as Solvency Risk, Liquidity Risk, Operational Risk, and Political or Reputational Risk. The first two are financial risks to deposit insurers that are specific to managing risks to the Deposit Insurance Fund (DIF). He said that an effective risk management system should be able to identify these risks and provide for measures for their mitigation.

He added that the risk management system should also uncover attendant risks to the DIF as well as ensure that the deposit insurer has adequate authorities and systems to adopt mitigating measures. It should be effective at pinpointing residual risks that may prevail even after mitigating measures are in place.

In expounding solvency risk, Dr. Seelig cited the IADI Paper on Evaluation of Deposit Insurance Fund Sufficiency on the Basis of Risk Analysis which noted that a DIF "should be sufficient for serious difficulties in the banking sector, but not for a systemic crisis." An effective financial modeling for evaluating sufficiency of the DIF and assessing solvency risks should accurately measure the magnitude of risk to the fund, and should surface all possible vulnerabilities of the banking sector. Appropriate models here will be stress testing and failure prediction models for banks, which are the models adopted for PDIC.

In addressing Solvency Risks, Dr. Seelig identified the mitigating factors as proper accounting practices, the ability of the deposit insurer to increase assessment or impose special levy/premium when stress levels are triggered, and the authority and ability of the deposit insurer to adopt a menu of prompt corrective actions to reduce losses to the fund arising from bank failures. The deposit insurer may also address solvency risks by addressing practices that will enhance its ability to increase recoveries from assets of failed banks. He also underscored the need for effective prudential regulation, citing that aggressive supervision and effective resolution processes may reduce the cost of failures, and serve as effective mitigants to solvency risks.

Liquidity risk is the lack of sufficient liquid assets to handle a likely bank failure. For the deposit insurer, this means that it may not have sufficient cash to pay insurance claims to depositors of a closed bank in the event of a bank failure. This arises from poor investment policy, excessive investment in claims against liquidations from prior bank failures, and lack of backup liquidity facility.

He said that the deposit insurer should consider implementing investment policies that should ensure proper and constant monitoring of liquidity position, drawn from appropriate financial models with supervisory input to alleviate liquidity risks. The deposit insurer should likewise be imbued with the authority to borrow from the national government or the central bank to address liquidity issues.

Dr. Seelig pointed out that operational risks arise from the internal processes and activities of the deposit insurer, and may mean failures in people, processes and systems that may impede the deposit insurer from effectively carrying out its mandate. These are manifested by failure to pay insurance claims to depositors in a timely manner resulting from lack of staff training, system breakdown or inadequate technology and systems to facilitate quick processing of claims.

Operational risks may also result from the lack of authority by the deposit insurer to carry out speedy resolution or payout/liquidation processes hence may lead to the inability to properly liquidate assets in a manner that maximizes the Net Present Value of these assets. Apart from ensuring the proper and clear legal mandate, the insurer will be

able to address said risk by properly delegating authorities to allow speedy decision making, developing manuals and procedures including procedures for disposal of assets.

According to Dr. Seelig, other factors that may trigger or aggravate operational risks stem from lack of public confidence in the banking system that may lead to bank runs. He underscored hence the importance of an effective public awareness program for depositors, transparent processes, and timely reimbursement of deposit insurance claims.

Other operational risks may emanate from deposit insurance fraud, leaks to confidential information, risks to safety of staff, and security of property.

As to political risks, Dr. Seelig described it as one stemming from a loss of trust and confidence by the public and institutions in the ability of the deposit insurer to carry out its duty. This may be addressed by having effective operational policies and procedures in place, good governance structure, proactive public information program, and a process for addressing legislative issues.

For the slides presented by Dr. Seelig during the Briefing, please refer to Annex B.

Stress Testing Model for Banks[1]

by Mr. Murat Arslaner, Financial Sector Specialist, The World Bank

I. Overview

Mr. Murat Arslaner said that financial forecasting is crucial for developing the realistic financial plans that are the basis of strategic decision-making. Bank profits that are achieved without effective forecasting and effort to detect, control, and manage risks border on speculation. Simulating bank performance under different forecast scenarios can underline the critical role played by key variables to which financial performance is sensitive. In this way, financial forecasting and simulation support the financial planning process, which itself ties together a bank's strategic and operational planning and assures that current management decisions consider the future operating environment.

He does not recommend undertaking a projection/simulation without good quality information regarding the target bank and the contribution of each of its business divisions (trading, credit, investment and funding, other fee-based services) to risks and revenues. At a minimum, this information should include a good level of understanding of the bank's operating environment and of the drivers of the overall banking system and economy. Limited access to information or poor-quality information means reduced credibility and quality of the projected results. Preparing the necessary information requires access to certain sources and reports, as well as a detailed analysis of the essential information that these reports should contain.

II. Integration of the Model into PDIC`s Bank Risk Assessment Process

The Financial Projection Model (FPM) reflects the existing prudential, regulatory and accounting practices in the Philippine banking sector. It is ready for integration into the risk assessment process of the Philippine Deposit Insurance Corporation (PDIC) as a tool to assess the strengths and weaknesses of individual banks and the whole banking system based on scenario analyses. To do so, PDIC will need to:

- Establish an effective framework with defined roles and responsibilities;
- Maintain the Model by incorporating changes in regulations, standards, and market practices as and when they occur; and
- Allocate resources and establish written policies and procedures to facilitate the integration of the Model into PDIC`s risk assessment process.

III. Implementation of the Model by PDIC

The Model has been fully customized to implement scenario analyses for large individual banks and the group of large banks. The Examination and Resolution Sector is expected to implement the Model into scenario analyses to assess the resilience of large banks as individual and whole with a goal of preparing for a potential stress in the banking system.

Data Collection: The World Bank (WB) and PDIC teams have developed a common template for data needed

1/ Based on Report submitted to PDIC

for running the Model. The WB Team has developed a Database file combining the data provided by banks and linked the Database file to the Model. Database file needs an update every quarter once PDIC receives the prudential reports and other financial data for banks. PDIC is suggested to develop a process to make the update of the Database file automatic as far as possible. The template also should be integrated into PDIC`s central data warehouse with necessary control functions to ensure data quality.

Implementing Scenario Analysis in Examination and Resolution Sector: The Examination and Resolution Sector can implement scenario analyses for large banks on individual and system-wide basis once the baseline projections have been generated involving all available information, including on-site examination results, into the development of baseline projections (calibrating implied assumptions), which reflects all known or expected events. The User should make sure that scenarios capture a spectrum of events and severity levels, common or tailor made for all banks. Scenarios should be developed by the Sector in discussion with other Sectors.

Informing Decision Making Process: The Examination and Resolution Sector should develop a process through which various decision making processes take the model`s results as input. Such decisions should take into consideration the shortfalls of the Model and the limitations of the methods and assumptions used, as well as data quality. The decision makers have responsibility for using the Model`s results in taking appropriate actions. These actions may vary depending on the circumstances and other available information.

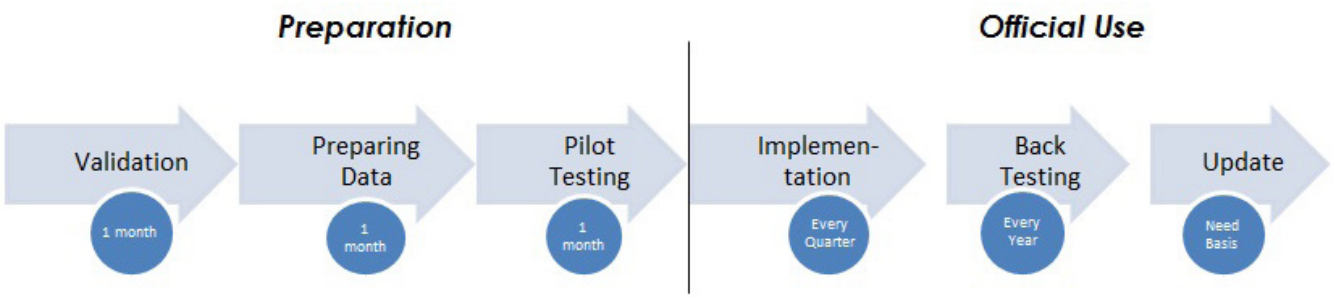
It is imperative that the Model`s projection results be taken carefully with extreme caution and users should consider a range of relevant qualitative and quantitative information while taking appropriate decisions.

The Model shall be subject to the terms and conditions (http://www.worldbank.org/terms) applicable for the materials, communication tools, and new tools, made available to public on the World Bank`s website.

Communication with the banking system: PDIC should engage in a constructive and systematic dialogue with banks and other public authorities, such as the Central Bank, to develop stress scenarios. The dialogue with the industry should help PDIC to come up with robust scenarios and understand the vulnerabilities in the system bank-by-bank and system-wide. PDIC might consider sharing the results of stress testing exercises with the Central Bank.

IV. Path to Implement and Maintain the Model

PDIC should implement the Model officially as soon as the preparation process is completed as per the timeline suggested below.



Validation of the Model: Although the developers of the Model and the PDIC`s core team have reviewed and tested the customized model in detail before the delivery, it is critical that modelers and owners validate the Model before officially starting to use it. The purpose of validation is to contain model risk, ensure (and perhaps increase) the reliability of the Model, and promote improved and clearer understanding of a model`s strengths and weaknesses among management and users. The validation is crucial prior to reliance on the model output for decision making and reporting. The validation process should be completed in a month.

Data Preparation: There should be rigorous assessment and documentation of data quality. All input data should be validated prior to use in the Model. Before the implementation of the Model, data quality needs to be ensured. This process might take a month.

PDIC is suggested to integrate the data needed for the Model into its integrated Data Warehouse for avoiding or limiting manual entries which are prone to error. Model data should be warehoused to ensure that the model results (except for model enhancements) may be reproduced and back-tested. Although PDIC should do its own assessment, banks are ultimately responsible for data quality. Banks which continue to have data problems systematically should be subject to the Central Bank`s supervisory action.

Pilot Testing: PDIC should do a pilot testing to determine whether the model is performing as intended. Before the pilot test, modelers and owner should provide training to the potential users. In testing, modelers with the help of users should evaluate the various components of the model and its overall functioning. Model owners and developers should implement the Model on a pilot basis and improve the Model further, if needed. This process should be completed in a month.

Running Scenarios: PDIC is suggested to implement the Model on a quarterly or semi-annual basis for stress testing and on a need basis for other purposes.

Back Testing: Once in use, model estimates should continually be compared to actual results, a procedure referred to as "back testing". Back testing should be done on an annual basis by model owners with the help of model developers and users. The objectives of back testing are: to determine if the model is functioning as intended; reflects business realities; and the need for any changes to the model. Testing activities should be appropriately documented. The testing should be done every year.

Maintaining the Model: Model owners/developers need to improve the model methods and assumptions on a continuous basis. They should also keep the Model up-to-date with changes in regulations, accounting standards, and sector practices on as needed basis. All changes in the model need to be executed by modelers. Other than fixing any errors in the current Model with appropriate documentation, changes should be subject to review and approval by model owners. Any changes that significantly impact the functioning or outputs must be jointly agreed by the model owners, developers, and users. All changes must also be validated and documented prior to implementation.

V. Model`s Governance-Roles and Responsibilities

PDIC`s senior management assumes the ultimate responsibility for developing and maintaining an affective framework for keeping the Model structure intact with continuous changes in line with the changing market practices, as well as regulatory rules and standards. Senior management needs to establish adequate guidelines and procedures and ensure compliance, oversee model development and implementation, evaluate model results, and take prompt remedial action if necessary. Senior management should make sure that responsible officers from Examination and Resolution and other sectors are assigned as the official owners and modelers. These officers will dedicate sufficient time of their office work in maintaining the model. Sufficient resources in terms of time and IT support should be at the disposal of these officers so that they could always keep the model up to the required standards. Obviously model maintenance as expected would be one of the key performance appraisal measures for these officers.

Model Owners: Model owners will take the primary responsibility of owning the logic and methodology, defining inputs, and testing and validating the model. Although the World Bank team has tested the Model for ensuring its soundness, the model owners need to ensure that modelers validate and test the model before involving the model in PDIC`s supervisory tasks officially.

Model Developers: Model developers will act as the custodian of the Model by ensuring that the Model complies with best development and compliance practices (including design, methodologies, coding, and documentation)

Model developers are responsible for ensuring that the model components work as intended, are appropriate for the intended purpose, and are conceptually sound and mathematically and statistically correct. Whenever there is a need for updating the Model, the changes need to be reviewed by all developers. Model owners and developers are also responsible for providing hands-on training to model users.

Scenarios for the whole banking system need to be developed by model users with a leading role falling on the modelers and approved by Model owners.

Model users: A model user would be the ultimate beneficiary of the model output and will be using the model for decision making. Model users can provide valuable insight for improving the Model further and keeping up with the changes in regulations and standards. Users can also question the methods and assumptions underlying the Model. This is healthy if it is constructive and causes model developers to justify or improve the methods and assumptions.

Security: The Model will be secured with access to underlying code and formulae limited to only model owners and developers. Password protection is necessary for avoiding unauthorized code or formulae changes

while minimizing user error.

Business continuity: Copies of versions of the model needs to be stored with both model developers and owners. The rules applicable to current business continuity and backs-ups are applicable to the Model.

VI. Structure of the Model

The FPM, an Excel-based model, contains different tabs which are briefly explained below:

Dash Board: It contains key parameters such as frequency or projection periods and historical data, minimum capital adequacy ratio, etc.

Data Entry: Data can be entered by two ways; first way is that this tab can be linked to the Database file that involves all the banks' data or as a second way the user can enter data to this tab manually.

Mapped Data: The Model maps all the data in the Data Entry tab to the Mapped Data tab according to the unique codes assigned to each line item.

BS Assumptions: This tab calculates the required implied assumptions for the Balance Sheet items as well as capital adequacy and liquidity lines. Implied assumptions can be manually calibrated by the User if required.

PLA Assumptions: This tab calculates the required implied assumptions for the Profit & Loss Account items. Implied assumptions can be manually calibrated by the User if required.

Calculations: All the calculations needed for projections are executed in this tab.

Funds Flow: In this tab the funds flow calculated from Operating, Financing, and Investment Activities are allocated into the core business activities, if the net funds flow is positive. If it is negative, the Model projects the reduction of interbank assets and sale of securities in this tab.

Projected BS: This tab, which is linked to the Calculations tab, includes the projected balance sheets.

Projected PLA: This tab includes the projected Profit and Loss Accounts.

Summary: This tab includes all the summary financial statements as well as CAMEL indicators.

Scenario Analysis-%: Through this tab bank the User can implement various stress scenarios by entering changes in risk factors by percentage points.

Scenario Analyses-P: Through this tab bank the User can implement various stress scenarios by entering changes in BS and PLA items in absolute amounts.

Liquidity: Through this tab a liquidation value of the bank can be projected based on assumptions in relation to asset recoveries, insured and covered liabilities, resolution expenses, etc.

Present Value: This is the tab in which the User can project the present value of the bank under an income approach based on income and assumptions regarding discount rates.

VII. Assumptions

To get realistic projection results, there should be realistic/reasonable assumptions. There are two tabs for assumptions in the Model: Balance Sheet Assumptions & Profit and Loss Assumptions.

These tabs contain two parts: Implied assumptions and calibrated assumptions. The implied assumptions are the historical rates calculated for balance sheet and income statement lines based on their set behaves by the model developers. For example; cash & checks is growing based on % of Deposits. Assets, mostly interest earning ones, for which no such Rates/Ratios are calculated, are basically dependent upon the Allocation of Funds Flow available with the bank.

Assumptions are calibrated whenever projections are not realistic or totally contrary to expectations. Moreover, the User is urged to calibrate implied assumptions to incorporate expected events occurrences for scenario analysis. Given the new information banks do change their short and medium term strategies. Users need to incorporate its best expectation into projection assumptions. Formulas can be overridden but should be set back again later. We have pop-ups to warn the User if the projection assumptions are "implied" or calibrated".

It cannot be overemphasized that the bank's reported data should be accurate. However, in case the reported data yields unrealistic ratios and percentages and there is no immediate clarification for the data, the User can still manage the projections by adjusting the BS and PLA assumptions manually. The relevant assumptions may then be calibrated i.e. by manual input of some values which are more reflective of the expected conditions.

Though all the ratios in BS and PLA are important, however certain rates/ratios need more attention and they are:

- Growth of deposit
- Probability of default
- Loss given default or specific provision ratio
- Work out ratio or loan restructuring ratio
- Charge off or loan written off ratio
- Interest rates
- Gains and losses rates on sale of securities
- Dividend rates

VIII. Review / Analyze the Projected Results

There are four main output reports with the following individual tabs:

- Projected Balance Sheets
- Projected Profit & Loss Accounts
- Funds Flow
- Summary & CAMEL (financial ratios)

The initial review of all these reports should show the base period data which tally with the base period data in the Data Entry tab or Database worksheet.

Secondly, all the projections should show resulting realistic ratios and percentages. Certain basic important items to be reviewed in the projections are:

- Projected BS for each period is balanced
- Total assets and net profit (loss) are within reasonable, reported historical limits
- Capital adequacy ratios in the Summary & CAMEL tab must be thoroughly reviewed and it should be within historical level.

For slides presented by Mr. Arslaner during the Briefing, please see Annex C.

General Framework in Modeling Bank Failure Prediction[2]

by Mr. John O'Keefe, Senior Economist, Federal Deposit Insurance Corporation

Mr. John O'Keefe recalled that the World Bank, in consultation with the Philippine Deposit Insurance Corporation (PDIC), assessed the adequacy of the Philippine deposit insurance fund reserves and appropriateness of the reserving methodology. The World Bank recommended that the PDIC develop a forward-looking approach for predicting bank failures and resulting insurance fund losses. Specifically, the World Bank recommended that the PDIC develop a bank failure prediction model to estimate the likelihood of failure within one year. This study responded to that recommendation by developing a statistical bank failure prediction model for the Philippine banking system.

I. Bank Failures in the Philippines

The Philippine banking system is comprised of commercial, rural, and thrift banks. Rural banks dominate the majority of banks but are smaller in asset size. As of end 2012, rural banks account for 85% of all banks, but only 2% of industry assets. Closures happened mostly among rural banks with 125 banks closed between 2008 and 2012. During this period, there was also a significant number of banks- at- risk of failure due to low equity capitalization rates (i.e., equity capital-to-asset ratios below 2 % or critically undercapitalized). For instance, between March 2008 and September 2012, the quarterly average number of critically undercapitalized banks was 50 and an average of 4 of these banks were in fact among the closures in the subsequent quarter. Majority of the critically undercapitalized banks during the said period remained critically undercapitalized for 12-24 months.

These results indicate that some banks transitioned to critically undercapitalized status in the closure quarter and/or suffered from critical liquidity problems. However, not all closed banks were identified as having critical capitalization problems prior to closure. This means that modeling critically undercapitalized banks alone might miss information about the characteristics of banks that underwent sudden and severe financial deterioration that led to closure. This possibility was controlled by modeling these types of bank "failure" – bank closings, bank with capitalization under 2 percent, and both closings and critically undercapitalized banks.

II. Modeling Bank Failure

Different definitions of banks failures and the variables that might explain failures were explained and considered.

Dependent variables

The study defined three (3) levels of failure as bank closure, bank capitalization of less than 2% (criticallyundercapitalized) and the sum of closed and critically undercapitalized banks. These three, which were assumed as the dependent variables, are variables that indicate the occurrence of failure within one year after the reporting date of the explanatory variable.

Explanatory (Independent) variables

The primary explanatory variables used in the model were measures of bank capital adequacy, asset quality,

2/ Based on Report submitted to PDIC

earnings strength, liquidity and sensitivity to market risk, also known as the CAELS attributes. The first set of variables used the financial ratios derived from bank income statements, balance sheets and related financial schedules.

Financial Ratio Models

The financial ratio models, which heavily utilized asset quality measures but do cover the CAELS attributes, included the following:

- Gross Problematic Assets-to- Unimpaired Capital and Recognized Allowances
- Non-performing Assets-to-Total Assets
- Non-Performing Loans- to- Gross Loans
- Past Due Loans-to-Gross Loans
- Gross Problematic Loans-to-Gross Loans
- Total Allowance-to-Non Performing Assets
- Net Interest Income-to-Average Interest Earning Assets
- Non-Interest Expense (including Provisions)-to-Net Interest and Non-Interest Income
- Profit (loss) after Taxes-to-Average Assets (ROA)
- Profit (Loss) after Taxes-to-Average Equity (ROE)
- Quick Assets-to-Total Deposits
- Quick Assets-to-Total Assets
- Core Deposits-to-Total Assets
- Gross Loans-to-Total Deposits
- Current Loans-to-Total Deposits and Borrowings

The models were disaggregated into two financial models. Financial Model 1,which assumed bank closures and critical undercapitalization as dependent variables, used return on asset (ROA) as a measure of bank profitability and the ratio of quick assets-to-total assets as a measure of liquidity. Financial Model 2 used return of equity (ROE) as a profitability measure and the ratio of quick assets-to-deposits as a liquidity measure.

Another set of variables was used such as the financial ratios derived from bank statements and models based on income statement measures of profitability and credit loss provisioning, loan charge-offs, asset composition, loan portfolio composition, loan payment status (performing and non-performing), and resident versus non-resident loans.

Asset Composition Models

Using this second group of variables, referred to as the Asset composition models, the first model includes balance sheet measures of asset composition as additional explanatory variables. The measures, which are percentages of total bank assets, included the following:

- Held-to-Maturity Financial Assets
- Unquoted Debt Securities Classified as Loans
- Investments in Non-Marketable Equity Securities
- Loans to Bangko Sentral ng Pilipinas
- Interbank Loans
- Other Loans and Receivables
- Loans and Receivables arising from Repurchase Agreements

The second model included information on loan concentrations for categories of Philippine resident loans reported in Financial Reporting Package Schedule 11. The model also measured the loan concentrations as percentage of total bank assets. The categories used are:

- Government Loans
- Agrarian Loans

- Development and Incentive loans
- Microfinance Loans
- Small-to-medium size Enterprise Loans
- Contracts to Sell
- Loans to Private Corporations
- Loans to Individuals for Housing Purposes
- Credit Card Loans to Individuals
- Automobile Loans to Individuals
- All Other Loans to Individuals.

The third model assumed information on loan concentrations for categories of Philippine resident loans reported in FRP Schedule 11a (loans classified as to payment status). The different variables used in resident loan status categories are the current portions of the resident loan categories used in Model 2.

The model based on loan payments used 5 categories, and these include resident loans-current, resident loans past due but not yet non-performing, resident loans past due and non-performing, resident loans in litigation, and allowance for credit losses on resident loans.

Resident Loan Payment Status Model

Individual loan categories are useful predictors of bank failure when a particular loan category is inherently risky due to uncertainty in repayment sources, collateral values, loan maturity and loan underwriting standards. For example, in the U.S. loans for commercial and residential real estate properties are inherently riskier because of the uncertain future value of properties and the use of these properties as loan underwriting standards (e.g, credit is extended based on future sales value of properties). This may not be the case for the Philippine banking market as individual loan concentrations and payment status may be less important for bank performance that is the payment status of resident loans overall. This assumption was tested through a model. All loan concentrations were measured as percentages of total bank assets. The loan categories included in the model are:

- Resident loans – Current
- Resident Loans Past Due but Not Yet Nonperforming
- Resident Loans Past Due and Nonperforming
- Resident Loans in Litigation
- Allowance for Credit Losses on Resident Loans

III. Model Estimation Results

The models were structured and estimated using the Stepwise Logistic Regression of Determinants of Bank Failure within One Year using financial data from 2008 to 2011. All financial ratios were winsorized to Ist and 99th percentiles; and observations were not weighted by banks assets. The estimation included all Philippine banks (commercial, thrift and rural banks) as samples.

Results of Financial Ratio Models 1 and 2, which differ only in the definition of two financial ratios – profitability and quick assets -- are very similar. Both models appear equal in terms of standard measures of explanatory powers. Importantly, both specifications of the PDIC financial ratios models suggest the same financial ratios are consistent predictors of bank failure – gross problematic assets-to-unimpaired capital and recognized allowances, quick assets and profitability.

Both models were also used to predict failure through bank closures only, but the results were less consistent in terms of statistically significant explanatory variables.

The Financial Ratio Model 1 was likewise subjected to predictive accuracy by investigating the model's ability

to rank-order the failure risk of banks through the following:

1. Using a reference year (e.g. 2008 financials to predict 2009 failures then use the estimated model to predict each bank's probability of failure in 2010);
2. Placing banks into risk-ranked deciles; and
3. Obtaining the actual number of failed banks that occur within each decile .

Results showed that financial ratio model 1 is able to rank-order the failure risk of banks well. This accuracy is on account of the fact that over 70 percent of banks that are critically undercapitalized remained as such over the next 12 months and this information was used in the modeling, including the ratio of adjusted gross problematic assets to unimpaired capital plus recognized allowances. Hence, the adjusted gross problematic assets ratio is considered a good predictor of future capitalization.

The predictive accuracy of Financial Ratio Model 1 was also tested using critically undercapitalized banks as a variable. Results showed that the accuracy of the model is lower compared to combined failures of closures and critically undercapitalized banks. The model however remains a good predictor of accuracy.

Results of Other Models

The asset composition models (which assumed closures and critically undercapitalized banks as variables) produced expected relationships among the independent variables, but not so between year-ends 2010 and 2011. The study does not recommend the use of asset composition and resident loan payment status models by PDIC for establishing loss reserves due to less robust results relative to financial ratios models.

IV. Robustness over time of bank prediction model

The paper established the model that predicts bank failure that is robust over time. In doing so, it assumed the following: (i) combined financial data for 2008 to 2011; (ii) use of financial ratios model 1 since it uses the return on assets as the profitability measure relative to model 2 where the return on equity values are meaningless for many insolvent banks in the estimation sample; and (iii) financial ratios model 1 was estimated using the three assumptions of failure events -- bank closures, capitalization under 2 percent or critically undercapitalized banks, and both events.

Results of the separate panel for the model using the three failure events shows that ROA is statistically significant in the combined failure and critically undercapitalized events versions of the model but was statistically insignificant in the closure event of the panel.

The panel models for the three failure events were further tested for model accuracy through computation of table classification for failure and non-failure events using different thresholds as the "failure event" classification. Results of the tests are provided in Slides 28-31 of the presentation.

V. Conclusions and Recommendations

The study concluded with the 2008-2011 panel data version of financial ratios model 1 as the most appropriate model for PDIC the PDIC to use in making bank failure forecasts given its accuracy, robustness and simplicity in terms of data requirements (i.e., it uses financial ratios that the PDIC already maintains and monitors for every bank). The model also uses the fewest number of financial ratios to capture the CAELS attributes. However, the paper recommended that an acceptable classification accuracy trade-off between failed and non-failed banks must be established prior to applying estimated failure probabilities. The study further recommended that PDIC adopt a probability cut-off value to limit the loss exposure estimates and tap experts to further limit such exposures.

For the slides presented by Mr. O'Keefe during the Briefing, see Annex D.

OPENING REMARKS

by Mr. Motoo Konishi, World Bank Country Director

Mr. Motoo Konishi congratulated PDIC, the third oldest deposit insurer in the world, for its 50th anniversary this year. He applauded PDIC for being one of the most active deposit insurance agencies and for its experience in effectively dealing with bank closures for many years.

He remarked that the World Bank considers working with PDIC, a privilege and in many ways, a learning opportunity.

"We were continually impressed by the professionalism, knowledge and dedication of the PDIC staff, including all those early morning and late night calls with the World Bank Head Office in Washington D.C.," Mr. Konishi said.

Mr. Konishi proceeded to explain that the tools presented at the workshop were cutting-edge solutions, representing frontier knowledge in modeling and forecasting the needs for the deposit insurance. "We are particularly pleased that we were able to bring the expertise of FDIC and the World Bank to enable the dialogue among the experts. The teams in PDIC and the World Bank worked on a tight schedule and deserved credit for delivering the model within slightly three months earlier," he added.

He said the World Bank team looks forward to a continued closed cooperation with PDIC as the work on the project continues. "The strong economic performance of the Philippines in recent years and the help of its financial system are recognized internationally, and PDIC is a key element guaranteeing the stability of the Philippine banking system and supporting greater access to finance." He was quick to point out, however, that the stress testing models suggest that some banks show concern and require attention.

He said that the World Bank is proud and grateful that the PDIC decided to showcase the preliminary results of the financial models.

Lastly, Mr. Konishi said he hoped that colleagues and experts to the deposit insurance field around the world found this information interesting. "As knowledge exchange continues, we in the World Bank stand ready to support its work and as always, learn from the process."

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Tel. No. (632) 841-4000 | e-mail: info@pdic.gov.ph
Toll Free: 1-800-1-888-7342 or 1-800-1-888-PDIC
Website: www.pdic.gov.ph

ANNEXES

Annex A

Overview of PDIC's Risk Management Framework

Ms. Imelda S. Singzon

BASIS

- Section 1 of Republic Act (RA) No. 3591, as amended, also known as the "PDIC Charter"

  … The Corporation shall, as a basic policy, promote and safeguard the interests of the depositing public by way of providing permanent and continuing insurance coverage on all insured deposits.[1]

  [1]*… the government must extend all means and mechanisms necessary for the Philippine Deposit Insurance Corporation to effectively fulfill its vital task of promoting and safeguarding the interests of the depositing public by way of providing permanent and continuing insurance coverage on all insured deposits, and in helping develop a sound and stable banking system at all times.*

BASIS

- The "PDIC Charter" provides for a range of risk management tools such as examination, investigation, determination of certain bank examination findings as unsafe and unsound, exclusion of certain deposit products from deposit insurance, and various resolution tools, among others.
- The Central Bank, which implements a number of risk management tools, enforces Prompt Corrective Action as soon as a bank's condition indicates higher than normal risk of failure.

The PDIC's CAPITAL ACCOUNT

DEPOSIT INSURANCE FUND (DIF)

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$$\text{FUND ADEQUACY} = \frac{\text{DEPOSIT INSURANCE FUND}}{\text{INSURANCE RESERVE TARGET}}$$

INSURANCE RESERVE TARGET

Defined as: *The reasonable level of insurance reserves and consists of specific reserves to cover potential losses from banks that have high probability of failure; and general reserves to cover unanticipated losses from deposit insurance payouts and grant of financial assistance.*

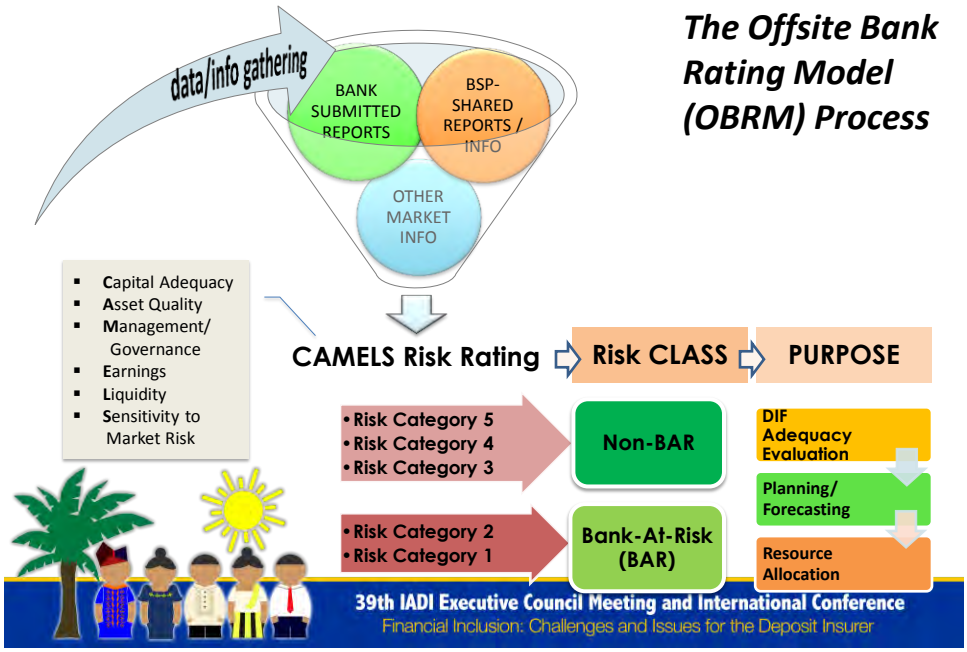
New Fund Adequacy Methodology:

Ratio of Deposit Insurance Fund to Total Estimated Insured Deposits

Recommended Target Ratio for Fund Adequacy is 5.0%

RISK ASSESSMENT

The Offsite Bank Rating Model (OBRM) Process



RISK ASSESSMENT

The results of the OBRM become the basis of the:

- list of banks to be examined by PDIC;
- list of banks to be encouraged to participate in PDIC's bank resolution approaches, particularly in SPRB Plus; and
- in the estimation of insurance reserves target and its impact on the Deposit Insurance Fund (DIF).

PDIC Financial Modeling Project for Deposit Insurance

a) **Stress Testing Model for Banks**

b) **Modeling Bank Failure Prediction**

Support from: The World Bank and FIRST

End of Presentation
Thank You

Imelda S. Singzon
PDIC - Executive Vice President
Examination & Resolution Sector

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Annex B

Overview of Risk Management Systems for Deposit Insurers

Dr. Steven A. Seelig

Categories of Risk Facing Deposit Insurers

- Solvency Risk
- Liquidity Risk
- Operational Risk
- Political/Reputational Risk

For each category of risk, a risk mgt. system should:

- Identify the risks facing the fund
- Identify the available mitigants to the risk
- Identify the residual risk remaining after mitigants have been put in place

Solvency Risk

A deposit insurance fund "should be sufficient for serious difficulties in the banking sector but not for a systemic crisis."

Source: International Association of Deposit Insurers, *Evaluation of Deposit Insurance Fund Sufficiency On the Basis of Risk Analysis, November 2011, p.7.*

Solvency Risk - Risks

- Does fund balance adequately reflect existing liabilities and properly value claims against liquidations?
- Is the fund sufficient given risks and vulnerabilities facing the banking sector
  - Financial modeling can provide an indicator of the magnitude of risk facing the fund
    - Stress testing and Failure prediction models

Solvency Risk – Mitigants

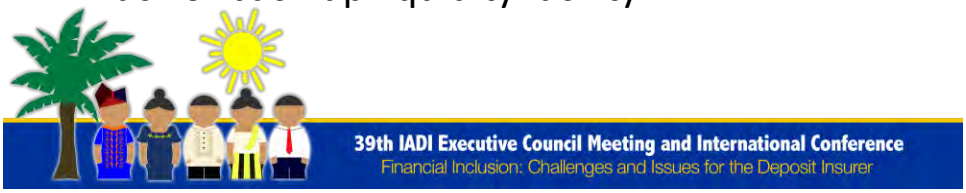
- Proper accounting practices
- Ability to increase premiums (assessments)
- Ability to impose special assessments
- Reduce losses from failures by earlier closing (PCA)
- Reduce risks by more aggressive supervision
- Resolution techniques that reduce cost of failures
- Increase recoveries on failed bank assets

Liquidity Risk

Risk that fund will not have sufficient cash to meet its obligations to depositors in the event of a failure or failures.

Liquidity Risk - Risks

- Lack of sufficient liquid assets to handle likely bank failure
  - Either because of poor investment policy, and/or
  - Excessive investment in claims against liquidations from prior failures
- Lack of back-up liquidity facility



Liquidity Risk - Mitigants

- Implementation of appropriate investment policy that incorporates liquidity needs
  - In part these are based on financial models and supervisory input
  - Policies to assure continuous monitoring of liquidity position
- Back up borrowing authority
  - Central Bank or government (nondiscretionary)

Operational Risk

Operational risks are those incurred by the deposit insurer in its internal activities. It entails people, processes and system failures that could impede the deposit insurer from successfully carrying out its mission.

Operational Risk – Risks and Mitigants

- Not being able to meet obligation to insured depositors in a speedy time frame.
  - Closing procedures, manuals, and plans for quick payment to depositors
  - Software and/or hardware to facilitate account combination
  - Proper legal authority to allow speedy resolution/payouts
  - Staff training

Operational Risk – Risks and Mitigants

- Inability to properly liquidate assets of failed bank in a manner that maximizes their NPV.
  - Clear legal mandates
  - Proper delegations of authority to allow speedy decision making
  - Manuals and procedures
  - Asset sales procedures and development of markets

Operational Risk – Risks and Mitigants

- Lack of confidence in banks leading to bank runs.
  - Assure public knowledge of deposit insurance
  - Assure insured depositors access to their funds quickly
  - Transparent processes

Operational Risk – Other Risks

- Fraud
- Leaks of confidential information
- Risks to safety of staff and security of property

Political/Reputational Risk

This risk entails a loss of trust by the public or the political establishment in the ability of the deposit insurer to do the job properly.

Political/Reputational Risk - Mitigants

- Having good policies and procedures in place over the operations and finances of the deposit insurer
- Good governance structure
- A proactive public information program
- A process for addressing legislative queries

Thank You

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Annex C

Financial Modeling Workshop on Risk Management

Stress Testing Model for Banks

Mr. Murat Arslaner

Agenda

- Background Information
- Model`s Implementations
- Model`s Technical Details
- Model`s Implementation into Stress Testing
- Analyzing Stress Testing Results
- Integration of the Model into PDIC

Background of Technical Assistance to PDIC

The objective of the technical assistance was to help PDIC to implement stress scenarios for large banks. The World Bank Team has, so far,

- Reviewed all available data and prudential rules, as well as accounting standards in the first mission
- Customized the WB`s Financial Projection Model to those data, rules, and standards
- Fine-tuned the customized Model based on pilot testing it over large banks
- and in this mission the Team will
  - Deliver the Model with hands-on training to potential users
  - Transfer know-how to potential modelers

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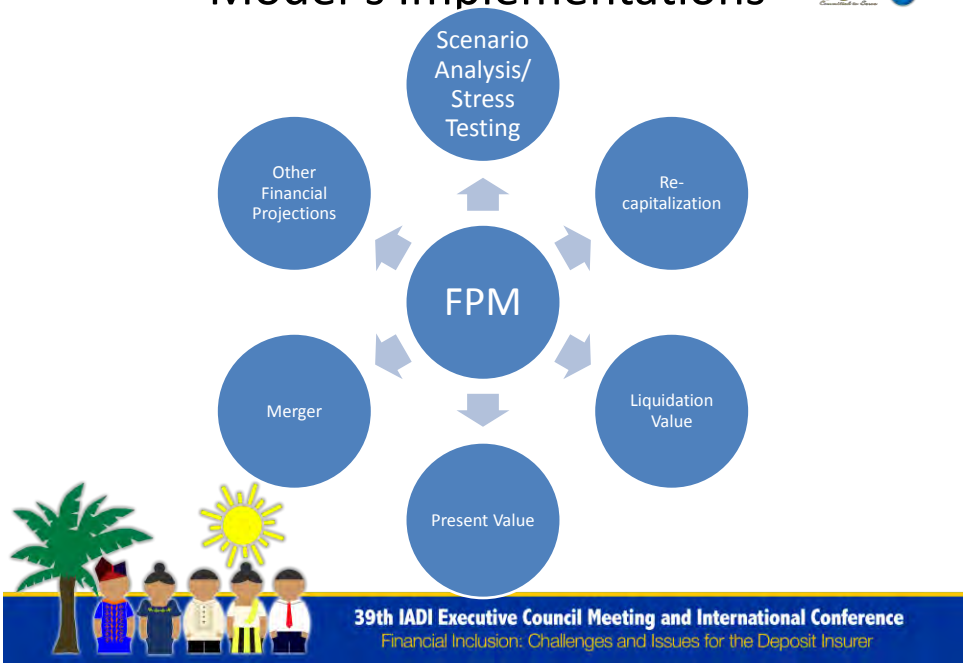
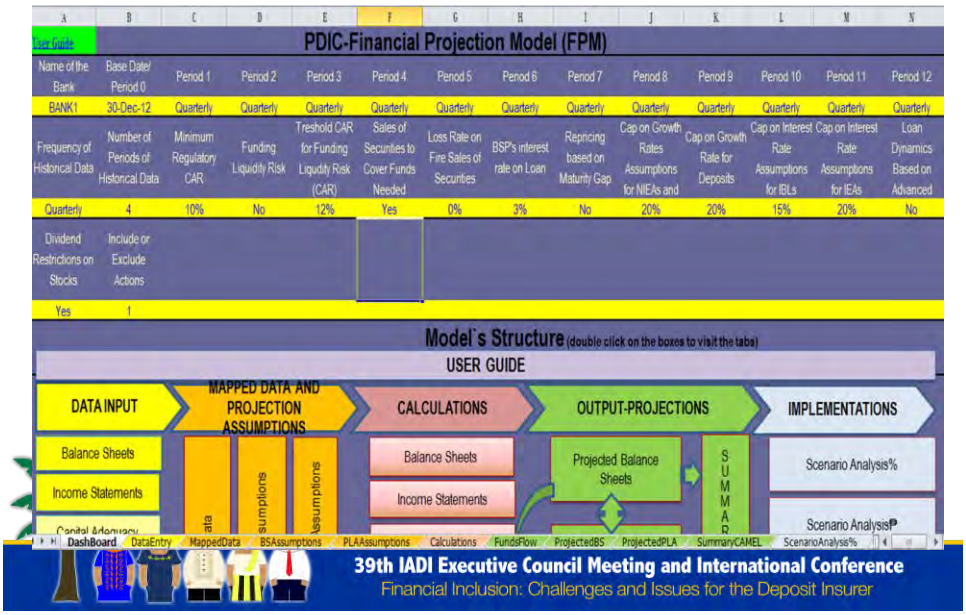
Model`s Implementations



Model Details: Features/Specifications

- Excel based
- Simplicity
- Accommodate any granularity on financial and prudential reports
- Forward-looking
- Inspired from real banking practices
- Flexible projection periods with various frequencies
- Integrated approach for assessing all material risks
- Individual and system-wide
- Familiar structure for data entry and projections
- Informative

Screenshot of the Model



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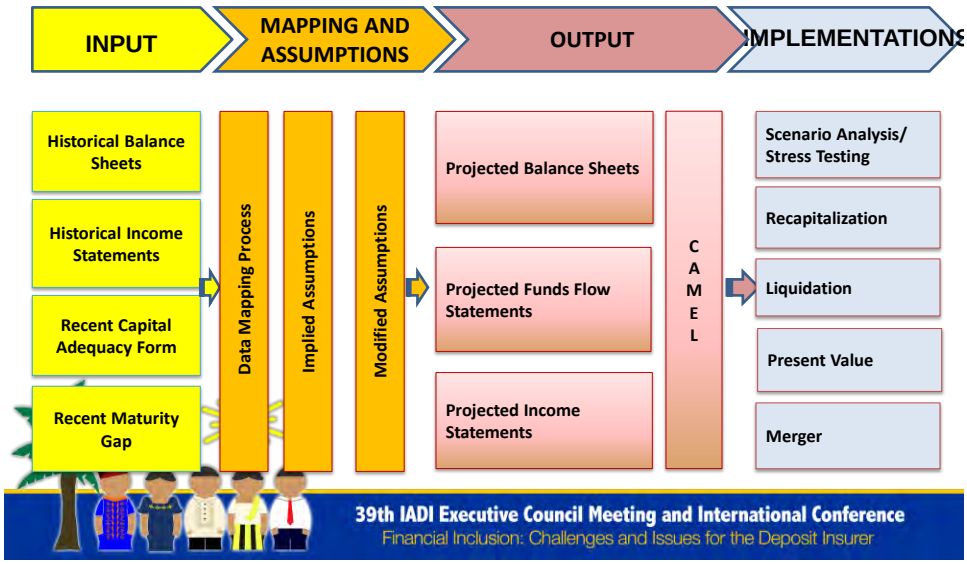
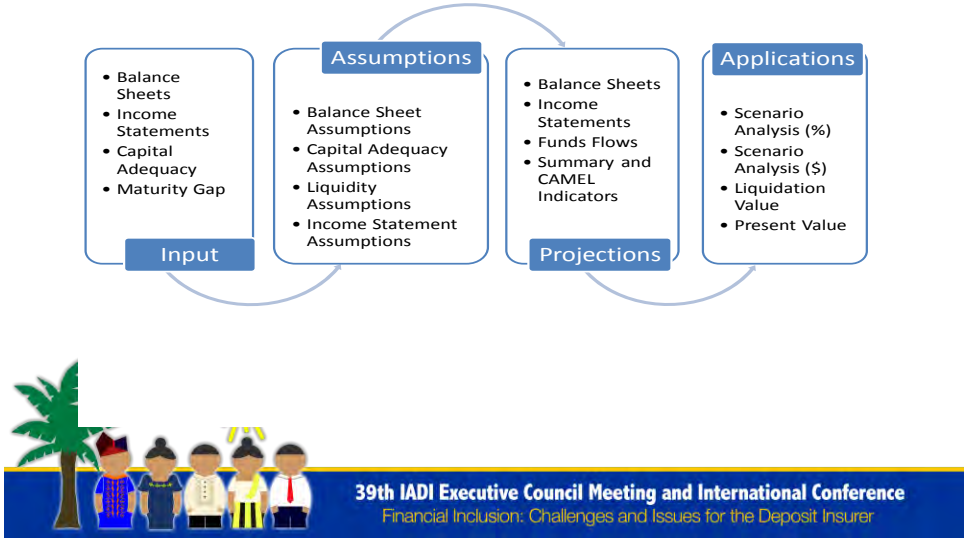
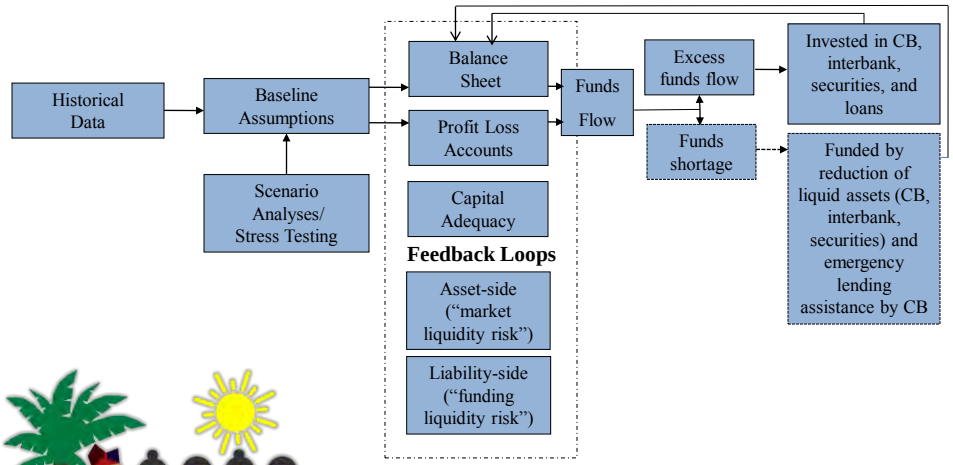
The Structure of the Model



Sequence of Projections



Model Architecture and Driver of Projections



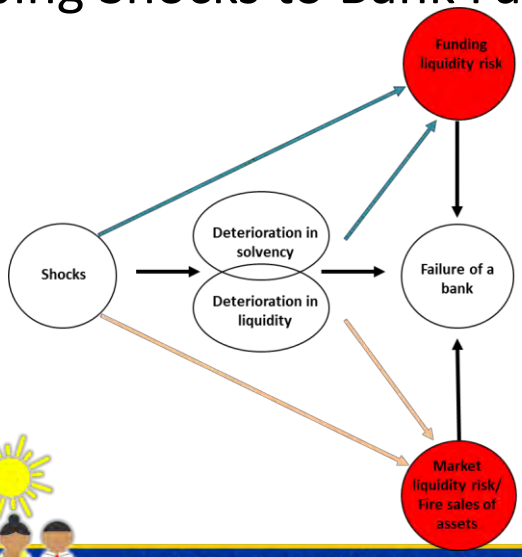
Model`s Implementations into Stress Testing

- **Stress scenarios**: Sensitivity analysis, historical scenarios, and hypothetical scenarios
- **Multivariate stress testing**: Credit, interest rate, and liquidity risks with various risk factors
- **Multi period**: 12 periods with adjustable frequency
- **Systemic risk assessment**: funding liquidity risk, fire sale of assets

Stress Testing Parameters

Credit risk	• Deterioration of loan quality (Probabilities of Default, PDs) • Provisioning for NPLs (LGDs) • Restructuring NPLs • Writing-off NPLs
Interest rate risk	• Interest rates on assets • Interest rates on liabilities
Liquidity risk	• Deposit run • Funding liquidity risk • Market liquidity risk • Change in liquid and current portion of Balance Sheet items

Mapping Shocks to Bank Failure



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Stress Testing Results-Summary

BALANCE SHEET	2012	2013	2014	2015	2016	2017	2018
Cash & Bank							
Securities & Investments							
Net Current Loans							
Net Pass-due Loans							
Real and Other Properties Acquired - Net							
Other Assets							
Total Assets							
Total Deposits							
Money Market							
ELA							
Capital Market Borrowings							
Other Liabilities							
Total Liabilities & Equity							
Net Total Equity							
Unimpaired Capital							
PROFIT & LOSS ACCOUNT							
Total Interest Income							
Total Interest Expense (-)							
Provisions (-)							
Net Interest Income							
Non Operating Incomes							
Net Fee & Commission Income (+/-)							
Non Operating Expense (-)							
Net Income (Loss)							
OTHER INFORMATION							
Primary Reserves							
Secondary Reserves - Gov't. Debt Sec.							
Estimated Insured Deposits							
Uninsured Deposits							

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Stress Testing Results-CAMEL

PERFORMANCE INDICATORS							
CAPITAL	2012	2013	2014	2015	2016	2017	2018
% Capital Adequacy Ratio (CAR)							
Required Tier 1 & 2 additions for min. CAR							
of which: % Tier I							
of which: % Tier II							
% NPAs/Capital							
% Equity to Deposits							
% Net NIEA-NIEL to Equity							
% Capital Formation Rate							
% Past-Due Loans/Equity							
ASSET QUALITY							
% Increase in Net Loan Receivables							
% Increase in Past-Due Loans							
% General Provisions to Current Loans							
% Total Provisions to Gross Loans							
% Current Loans to Gross Loans							
% Past-Due Loans to Gross Loans							
% NPAs toTotal Assets (including Past-Due Loans not NPLs)							
% Specific Provisions/Past-Due Loans							
% Net Cost of Past-Due Loans (Yearly Specific Prov. To NPLs)							
% Earning Assets to Total Assets							
MANAGEMENT EFFICIENCY							
% Fees and Commisions/Net Revenue							
% Efficiency Ratio (Cost- to-Income Ratio)							

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Stress Testing Results-CAMEL

EARNINGS	2012	2013	2014	2015	2016	2017	2018
% Net Income to Gross Income (Profit Margin)							
% GOM-to-Total Assets							
% ROA (NIAT-to-Total Assets)							
Leverage (Total Assets-to-Net Worth)							
%ROE (NIAT to Net Worth)							
% Average Yield on Int Earning Assets (Gross)							
% Average Yield on Int. Earn Assets(Net)							
% Average Cost on Int Bearing Liab.							
% Average Projected Spread (Gross)							
% Average Projected Spread (Net)							
% Average Yield on Gross Loans							
% Average Yield on Net Loans							
% Average Cost of Deposits							
% Spread Loans less Deposits (Gross)							
% Spread Loans less Deposits (Net)							
LIQUIDITY							
% Cash & Cash Equivalents to Total Deposits							
Intermediation Ratio (Gross Loans/Total Deposits)							
% Loans-to-Deposits and Borrowings							
Liaquid Assets to Total Deposits							
Liquidity Ratio based on maturities							
Liquidity Ratio (including ELA) based on maturities							
% Deposits-to-IBLs							
ELA to Total Liabilities							
Insured Deposits to Total Deposits							
Primary Reserves/Total Deposits Ratio							
Liquid Assets/(Total Deposits + Borrowings)							
Current Loans//(Total Deposits + Borrowings)							

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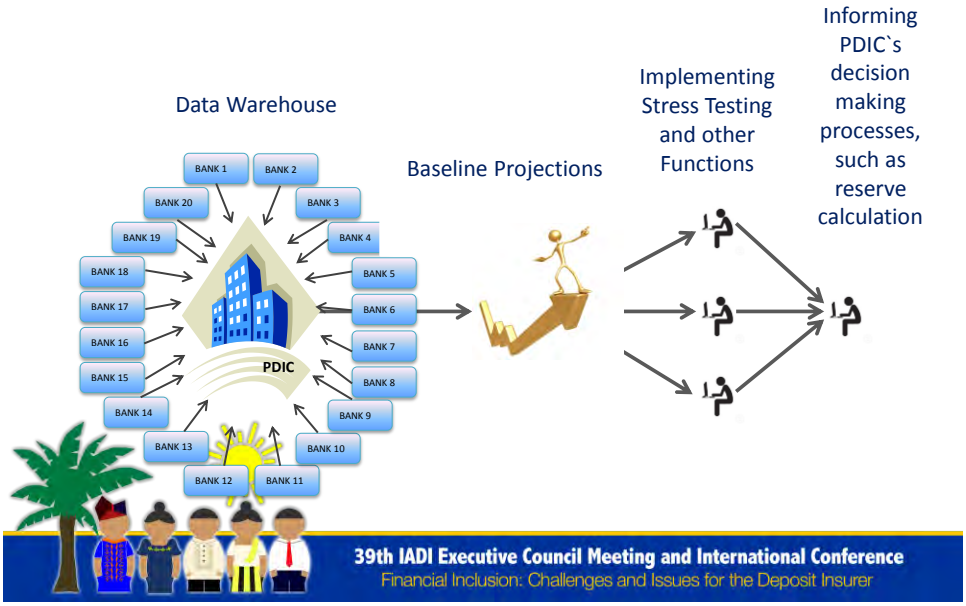
Integration of the Model into Supervision



End of Presentation
Thank You

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Annex D

Financial Modeling Workshop on Risk Management

Bank Failure Prediction: Philippine Banking System 2008 - 2012

Mr. John O'Keefe

Project Description

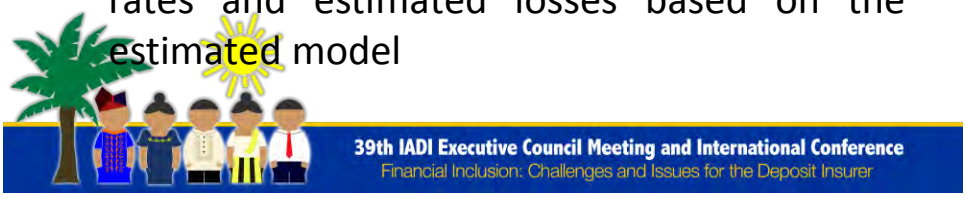
Technical Assistance Assignment to the IBRD to assist the Philippine Deposit Insurance Corporation (PDIC) to develop an empirically derived bank-failure prediction model

Proposed Activities and Deliverables

- Define data requirements for the development of a statistically derived failure prediction model, including parameters for
  - the outcome variable,
  - explanatory variables,
  - sample size,
  - time series requirements

Proposed Activities and Deliverables

- Propose a model estimation methodology with the objective to maximize predictive power based on available data
- Draft a technical paper documenting estimation methodology and results
- Design a tool for calculating predicted failure rates and estimated losses based on the estimated model



Model Development Data

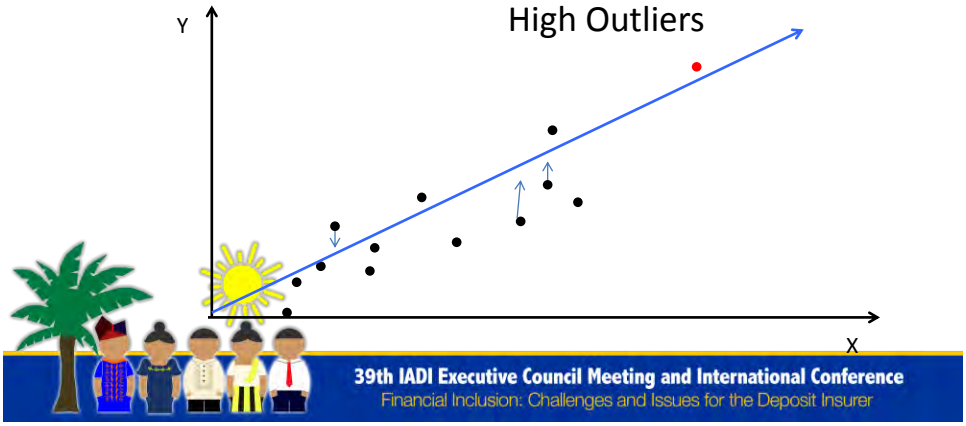
- Financial reporting package (60 schedules)
  - — Income statements
  - — Balance sheets
  - — Securities and hedging
  - — Loan exposures
    - Product type
    - Resident vs. non-resident
    - Payment status
    - Economic activity
- Macroeconomic data
- Supervisory ratings
- Bank structure data
  - – Establishment date
  - – Mergers
  - – Closure dates (by gov't)

Data Quality: Year-ends 2010 and 2011

Variable	Minimum	Maximum	1st Percentile	Median	99th Percentile
Gross Problematic Assets to Unimpaired Capital	(115.92)	866.44	(4.52)	0.45	7.88
Non-Performing Assets to Total Assets	0.00	0.94	0.00	0.10	0.60
Non-Performing Loans to Gross Loans	0.00	1.00	0.00	0.10	0.80
Past Due Loans to Gross Loans	0.00	1.70	0.00	0.16	0.92
Gross Poblematic Loans to Gross Loans	0.00	1.00	0.00	0.10	0.98
Total Allowance to Non-Performing Assets	0.00	3,101,912.89	0.00	0.37	14.20
Net Interest Income to Ave. Interest Earning Assets	(1.17)	1.21	(0.03)	0.10	0.32
Non-Interest Expense (incl.Provisions) to interest and non-interest income	(796.74)	30.46	0.35	0.84	3.66

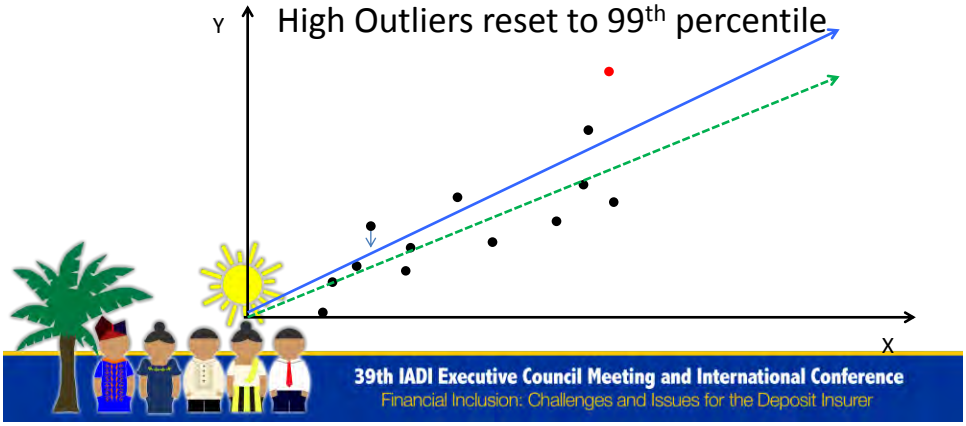
Controlling for Outliers

- Extremely high (low) values for explanatory variables will bias regression model results



Winsorizing the Data

- Reset outliers to specific percentile values
- 1st and 99th percentiles



Modeling Bank Failure

- Failure defined as
  - Capitalization < 2% and
  - Bank closure
  - One-year forecast horizon
- Many alternative models tested; six models made final round
  - "PDIC financial ratios" models 1-2
  - Asset and loan composition models 1-4

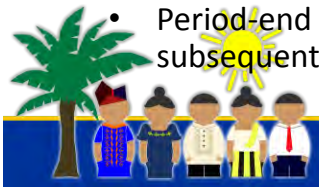
Model Structure

- Stepwise, logistic regression of determinants of failure:

$$\boldsymbol{Failure}_{j,t} = \alpha_t + \boldsymbol{\beta}_t' \boldsymbol{X}_{j,t-1} + \boldsymbol{\lambda}_t' \boldsymbol{V}_{j,t-1} + \varepsilon_t$$

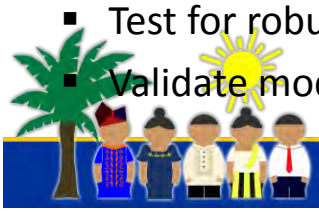
Estimation of the Model

- Sample
  - All Philippine banks (commercial, rural and thrift banks)
  - All financial ratios winsorized to 1st and 99th percentiles
  - Observations not weighted by bank assets
  - Year-end estimations: 2008 - 2011
- Timing
  - Period-end financials related to failure events during subsequent 12 months



Model Selection Process

- Identify variables correlated with failures
- Ensure regression conforms to econometric assumptions
  - Especially, model variables independently distributed (not highly correlated)
- Test for omitted and irrelevant variables
- Test for robustness and sensitivity
- Validate model (out-of-time backtests)



PDIC Financial Ratios Model 1

- Gross Problematic Assets-to-Unimpaired Capital
- Past Due Loans-to-Gross Loans
- Total Allowance-to-Nonperforming Assets
- Net Interest Income-to Average Interest Earning Assets
- Non-interest Expense (including Provisions)-to-Net Interest and Non-Interest Income (aka, efficiency ratio)
- Profit(loss) after taxes-to-Average Assets (ROA)

PDIC Financial Ratios Model 1

- Quick Assets-to-Total Assets
- Core Deposits-to-Total Assets
- Gross Loans-to-Total Deposits
- Current Loans-to-Total Deposits and Borrowings
- Dummy Variables Tested
  - De Novo Banks (Age < 7 years)
  - Bank Type (Rural, Thrift, Commercial)

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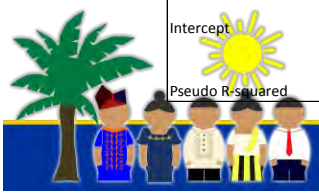
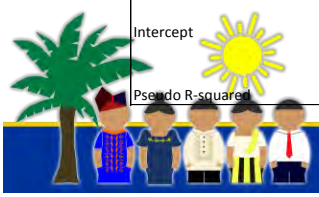
PDIC Financial Ratios Model 1
Stepwise Logistic Regression of Determinants of Bank Failure within One Year
(Failures include Bank Closings and Capitalization < 2 Percent)

Independent Variables	Dec-08	Dec-09	Dec-10	Dec-11
	Estimated Coefficient (Standard Error)			
Gross Problematic Assets/Unimpaired Capital	0.6749***	0.9754***	0.8402***	0.8681***
	(0.0787)	(0.1296)	(0.1162)	(0.1319)
Past-due Loans/Gross Loans	3.0466**			3.9572***
	(1.0801)			(0.9747)
Return on Assets (annual)	-15.1452**	-20.5778***	-14.3749**	
	(5.7229)	(4.3664)	(4.6057)	
Quick Assets/Assets	-7.9740***	-7.5824***	-10.3890***	-9.9742***
	(2.1632)	(1.5946)	(1.6991)	(1.7693)
Current Loans/(Deposits and Borrowings)			-2.5068**	
			(0.8266)	
Net Interest Margin				-14.7398***
				(4.1109)
Intercept	-2.5965***	-2.2160***	0.7058	-1.0067
	(0.5271)	(0.4044)	(0.8129)	(0.6337)
Pseudo R-squared	0.563	0.577	0.536	0.572



PDIC Financial Ratios Model 1
Stepwise Logistic Regression of Determinants of Bank Failure within One Year
(Failures include Bank Closings Only)

Independent Variables	Dec-08	Dec-09	Dec-10	Dec-11
	Estimated Coefficient (Standard Error)			
Return on Assets (annual)	-12.8829***			
	(3.6510)			
Quick Assets/Assets	-8.7674**	-12.1684***	-7.8513***	-8.7742***
	(2.8582)	(2.9438)	(1.8174)	(1.5315)
Current Loans/(Deposits and Borrowings)	-2.0470**			-4.1248***
	(0.7807)			(1.0297)
Gross Problematic Assets/Unimpaired Capital		0.2357**	0.2549**	
		(0.0818)	(0.0922)	
Net Interest Margin		-10.7442**		-16.0126**
		(3.8141)		(5.8799)
Past-due Loans/Gross Loans			5.1649***	
			(1.1807)	
Intercept	-0.2499	-0.6347	-3.6490***	2.6867***
	(0.7085)	(0.6169)	(0.4848)	(0.7996)
Pseudo R-squared	0.27	0.339	0.394	0.363

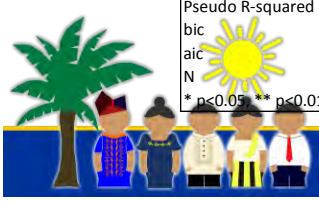


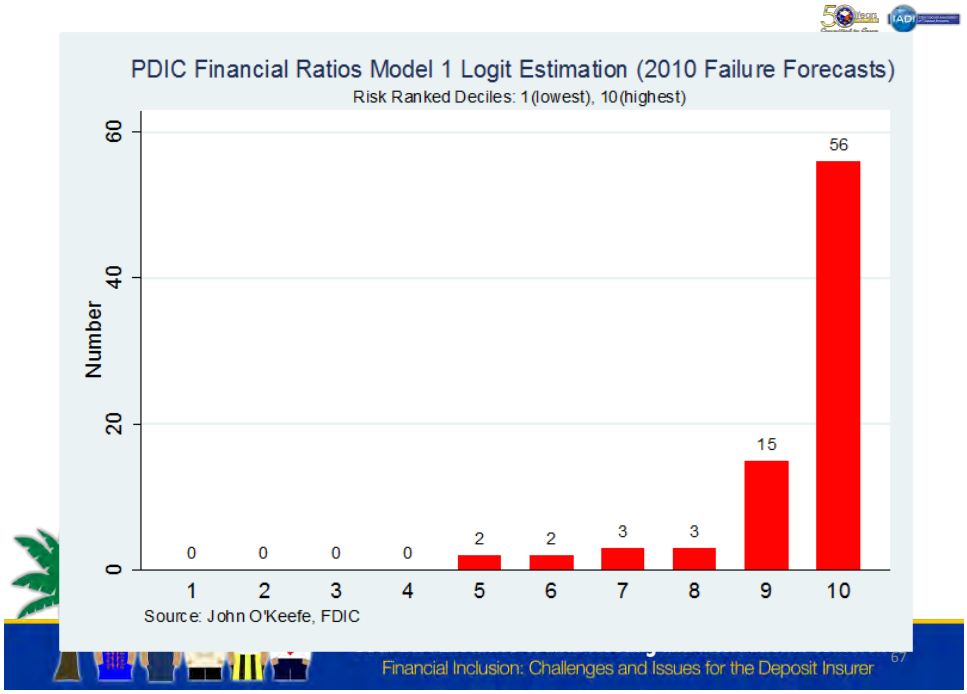
PDIC Financial Ratios Model 1
Stepwise Logistic Regression of Determinants of Bank Failure within One Year
(Failures include Bank Closings and Capitalization < 2 Percent)

Independent Variables	Year-ends 2008 to 2011 Estimated Coefficient (Standard Error)
Gross Problematic Assets/Unimpaired Capit	0.7989*** (0.0551)
Past-due Loans/Gross Loans	2.4142*** (0.5781)
Net Interest Margin	-3.1208* (1.4364)
Quick Assets/Total Assets	-7.9527*** (0.8454)
Return on Assets (annual)	-13.5467*** (2.3144)
Intercept	-2.0545*** (0.2824)
Pseudo R-squared	0.548

PDIC Financial Ratios Model 1
Stepwise Logistic Regression of Determinants of Bank Failure within One Year
(Failures include Bank Closings Only)

Independent Variables	Year-ends 2008 to 2011 Estimated Coefficient (Standard Error)
Gross Problematic Assets/Unimpaired Capi	0.2252*** (0.0440)
Past-due Loans/Gross Loans	3.0817*** (0.5807)
Net Interest Margin	-5.6544** (1.8250)
Quick Assets/Assets	-7.2816*** (1.1271)
Intercept	-2.5017*** (0.3899)
Pseudo R-squared	0.31
bic	700
aic	670
N	3,083
* p<0.05, ** p<0.01, *** p<0.001	




PDIC Financial Ratios Model 1 Logit Estimation (2010 Failure Forecasts)
Risk Ranked Deciles: 1 (lowest), 10 (highest)
Number
0
20
40
60
0
0
0
0
2
2
3
3
15
56
1
2
3
4
5
6
7
8
9
10
Source: John O'Keefe, FDIC
Financial Inclusion: Challenges and Issues for the Deposit Insurer
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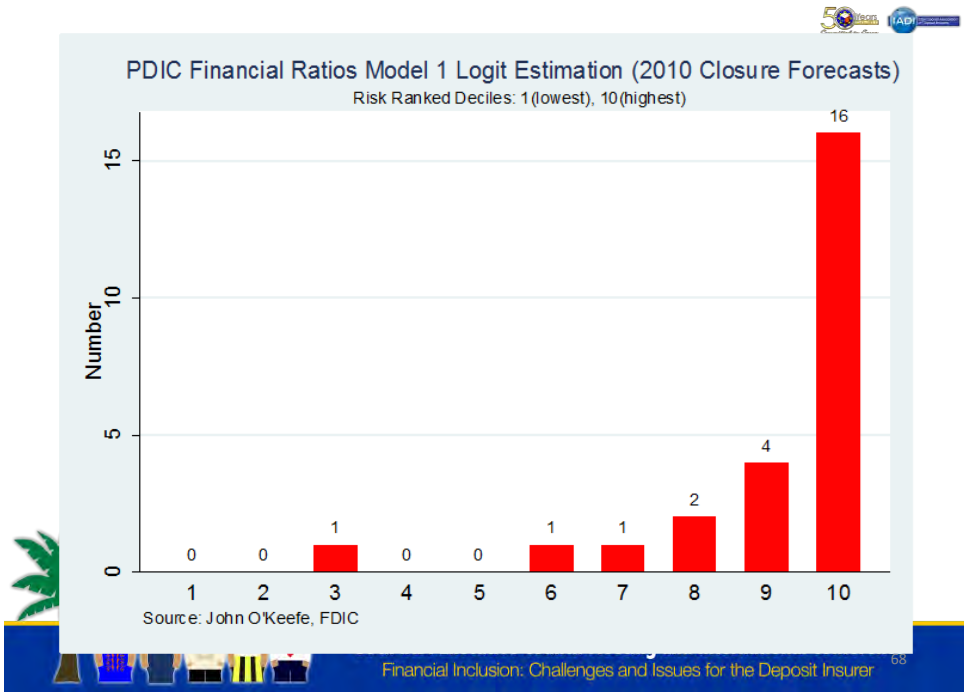
PDIC Financial Ratios Model 1 Logit Estimation (2010 Closure Forecasts)
Risk Ranked Deciles: 1 (lowest), 10 (highest)
Number
0
5
10
15
0
0
1
0
0
1
1
2
4
16
1
2
3
4
5
6
7
8
9
10
Source: John O'Keefe, FDIC
Financial Inclusion: Challenges and Issues for the Deposit Insurer
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Banks that were Closed and/or had Capital < 2%
In-sample Classifications for PDIC Panel Model 1

(p > 0.05 cutoff for failure classification)

	TRUE		
CLASSIFIED	Failed	Non-failed	Total
Failed	288	562	850
Non-failed	23	2168	2191
Total	311	2730	3041

Sensitivity	92.60%
Specificity	79.41%
Correctly Classified	80.76%

(p > 0.15 cutoff for failure classification)

	TRUE		
CLASSIFIED	Failed	Non-failed	Total
Failed	243	161	404
Non-failed	68	2569	2637
Total	311	2730	3041

Sensitivity	78.14%
Specificity	94.10%
Correctly Classified	92.47%

Asset Composition Models: Core Variables

Capital Adequacy:

- Gross Problematic Assets/Unimpaired Capital

Asset Quality:

- Past Due Loans/Gross Loans
- Current Loans/(Total Deposits and Borrowings)
- Accrued Interest Income/Assets

Asset Composition Models: Core Variables

Earnings (losses):

- Loan Loss Provisions/Assets
- Loan Write-offs/Assets
- Net Interest Income/Assets
- Net Income after Taxes/Assets (ROA)
- Non-interest Expense (incl. provisions)/Net Interest and Non-interest Income) (Efficiency Ratio)

Liquidity and Sensitivity to Market Risk:

- Quick Assets/Deposits
- Core Deposits/Assets

Portfolio Concentrations in Asset Model 1

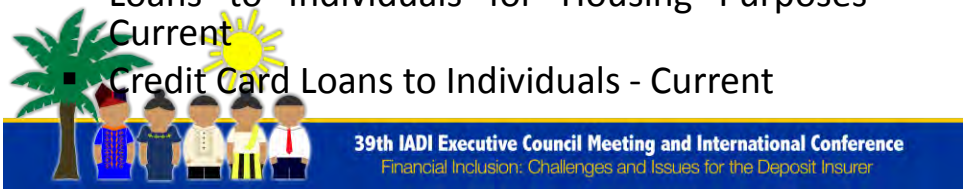
- Held-to-Maturity Financial Assets
- Unquoted Debt Securities Classified as Loans
- Investments in Non-marketable Equity Securities
- Loans to Bangko Sentral ng Pilipinas
- Interbank Loans
- Other Loans and Receivables
- Loans and Receivables arising from Repurchase Agreements

Portfolio Concentrations in Asset Model 2

- Government Loans
- Agrarian Loans
- Development Incentive Loans
- Microfinance Loans
- Small-to-Medium Size Enterprise Loans
- Contracts to Sell
- Loans to Private Corporations
- Loans to Individuals for Housing Purposes
- Credit Card Loans to Individuals
- Automobile Loans to Individuals
- All Other Loans to Individuals

Portfolio Concentrations in Asset Model 3

- Government Loans - Current
- Agrarian Loans - Current
- Development Incentive Loans - Current
- Microfinance Loans - Current
- Small-to-Medium Size Enterprise Loans - Current
- Contracts to Sell - Current
- Loans to Private Corporations - Current
- Loans to Individuals for Housing Purposes - Current
- Credit Card Loans to Individuals - Current



Conclusions

- Philippine Financial Reporting Package data are useful in predicting financial distress and bank failure
- The PDIC Financial Ratios used to monitor banks are the most consistent and accurate predictors of failure
- Asset and loan portfolio composition and payment status can also be used for offsite monitoring models

End of Presentation
Thank You

John O'Keefe
U.S. Federal Deposit Insurance Corporation
Division of Insurance and Research

Previous Literature

- FDIC staff study (1997), *History of the Eighties – Lessons for the Future.*
- Collier, Forbush, Nuxoll, O'Keefe (2003), The SCOR System of Off-Site Monitoring.
- O'Keefe (2010), The Effects of Underwriting Practices on Loan Losses: Evidence from the FDIC Survey of Bank Lending Practices.
- Nuxoll, O'Keefe and Samolyk (2003), Do Local Economic Data Improve Bank Off-Site Monitoring Models?