## Moody's Analytics

# RISK PERSPECTIVES

FEATURED ARTICLES:

# FROM THE EDITOR

**Welcome to the sixth edition of Risk Perspectives™**, a Moody's Analytics publication created for risk professionals.

"The reports of my death have been greatly exaggerated," famously quipped Mark Twain. I have been reminded of this quote recently as mainstream commentators talk of the demise of banking as we know it due to death by a thousand cuts from increased regulation in favor of more nimble Silicon Valley upstarts. Indeed, the impact of the continued low interest rate environment, combined with a range of new competitors and the effects of financial regulatory reform around the world, has created a perfect storm for traditional financial institutions. However, from the time the Florentine bankers developed the campagnia structure that introduced new forms of funding, such as time deposits and preferred equity-like structures, bankers have been innovating to provide essential services to society. In fact, one can argue that the effect of increased regulation is not only making the banking industry safer but also raising the cost for competitors to enter the market.

At our recent Risk Practitioners Conference, the focus of conversations was on extracting greater value from data, removing organizational barriers, and implementing technology-supported processes to improve capital allocation and enterprise risk management. The seeds sown by post-crisis regulatory drivers are giving rise to better risk management practices that will, in time, provide a competitive advantage. With this in mind, we are dedicating this edition of *Risk Perspectives™* to the future of risk management. *Risk Management: The Decade Ahead*, looks at the best practices of today that will form the successful risk management practices of the future.

In the first section, *Rethinking Risk Management*, Dr. Christian Thun takes stock of the forces that are challenging the traditional banking model. Brian Heale and Philip Allen look at the effect of new market entrants and consumer regulation on the distribution paradigm of the insurance industry.

Kevin Hadlock explores foundations of risk management culture through effective training programs.

In the second section, *Regulatory Spotlight*, María de la Concepción Cañamero updates the regulatory radar, a snapshot view of current and future regulatory initiatives by region and industry. Dr. Tony Hughes discusses the benefits and applications of industry data and models in the context of regulatory stress testing.

Next, the *Approaches to Implementation* section features an article on the implementation of a Risk Appetite Framework that considers a firm's business strategies. Dr. Amnon Levy, Dr. Pierre Xu, and Dr. Jing Zhang discuss ways to manage credit risk when faced with regulatory capital requirements. Then, Mehna Raissi and Grace Wang write about data visualization. Dr. Juan M. Licari, Dr. Gustavo Ordonez-Sanz, and Chiara Ventura explore dynamic simulation methods for retail credit portfolios.

In the final section, *Principles and Practices*, Cayetano Gea-Carrasco and Andy Frepp examine how banks can prepare for disruptions in the business ecosystem driven by the financial technology (FinTech) revolution. Yuji Mizuno writes about macroeconomic shifts that will change financial risk profiles and how banks' balance sheet management will become more complex due to regulations. Dr. Douglas W. Dwyer and Dr. Tony Hughes analyze the role of third-party data and analytics in the stress testing process.

I encourage you to take part in this conversation and help us shape future issues of Risk Perspectives™ by sharing your feedback and comments on the articles presented in this sixth edition.

Anna Krayn
*Senior Director and Team Lead,*
*Capital Planning and Stress Testing*
RiskPerspectives@moodys.com

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**RISK** PERSPECTIVES

Moody's ANALYTICS

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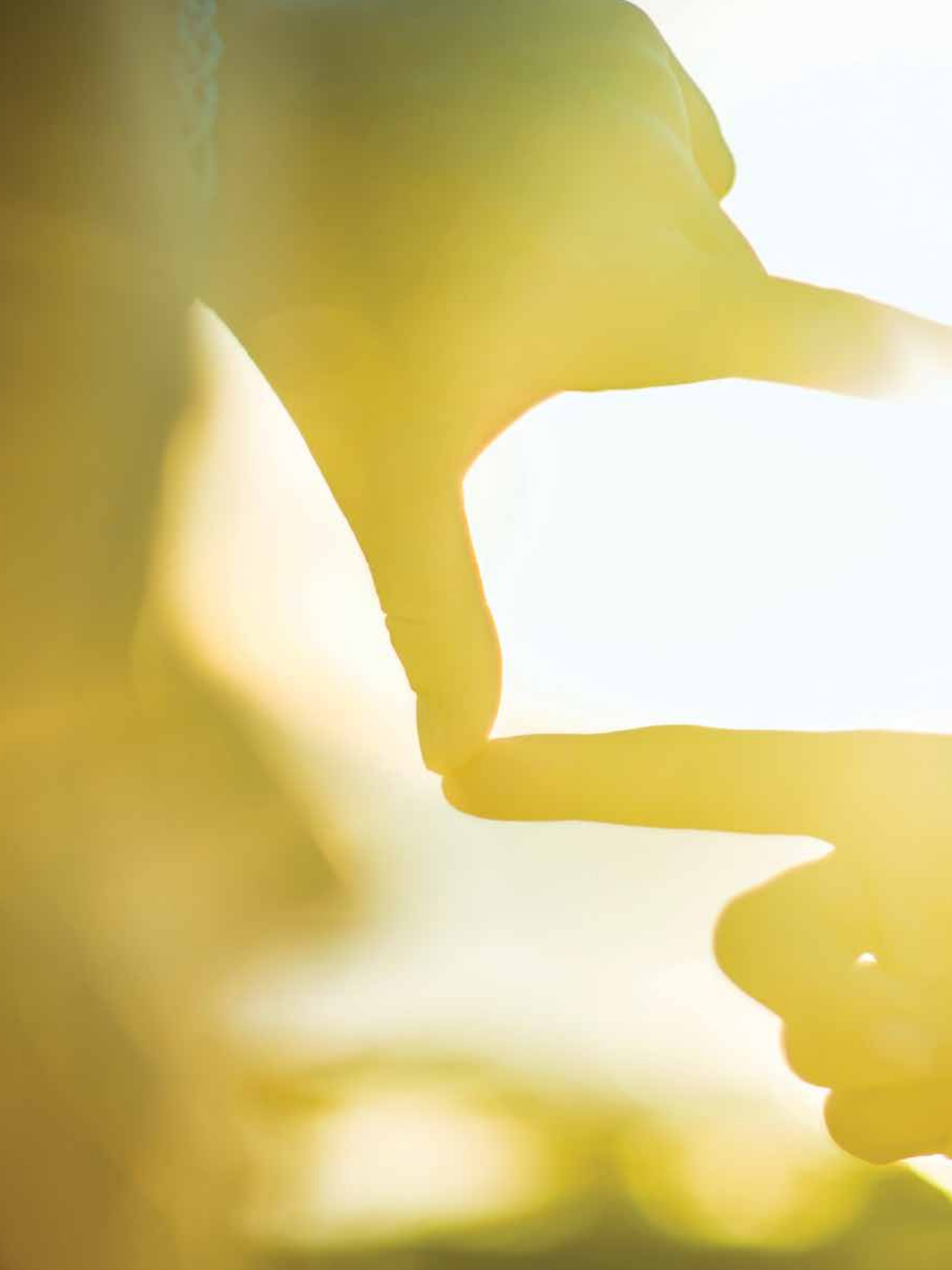
# RETHINKING RISK MANAGEMENT

# FIVE CHALLENGES FOR THE BUSINESS-MODEL "BANK"

By Dr. Christian Thun

**Dr. Christian Thun**
*Senior Director, Strategic Business Development*

Christian is responsible for providing thought leadership on credit risk management and strategic business development in the EMEA region and functions as a main contact for regulators and senior management of financial institutions.

Banks and the services they offer remain essential to global economies, despite repeat predictions of their imminent demise. To stay relevant, however, banks need to adjust their business models and adapt to the new realities – tighter regulation, lower interest rates, changing client needs and behavior, technology disruption, and accelerating disintermediation.

### The traditional role of banks is being increasingly challenged

"Banking is essential, banks are not." This popular quote from Bill Gates from 1994 sums up the challenges the banking industry faces more than 20 years later.

There will always be a need for financial services like deposit taking, lending, and investments, as well as for processing financial transactions such as trading securities or making payments. People, however, are becoming increasingly aware that traditional banks might not be the best choice to deliver these services.

In every economy, banks have traditionally played a critical role as the intermediary between investors and borrowers. Banks contribute to economic growth by ameliorating the information problems between the two groups, by intertemporal smoothing of risks that cannot be diversified at a given time, and insuring depositors against unexpected consumption shocks.[1]

Accelerating technological advances, evolving economic circumstances, and changing customer behavior have created an environment ripe for disruption of the typical business-model bank. The bad news for banks is that the pace of change is not going to slow.[2]

Figure 1  Five key challenges facing banks

| Evolving regulatory landscape is leading to higher costs | Low interest rates and compliance costs will constrain banks' profitability | Client needs and behavior are changing | New digital services are disrupting the market | Disintermediation is accelerating |
|---|---|---|---|---|
| Regulatory costs undermine once attractive businesses and force banks to invest in data, tools, and processes. | Low net-interest margins and minimal fee income erode traditional business. | Demand for more tailored, end-to-end, easy-to-use services and solutions is growing | Internet startups (FinTech) and large IT firms are competing with retail and corporate banks. | Unregulated competitors offer bank clients direct access to new sources of funding. |

Source: Moody's Analytics

1    Allen, F., Carletti, E., *The Roles of Banks in Financial Systems,* Oxford Handbook of Banking, page 1, 2008.

2    Rieker, F., *Does the future need banks?,* SAP Banking View, 2013.

Figure 1 summarizes five key challenges that banks face now and in the near future, which will have a profound impact on their business model.

## But there is also good news

Banks that are open to change can benefit directly from this disruption by combining their unparalleled domain expertise, reputation, and relationships with innovations in technology and a client-centric approach.

### 1. The evolving regulatory landscape is leading to higher costs

The ongoing regulatory reforms and new frameworks like Basel III aim to enhance the stability of the financial system. For financial institutions, however, these initiatives introduce significant costs and uncertainty, particularly for the largest, global systemically important banks (G-SIBs). Increases in the amount and loss-absorbency of capital will strengthen the banking sector but add to costs and hurt profitability. At the same time, new asset and funding liquidity requirements

require that banks hold higher levels of liquid assets that often generate lower returns, diminishing profits even further.

Consequently, many institutions have started to pull out of some business activities because they are either non-core (e.g., commodities or structured products) or too costly for their balance sheets. In addition, financial institutions are focusing more on their home markets and a limited number of strategic markets.

To meet the new Basel III requirements, banks have to manage both sides of their balance sheets while generating sufficient returns to meet their cost of capital. The Basel III framework also introduces new costs for increased staffing, complex data analysis, and updated IT systems.[3] For example, the effort by the Basel Committee on Banking Supervision to implement the principles on effective risk data aggregation and risk reporting capabilities (BCBS 239) could trigger investments of hundreds of million euros per bank.[4]

In the future, regulators globally will spin an

**Figure 2** EU banks' profitability remains persistently low compared to global peers
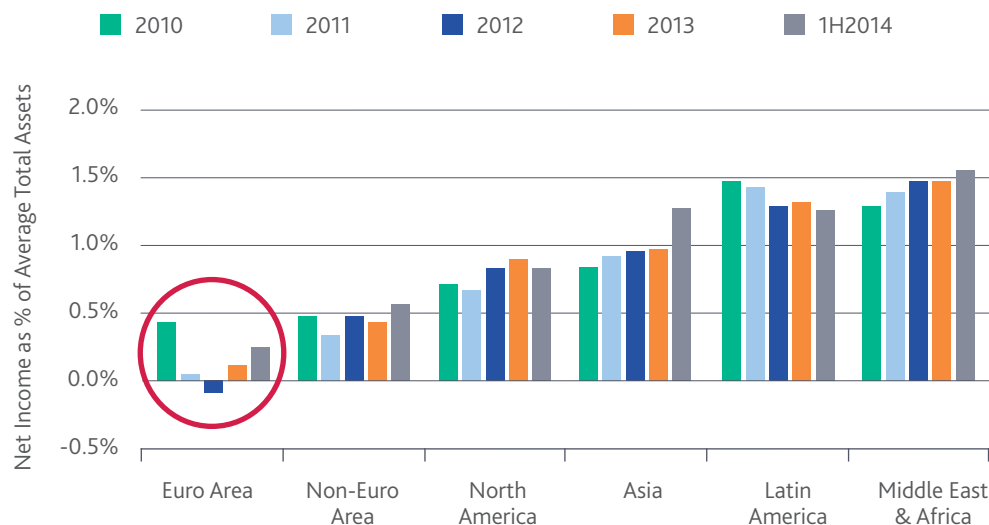


Sources:
Moody's Investors Service

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[3]  *2015 Banking Outlooks* (Presentation), Moody's Investors Service, page 15, 2015.

[4]  Hahn, T., *BCBS #239 kommt - haben Sie Ihre Hausaufgaben schon gemacht?* (pdf), page 3, 2014.

even tighter web of rules and regulations. Banks will have to adapt their business models and – more importantly – will need to enhance their reporting processes and invest in flexible data architectures that will allow them to respond to new regulatory requirements more quickly and at a reasonable cost.

## 2. Low interest rates and compliance costs will constrain banks' profitability

The low interest rate environment created by central banks around the world to stimulate growth following the global financial crisis will have a prolonged negative impact on banks' businesses. Although the unusual environment is supporting borrowers' repayment capacity and creating favorable funding conditions for banks, low interest rates will constrain the banks' net

on the profitability and resilience of German credit institutions revealed that profits are likely to fall considerably if the low-interest-rate setting persists. This is largely due to contracting margins in borrowing and deposit business, such as in the area of savings and transferable deposits.[6]

Moreover, rising compliance costs and settlement charges and persistently high credit costs in many banking systems are further pressuring banks' bottom lines. Because of low earnings, internal capital generation remains weaker than it was pre-crisis – a particular concern as banks look to build up capital and optimize both risk-weighted and nominal leverage to meet Basel III requirements.

A three-year study in the US from Scratch, an in-house unit of Viacom, found that the expectations of those born after 1981 (the Millennials) differ radically from those of any generation before them – one in three is open to switching banks in the next 90 days, 53% do not think their bank offers anything different from other banks, and 33% believe they will not need a bank at all.

interest margins and bottom-line profitability for some time to come.

Over the last few years, net interest margins in most regions have narrowed significantly, but funding costs have little room to fall further to offset low credit pricing. In addition, low credit demand and already high private-sector leverage in some countries are pressuring banks' pre-provision income levels, as in the German banking market – only 6% of German banks earn their cost or capital because of their interest-dependent business model.[5] A recent survey by the Bundesbank and the German Federal Financial Supervisory Authority (BaFin)

Banks in the euro area in particular will continue to suffer from weak profitability owing to anemic loan demand, low interest rates, and high costs. Figure 2 compares the asset-weighted net income of banks rated by Moody's Investors Service in different regions from 2010 through June 2014, with euro area banks at the bottom of the list.[7]

## 3. Client needs and behavior are changing

The fundamental dynamics that drive client decision-making in many different industries are similar. Price, service, and trust are key – especially trust. For several years now, banks have been trying hard to regain the trust lost

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5   Sinn, W., Schmundt, W., *Jäger des verlorenen Schatzes* (pdf), Deutschlands Banken, page 11, 2014.

6   *Results of the survey on the profitability and resilience of German credit institutions in a low-interest-rate setting* (press release), Deutsche Bundesbank, 2015.

7   *2015 Banking Outlooks*, Moody's Investors Service, page 24, 2015.

during the financial crisis and restore their business relationships with clients. But these attempts are meeting a client base with different needs and new behaviors. Like manufacturers or wholesalers, clients nowadays look to their banks to deliver services more quickly and conveniently, with greater transparency and much more flexibility of choice.[8]

Information about financial products and market insights were once the domain knowledge to which only banks had privileged access. Today, this information is in many cases available free of charge on internet forums or comparison portals, or in direct exchanges with experts on social media platforms. As a result, clients now expect more customized information and higher-quality advisory services from their banks than in the past.[9]

(the Millennials) differ radically from those of any generation before them:

» One in three is open to switching banks in the next 90 days.

» Fifty-three percent do not think their bank offers anything different from other banks.

» Thirty-three percent believe they will not need a bank at all.

» Seventy-three percent would be more excited about a new offering from Google, Amazon, Apple, Paypal, or Square than from their own nationwide banks.[11]

## 4. New digital services are disrupting the market

New digital technologies that process information faster and facilitate communication are changing how intangible information is produced, allocated, shared, published, and

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To help them become part of the disruption of new digital services and not its victims, banks can address the growing competition from FinTech in different ways. The most promising strategies focus on creating and fostering a culture within their existing organization that develops new ideas and services collaborating with newly emerging competitors or investing in these businesses very early on.

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To remain competitive and profitable, banks will need to adapt to these new client needs and behaviors. One short-term strategy pursued by many banks is to cut costs by closing branches. Large and small banks in the United States – and in countries such as Germany – have been shrinking their branch networks while spending more on mobile services, in an effort to cater to changing customer behavior.[10]

But adapting to changing client needs is becoming an increasingly difficult task, as research shows. A three-year study in the US from Scratch, an in-house unit of Viacom, found that the expectations of those born after 1981

consumed, which provides for more efficient processes, greater synergies, and higher productivity.

The growing spread of efficient web-based digital technologies and the rates at which people integrate these technologies into their lives have eroded some of the banks' traditional supremacy in standardized financial products. Falling transaction costs associated with modern web technologies will continue to help consumers or third parties process information from the web and provide corresponding financial business services that compete with the banks.[12]

These financial technology start-ups (FinTech)

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8   Duranton, S.; Russo, M.; Salzer, S.; Schürmann, J., *Out in Front: Exploiting Digital Disruption in the B2B Value Chain,* bcg perspectives, 2014.

9   Dapp, T., *Fintech – the digital (r)evolution in the financial sector,* page 17, Current Issues – Digital economy and structural change (pdf), 2014.

10  Chaudhuri, S. and Glazer, E., *Bank Branches in U.S. Decline to Lowest Level Since 2005,* The Wall Street Journal, 2014; Kunz, A., *Banken bereiten das Ende des Filial-Zeitalters vor,* Die Welt, 2015.

11  *The Millennial Disruption Index*, Viacom Media Networks, 2013.

12  Dapp, *Fintech – the digital (r)evolution in the financial sector,* page 17.

and large technology companies such as Google or Apple have proven to be faster than banks in taking advantage of advances in digital technology to develop standard banking products (such as payment products or short-term loans) that are more user-friendly, cost less to deliver, and are optimized for digital channels. These new players also benefit because, unlike their traditional banking competitors, they are less subject to regulatory compliance and are not yet impeded by complex or costly-to-maintain legacy systems. Instead, the FinTech and large technology companies can focus on creating single-purpose solutions, designed to offer people a better experience for single products or services.[13]

FinTech are often smaller organizations, built for innovation and driven by a strong entrepreneurial spirit – and they are more in tune with the peer-to-peer (P2P) culture engendered by the explosion of social media. Consequently, the FinTech are capturing more market share every year: By 2014, the market for FinTech in the United Kingdom was already estimated to be worth £20 billion in annual revenue generated in four main segments: payment services (around £10 billion), data and analytics (around £3.8 billion), financial software (around £4.2 billion), and platforms (around £2 billion).[14]

Despite the segment's impressive growth, however, the new players in the financial services space are not necessarily reinventing the banking business. They do know how to make good use of modern data analytics and web-based technologies, and in the coming years will cause major disruptions in the banking market.

## 5. Disintermediation is accelerating

Financial intermediation, or the channeling of funds from savers to borrowers, is the most fundamental role of banks in every economy. In Europe especially, commercial banks are the primary source of financing for the economy, providing more than 70% of the external financing of the non-financial corporate sector, while the financial markets (and other funding) provide less than 30%. By comparison, in the United States, commercial banks provide only 30% of funding.[15]

Although these numbers were stable for some time, in recent years[16] the role of banks in corporate financing in Europe has declined; by the first quarter of 2014, the European banks were providing only about 55% of the funding to the corporate sector, assuming more of the characteristics of the market in the United States.

The reason for the shift is growing disintermediation – i.e., the circumventing of financial intermediaries such as banks. Owing to new regulations (such as revised capital requirements), as well as the necessary repairs and deleveraging of their balance sheets, banks – especially in continental Europe – have been unable to meet the demand for financing from the corporate sector. As a result, the amount of outstanding debt instruments issued by European non-financial corporations had grown to more than €1 trillion by November 2014, up 50% since 2009. Over the same time, bank loans to corporates declined by €55 billion to €4.28 trillion.[17]

13   Rennick, E., *The Fintech 2.0 Paper: rebooting financial services* (pdf), page 4, Santander Innoventures and Oliver Wyman, 2015.

14   *Landscaping UK Fintech* (pdf), page 14, Ernst & Young, 2014.

15   *The shadow banking system in the euro area: overview and monetary policy implications* (pdf), page 21, Deutsche Bundesbank, 2014; Cour-Thimann, P., Winkler, B., *The ECB's non-standard monetary policy measures: the role of institutional factors and financial structure* (pdf), ECB Working Paper, No. 1528, page 7, 2013.

16   Kraemer-Eis, H., *Institutional non-bank lending and the role of debt funds* (pdf), page 10, European Investment Fund, 2014.

17   Barut, M.; Rouille, N., Sanchez, M.; *The impact of the new regulatory paradigm on the role of banks in financing the economy* (pdf), Banque de France Financial Stability Review No. 19 April 2015.

## Strategies for banks

Banks all over the world will need to develop strategies to respond to these challenges.

The global trend toward much tighter regulation of the banking industry and the low interest rate environment are external factors that banks cannot influence. To address these issues, banks will have to adjust their businesses wherever possible. For example, they could curb or abandon certain types of businesses to avoid regulatory capital charges or adjust their asset allocations to generate additional yield.

Other challenges can be addressed more actively. Increasing quantitative supervision offers banks the opportunity to revamp their often outdated IT and data management frameworks. Newer technologies and leaner processes can help banks to not only improve operational efficiency and cut operational costs, but also make decisions faster and respond more flexibly to new developments in the market, as well as to contend with growing regulatory pressure.

With regard to clients' changing needs and behaviors, banks have strengths they can leverage – competitive advantages that should not be underestimated. Changes in client needs and behavior can be met with banks' expertise in the financial markets and the knowledge and management of the inherent risks, discretion handling client specific data (especially information in digital form), and many years of experience of providing clients with a high standard of operational security. The latter can be a particularly strong competitive advantage, as some of the practices of the major (international) internet firms with regard to data security are a growing concern that many people are now re-evaluating. Nevertheless, banks will need to revamp their digital infrastructures and modernize their branch networks.

To help them become part of the disruption of new digital services and not its victims, banks can address the growing competition from FinTech in different ways. The most promising strategies focus on creating and fostering a culture within their existing organization that develops new ideas and services collaborating with newly emerging competitors or investing in these businesses very early on.

## Conclusion

Contrary to Bill Gates' view, banks and their services are still essential to global economies. However, to fulfill their important role, banks need to critically review their business models and adjust to new realities. These realities comprise tighter, more demanding, and more data-driven regulation, profitability under prolonged pressure, new client needs and behaviors, FinTech disruption, and growing disintermediation.

To address these challenges, banks will require leaner processes, newer IT, and better data management to improve operational efficiency and cut costs. They will need to digitize their offerings to cater to new clients and find ways to become part of the disruption process instead of becoming its victims. All of these changes will require bold moves by the banks, which will pay off in the long run.

# A NEW ADVICE AND DISTRIBUTION PARADIGM IN FINANCIAL SERVICES

By Brian Heale and Philip Allen

**Brian Heale**
*Senior Director, Business Development Officer, Global Insurance*

Brian is an insurance market and Solvency II specialist who has significant experience in the technology solutions and issues for the global insurance industry. He has an in-depth knowledge of the practical aspects of the insurance business, coupled with a comprehensive understanding of enterprise technology in relation to the development and implementation of core administration, actuarial/risk, data, and Solvency II reporting systems.

**Philip Allen**
*Associate Director, Retail Products*

Philip has more than 20 years of experience in business development and relationship management in financial services. He has developed a deep understanding of the retirement and workplace savings market and has extensive experience in both defined contribution and defined benefit pensions.

The way insurance and investment products are distributed and managed in the future will undoubtedly change, with technology, regulations, and new entrants into the market propelling this transformation. But firms can benefit from the new paradigm. This article addresses how financial institutions can remain competitive by delivering intuitive customer journeys at a low cost using the latest technology.

## Introduction

Increasing consumer legislation and new advice models, coupled with the entry of new digitally enabled propositions into the insurance market, will significantly affect the way pensions, insurance, and investment products are sold and managed in the future. In many ways, these trends are being driven by new technology, which is creating new possibilities – for example, smartphones and tablets are changing the way we access investment information and buy investments and insurance. Equally, new wealth management and automated advice platforms (so called "robo-advice" platforms) are providing greater access and choices for consumers in managing their investment and insurance needs.

Growing consumer regulations – such as the Retail Distribution Review (RDR) in the UK, multiple European initiatives including the Packaged Retail Investment Products (PRIPs), and the changes occurring in the US with the introduction of the Consumer Financial Protection Bureau (CFPB) and MiFID II – are driving increased professionalism and transparency on charges embedded in investments and insurance contracts. This is putting pressure on insurers in particular to reduce margins. New advice models and platforms are also transforming the way advice is provided to both the high net worth and mass market sectors.

## Consumer legislation

The UK is indicative of what is happening in Europe in terms of consumer protection, though the Nordics are also very advanced in this area. Generally, consumer legislation has taken two distinct routes:

1. **Consumer protection across the insurance and investment industries:** For example, the RDR is looking to improve the professional standards of intermediaries (focusing on new qualification levels) and eliminating provider bias (with the banning of commission).

   In the US, the CFPB is currently deciding whether it should help Americans manage retirement savings and regulate savings plans, particularly investment scams that target the retired and elderly. The Affordable Care Act, related to selling health plans directly to consumers, adopted the Employee Retirement Income Security Act-style regulatory model, requiring all plans to have standardized documents, such as a Summary Plan Document, but the marketplace was regulated by the individual

insurance commissioners of every state, with some states having multiple regulators (California maintains both a Department of Insurance and a Department of Managed Care).

Individual Retirement Accounts (IRAs) directed to consumers are regulated by the type of custodian (the FDIC regulates bank

to require guidance in relation to the options available to them. The government has looked to plug this gap by offering free guidance through its Pension-Wise Portal; however, the array of options and complexity of client requirements signify there is a major opportunity for direct-to-consumer technology solutions (D2C).

The global robo-advice industry in financial services is expected to reach $2.2 trillion in assets under management by 2020, with a compound annual growth rate of 68%. The main driver behind this growth is considered to be the cost benefits of automating financial advice. There are several pros and cons when choosing between a robot and a human advisor, and some claim that robo-advisors are primarily suited for cost-efficient processing of customers betting on low-cost index funds and exchange-traded funds (ETFs).

custodians, the IRS regulates non-bank custodians). Annuities, life insurance, and disability insurance purchased directly by consumers are regulated by individual state insurance commissioners.

2. **Greater freedom/choice:** In April 2015, the UK government's "Pensions Freedom" legislation introduced pension flexibility, with people having the option to take their entire direct contribution pension benefits as cash (subject to taxation), and the abolition of compulsory annuity purchase. There has been significant market commentary on the "advice gap" for those people who do not want to pay advice but are likely

Then, there is MiFID II, which relates to investment activities under which advisors have to state whether their advice is independent or not. It also prohibits independent advisors from receiving or giving third-party fees, commissions, or other monetary benefits.

These regulatory pressures have led to lower margins, simpler products, a cap on initial charges, and potentially a cap on exit charges (which together would reduce the embedded value of existing business). Regulatory compliance is also challenging the business models of traditional financial providers, advisors and wealth managers. Profitability,

### EXAMPLE: NUTMEG

Nutmeg, which was set up in late 2012, is the UK's first online discretionary investment management company that allows investors to create a professional and bespoke portfolio that gives them exposure in various markets. Once an investor is signed up, the software allows them to enter how much money they are looking to invest, for how long, and the amount of risk they are prepared to take.

However, the system relies on investment specialists, not machines, to determine where money is invested.

too, is challenged by regulations like RDR. The pressure on existing business models and need for automation will continue to increase.

**New advice models/platforms**

In recent years, we have seen the emergence of platforms, which look to automate the investment and financial advice processes for customers. Some of these operate on a D2C basis; others are dedicated to employers giving their employees online access to pension and investment information on so-called "retail" platforms. These platforms are offered by advisory firms such as Hargreaves Lansdowne, Nutmeg, and Money on Toast in the UK and Charles Schwab, Wealthfront, Vanguard, and RebalanceIRA in the US.

Earlier this year, Vanguard in the US introduced its Personal Advisor Services, which combines aspects of web-based advice and investment-modeling algorithms with traditional human contact. There is speculation that it is ready to be rolled out to clients in the UK. Schwab's Intelligent

Portfolios to retail investors and independent investment advisors will create portfolios of exchange-traded funds (ETFs) managed by Schwab and other providers. In foregoing management and transaction fees, Schwab intends the initiative to be "disruptive" to competitors. Most automated investment programs charge about 0.25 percent of the money that clients invest. Schwab clients can open robo-accounts with a minimum of $5,000. Investments are allocated by a sophisticated algorithm to around 20 asset classes, ranging from US stocks and bonds to commodities and emerging markets securities.

Equally, a number of insurers in the UK have also set up advice platforms – Standard Life, AON (who recently launched their Big Blue Retirement proposition), and Liverpool Victoria (who have taken a majority shareholding in Wealth Wizards, which powers its defined contribution and defined benefits workplace engagement propositions).

Figure 1 illustrates the basic advice process

**Figure 1** Basic advice process for insurance and investment products
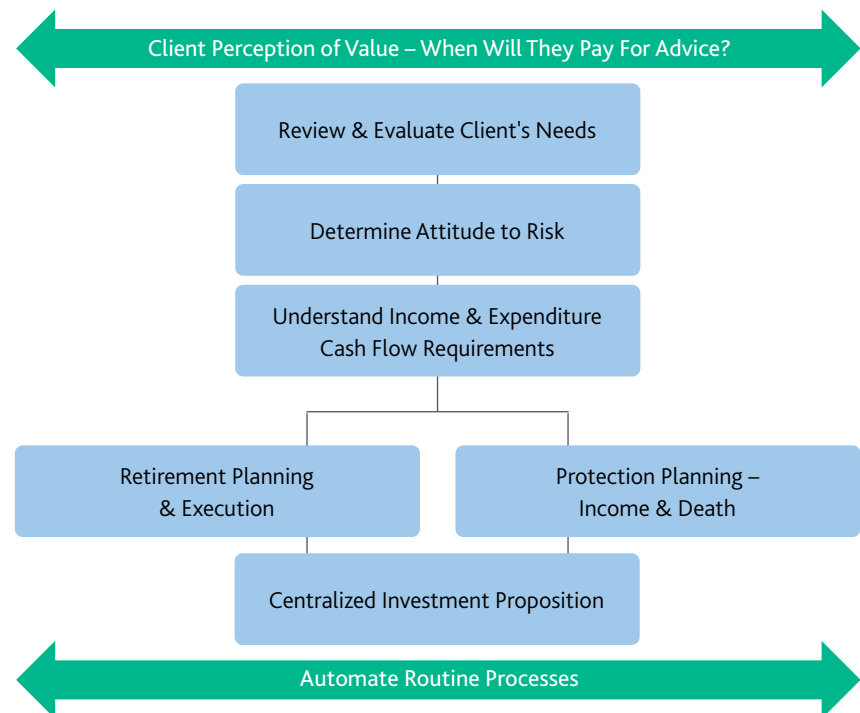


Source: Moody's Analytics

relating to insurance and investment products. Today, much of the process is manually oriented, based on questionnaires (with up to 200 questions) and expert advice. For wealthier segments of the market, human financial and

to the complexity of retirement decisions and mass market consumers' resistance to paying professionals fees for advice, there is a significant opportunity for technology-enabled propositions.

Given that very few people have the time or inclination to tackle the challenge of investment planning on their own, robo-advice is becoming a buzz-word. It is scalable yet individualized – and it lowers the cost of advice so it can be made available to those who might otherwise be intimidated.

investment advisors charging fees are still predominant. But some advisors use portal technology to give their clients easier access to wealth management information and portfolio modeling services.

Deloitte refers to a so called "advisory gap," where only the wealthiest customers value face-to-face advice and are therefore more willing to pay professional fees. There has been a trend within the mass affluent market for consumers to look for do-it-yourself propositions, and D2C platforms such as Hargreaves Lansdown have continued to grow in both the number of clients and assets under management. However, due

### Robo-advice

Artificial intelligence is another area that could become a central component in the future of financial advice, wealth management, and related services. Financial providers, insurers, and related advisors are now beginning to use artificial intelligence, machine learning, cognitive computing, and evolutionary algorithms. In the banking industry, however, the use of algorithms is nothing new – algorithmic trading has already made a huge impact on the stock markets, and credit and risk scoring algorithms have been at the core of banking for some time now. As algorithms become more sophisticated,

**Figure 2**  Robo-advice replacing personal financial advisors
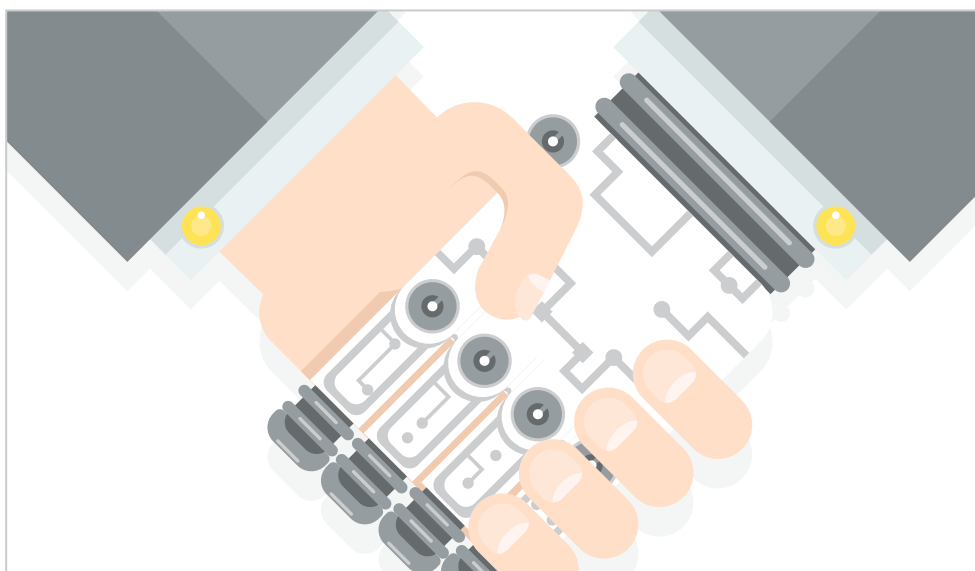


Source: Shutterstock

their potential applications are shifting from statistical analysis of historical data to a wide variety of potential applications, such as robo-advice.

### Example: US

The United States, though, is probably the most advanced in the provision of what is termed robo-advice services. Robo-advice is already a two-year-old trend in the US, where market leader Wealthfront has attracted $1.8 billion without ever seeing or speaking to any of its customers.

The Wealthfront model relies on customers first entering basic information about their income, life stage, appetite for investment risk, and amount they have to invest, albeit through a much slicker interface than a typical electronic form.

Its engine then combs algorithmically through the 4,000-odd ETFs available in the US, allocating the customer's money to a combination of products matching their

Australian start-up closest to this "pure" robo-advice model is StockSpot. Recognizing the poor reputation of human financial planners in the wake of the Commonwealth Bank and Macquarie Bank scandals, StockSpot's homepage makes much of the fact it is not incentivized to recommend any particular product. It will work with a customer who has as little as $2,000, and charges fees that would be impossible to sustain were a human involved in the process.

As an example of the growing demand for robo-advice, Yellow Brick Road's new portal will include both general and life insurance products in its "robotic" financial modeling. The technology, called Guru, calculates clients' financial needs and the actions they should take to meet them. It can also provide projections for five, 10, or 30 years into the future, assessing decisions made today and their impact on later life events. Guru generates a roadmap for each client, outlining his or her full financial situation.

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The same report predicts that 75% of all insurance purchases will be online by 2020. If these predictions are accurate, it will give Google a dominant position as the primary sales channel for the insurance industry. Is this the next industry where technology, with Google as a key player, disrupts the existing value chain?

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profile. Wealthfront's robo-advisor then periodically checks with the customers for changes in their situation, and automatically adjusts their portfolio accordingly – the engines can now even assign individual stocks. Organizations such as Charles Schwab, Wealthfront, and RebalanceIRA have developed platforms that provide clients with access to low-cost retirement solutions with financial education support and, in some instances, access to a telephone-based client manager.

### Example: Australia

The evidence from the US suggests that portfolios constructed automatically perform as well as those put together by human advisors, at a fraction of the cost. The

### Pensions

It is perhaps, in the pensions arena that robo-advice can make the greatest impact. Pensions often involve complex legislation and choices, resulting in a wide range of options for consumers to consider. There is, therefore, a need for guidance and, in many cases, active advice. However, many of the people now taking out pensions are only investing small amounts of money and cannot afford human advice. Consequently, low-cost automated robo-advice for pensions is growing fast, and is already advanced in the US, the Nordics, and Australia.

Mutual fund companies, such as Fidelity and Vanguard, have gained a huge share of the

investment dollars in 401(k) retirement plans in the US, and relatively recently they were allowed to offer some investment direction to plan participants. The creation of target-date retirement funds as a "safe harbor" made portfolio decisions easy for those who did not want to study the market and/or adjust (rebalance) portfolios along the way. Financial planners and mutual fund companies already offer individualized Monte Carlo modeling strategies for retirement withdrawals – but can that advice be applied broadly and robotically, or will it always need a personal touch?

Some experts predict that personal financial advisors will be replaced by robots in financial services and banking, and in this scenario the future is now! UBS predicts direct advice and simplified advice's share of UK retail savings inflows will rise from 21% to 29% by 2025 – although it does not break out how much of this figure will be accounted for by robo-advice. Given that very few people have the time or inclination to tackle the challenge of investment planning on their own, robo-advice is becoming a buzz-word. It is scalable yet individualized – and it lowers the cost of advice so it can be made available to those who might otherwise be intimidated.

It is workplace pensions advice that will grow more sharply, according to banks' forecasts: up from a current level of 19% to 31% by 2025. This equates to a compound annual growth rate of 10%, compared with 8% for the direct/ automated advice space.

However, a recent Wells Fargo/Gallup Investor and Retirement Optimism Index survey found the following:

» Majority of clients still prefer traditional face-to-face financial advice when preparing for retirement or planning investments

» Around 44% preferred the traditional model of advice, compared with 20% who would seek out online alternatives.

"The [survey] shows that the great majority of investors feel they need expert advice to help them invest in the stock market, and the desire for professional input would likely be greater when advice needed for other types of financial matters (such as planning for retirement, college expenses and healthcare) is factored in," said Gallup Poll senior editor Lydia Saad, in a statement reflecting on the survey results.

### Example: UK

In the UK, the "retirement freedoms" have led to a major increase in client interest in pensions. At present, however, a lack of clarity in relation to the provision of guidance without advice is hampering the development of new age robo-advice propositions. Technology companies continue to work with product providers to develop their strategies for the new pensions world. In addition, the Financial Conduct Authority has committed to review pensions communications, simplified advice, and robo-advice.

**Figure 3** Technology firms may disrupt the financial services industry

**89%** OF INSURERS SAY THAT DISTRIBUTION COMPETITION WILL INTENSIFY IN 3 YEARS

**64%** OF COMPETITION FROM NON-INSURANCE PLAYERS

- AMAZON.COM
- APPLE PAY
- EBAY
- GOOGLE
- WALMART
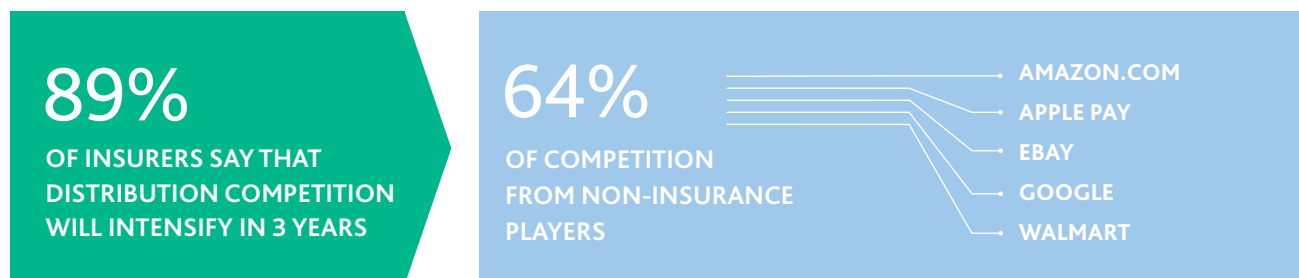
Source: Moody's Analytics

In the meantime, both providers and advisors have also supported hundreds of thousands of employers through the new process of auto enrollment of their employees into designated pensions schemes, while at the same time negotiating fee agreements to pay for their services. This has led to employers looking to work directly with providers to reduce their advice costs, and providers developing business-to-business relationships without advice.

### New entrants

Financial services has always been a conservative marketplace dominated by banks, insurance companies, and traditional advisors. But the public perception of these organizations is generally quite poor, particularly with the younger generation. The next generation is much more loyal and has a better customer experience with firms such as Google, Apple, eBay, and Amazon. Interestingly, all these companies have expressed an interest in the financial services marketplace. And while there are barriers to entry, their significant client base, brand awareness, and strong customer experience would make them formidable competitors to traditional insurance and investment providers.

As an example, the insurance markets are highly regulated, capital intense, low margin, and commoditized to a degree. In direct contrast, the business models of Amazon, Google, and Walmart are built around a high volume of transactions, where regulation is not a major problem. Amazon and others excel in selling commoditized products, which is not a particular strength of insurers.

Some insurance products are obviously easier to sell than others – for example, most people have the compelling need for home, automobile, and term life insurance. Insurance products such as these have moved toward a comparison site/dial-a-quote model and could be easily sold or offered by Amazon or Google. However, more complex life and investment products require a more sophisticated approach, usually involving a professional advisor (or possibly in the future an automated advice portal).

For the mass market, there is the need for simplified products, advice, and low costs, which are areas where the likes of Google and Amazon could prove to be winners. They would, however, face significant challenges, such as obtaining authorization to trade by the relevant industry regulators, capital management, as well as the need to fundamentally change their operating models and support clients with call centers. It could be argued that this would essentially be departing from what has made these companies successful in the first place. Therefore, another option could be for these organizations to partner (or even acquire) with companies who are established in the financial services market.

Google is a good example. In terms of collecting and organizing data, Google is unparalleled – with six billion daily unique searches and more than 50 billion web pages (2013) indexed.

In a recent report published jointly with BCG India, Google concluded that insurance is among the top five product categories in which the web is the dominant purchasing channel, along with travel, digital media, ticket purchases, and books/magazines. In the other four product categories, traditional sales channels have long been redundant as a result of digital disruption. The same report predicts that 75% of all insurance purchases will be online by 2020. If these predictions are accurate, it will give Google a dominant position as the primary sales channel for the insurance industry. Is this the next industry where technology, with Google as a key player, disrupts the existing value chain?

Google made its first move toward the insurance industry back in 2012 with the acquisition of BeatThatQuote, the price comparison service for car insurance, for £37 million. According to the numbers, Google charges up to $54 per click for insurance quote searches. Perhaps the question is not whether Google is going to take a position in the future value chain for the insurance industry, but which position Google wants to take and how this will affect incumbents.

Apple is another interesting example. Apple Pay

is Apple's first venture into the financial arena. Apple Pay is a virtual wallet installed on your iPhone or Apple Watch that uses near-field communication technology. When paying for something, you swipe your iPhone 6 or Apple Watch – the only devices currently supporting the software – at a contactless payment reader, and the funds are withdrawn from your account. You can also use Apple Pay online for a seamless digital shopping experience, meaning that it will be easier than ever to spend money, and pay for insurance and investments!

## Conclusion

There will undoubtedly be changes to the way insurance and investment products are distributed and managed in the future. There will, of course, be winners and losers. The winners will be those companies that can make financial products and advice accessible through intuitive customer journeys that are delivered at a low cost using the latest technology. A key metric of success would be

which company dominates consumer screen time.

Pensions can also benefit from the new paradigm. Consequently, there is an opportunity for new entrants who understand the retail market and already have experience with managing data to provide products aligned with client behavior. Making the complex world of pensions accessible through intuitive customer journeys can only be delivered at a low cost by technology, and those organizations that focus on a digital proposition to control the client experience should have a competitive edge.

Advisors have established themselves as experts and have proven to be more appealing to high net worth clients who value their services. Advisor and platform providers, however, continue to review their strategies and are looking to develop robo-advice propositions that complement their existing wealth management propositions.

# CRAFTING A SUCCESSFUL RISK MANAGEMENT CULTURE

By Kevin Hadlock

**Kevin Hadlock**
*Senior Director, Training*

Kevin is a Global eLearning Solution Specialist. He has designed numerous distance-learning and web-based training programs, developed and taught many seminars, webinars, and full, blended training programs, and has authored content used globally by thousands of credit trainees.

This article addresses the two interdependent needs of effective integrated risk training and measuring optimal risk management to make recommendations for how to train and track behavior. Along the way, it explains why upper management must lead, why teams and work groups must reinforce sound risk training and practices, and why individuals must internalize and enhance those practices for improved risk management to become a reality.

Much has been done in recent years to improve risk management at financial institutions, but more remains to be achieved. Risk management has not matured across the industry to the degree many experts had anticipated – in spite of huge investments – and its future remains unclear.[1] As evidence, there are two questions that bank chief risk officers and regulators ask us repeatedly:

1. How can we provide effective integrated risk training throughout our institution?

2. How can we measure institutional progress toward an optimal risk management regime?

As we have worked to answer these questions, it has become apparent that firms cannot accomplish one in a truly optimal way without the other. That is, to be effective, risk training has to take place within a holistic, measurable change management construct. Conversely, measuring institutional progress means little if employees are not held accountable for modifying their risk behaviors post-training.

## What is optimal risk management, and are we there yet?

Risk management can be defined as the "identification, analysis, assessment, control, and avoidance, minimization, or elimination of unacceptable risks."[2] Optimizing risk management simply means minimizing losses and protecting investors' and depositors' capital while allowing an institution to grow and achieve target profitability.

Since the Lehman Brothers bankruptcy in September 2008, risk management has been the catch phrase of governments and the financial services industry. Regulations upon regulations have been passed, requiring ever more focused and comprehensive risk management activities, and billions of dollars have been spent by institutions globally to meet those requirements. Organizational changes designed to address risk management have been myriad, perhaps best exemplified in the increase in the percentage of banks having chief risk officers, many of whom now report directly to boards of directors.[3]

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1   JournalofAccountancy.com, *Five Barriers Restricting Risk Management Progress*, Neil Amato, June 19, 2014.

2   BusinessDictionary.com

3   *Global risk management survey, ninth edition: Operating in the new normal: Increased regulation and heightened expectations, Deloitte University Press*, Edward T. Hida II, May 13, 2015.

Many institutions can show that risk management practices have improved as a result of all the attention and expenditure. And yet, with all that has been done, successful risk management still depends on individual employees behaving in ways that minimize risks and losses. Institutional management, however, is finding it difficult to train employees sufficiently and steer their behaviors. Few institutions know exactly where they are in the process of improving employee behavior – in other words, they do not have an objective, measurable handle on their progress in implementing effective, integrated, and adaptable risk management regimes (and, for their part, most regulators do not know how to measure that progress in the organizations they oversee).

poorly or insufficiently, do little to fight risk. For example, we have clients who use our RiskAnalyst™ spreading and analysis solution purely to provide consistently formatted balance sheets and income statements to go into borrower files. These banks do not generate any of the numerous analytical reports available in the system, and, therefore, do not accrue the risk-identification benefits they provide. Still, others produce the analytical reports but do not require loan officers to comment on them or address them in their credit write-ups. And others do not use the system's valuable projection capabilities, depriving themselves of the essential insights and analytical discipline that forecasting can provide about a borrower's ongoing ability

> Management – with all its controls, money, experience, and motivation – is at the mercy of its staff. What's more, this dependency increases the farther down you go in the pay scale. A risk-unaware clerk can scuttle a bank's best risk management plans just as surely as a small hole in the hull can sink a formidable ship.

More succinctly, in spite of the money spent to improve risk culture and practices, a risk management regime is not broadly effective unless all employees are aware of it and doing their part to make it happen every day. And unless institutions frame and measure their progress, risk management will not be the formal process they desire going forward.

### The role of people: Why upgrading systems is not enough

New and improved systems, protocols, and data handling are all critical to improving risk management across an organization. The move to enterprise risk management has been extremely useful in identifying, managing, and mitigating risks. Many institutions still have a ways to go to optimize their systems, but the industry as a whole has made great strides.

Systems and protocols and data are never enough, however. The best systems, used

to service debt. The failure to use these tools or the rich data they provide unavoidably increases credit risk, right at the frontline employee level.

Ultimately, an institution has to accept that its people must consistently and effectively implement systems and protocols and manage data to optimize risk management. Stated differently, management – with all its controls, money, experience, and motivation – is at the mercy of its staff.

What's more, this dependency increases the farther down you go on the pay scale. A risk-unaware clerk can scuttle a bank's best risk management plans just as surely as a small hole in the hull can sink a formidable ship – hence the case for top-to-bottom integrated risk management and for providing training to all employees so they can participate fully. The best institutions are taking this theme a step further: They see every employee as a risk manager, not

just as someone who does a job and hopefully does not cause too much damage along the way.

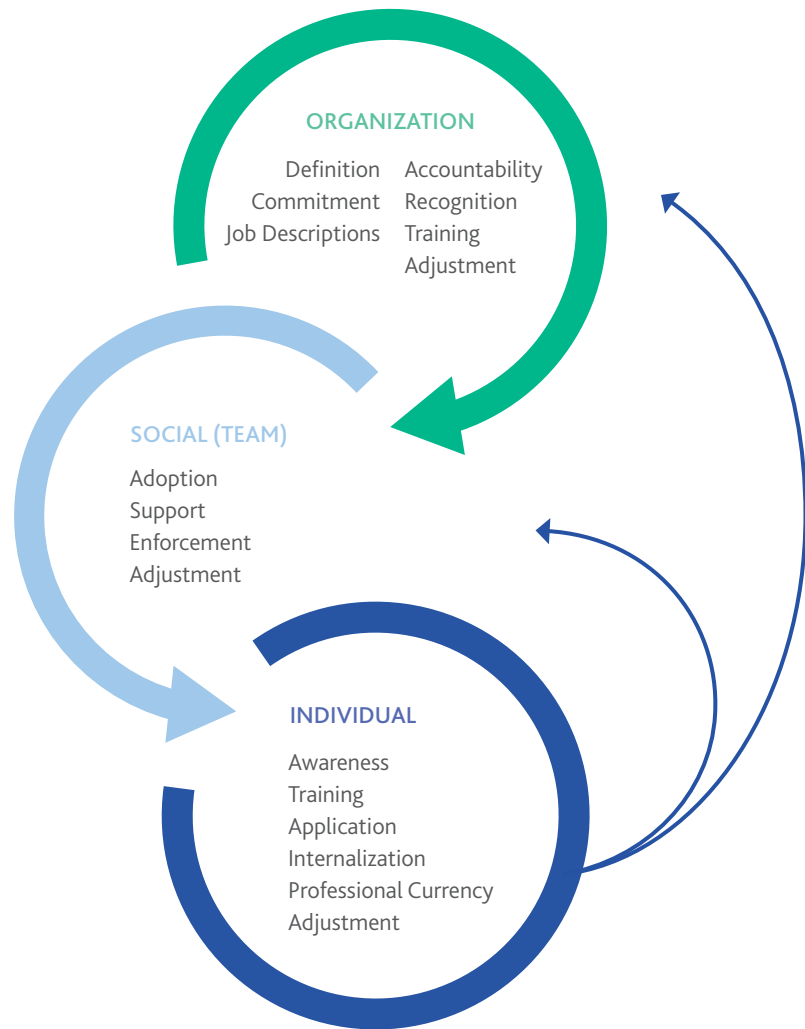### How to drive and sustain improving risk performance

How can upper management transform all employees into risk managers, so that their conduct and behavior every day can enhance organizational risk performance? Is it just a matter of training them once? Or does it involve a broader look and a more pliable approach? And is training alone the answer?

Training is crucial, but only providing it once or solely in a formal format is insufficient in a world with dynamic risk. Further, training alone is never the perfect prescription. Indeed, decisions, actions, and improving knowledge at all levels is essential to ongoing, sustainable improvement in risk behavior. Figure 1 provides one way of looking at this multi-tiered approach, along with detailed steps to take at each level.

The three levels shown in Figure 1 – Organization, Social (Team), and Individual – are borrowed from a discipline promulgated by Grenny, McMillan, Switzler, and Patterson, in their book *The Balancing Act: Mastering the Competing Demands of Leadership.*[4] In it, they

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**Figure 1** Multidimensional approach to risk management improvement



**ORGANIZATION**

| Definition | Accountability |
| Commitment | Recognition |
| Job Descriptions | Training |
| | Adjustment |

**SOCIAL (TEAM)**

Adoption
Support
Enforcement
Adjustment

**INDIVIDUAL**

Awareness
Training
Application
Internalization
Professional Currency
Adjustment

Source: Moody's Analytics, created from information in the book: *The Balancing Act: Mastering the Competing Demands of Leadership*

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4 *The Balancing Act: Mastering the Competing Demands of Leadership (1996)*, Joseph Grenny, Ron McMillan, Al Switzler, Kerry Patterson

look at motivation and capacity at all three levels:

1. The individual level

2. The social or team level (the small group of people with whom the individual works every day)

3. The organization level

The sequence is inverted in Figure 1 simply because an institution's management is, of necessity, the place where organizational change begins. Management is ultimately responsible for how the organization, its work teams, and its individual employees perform.

That said, any initiative can be either elevated or scuttled at the social level if small teams do not reinforce desired behaviors and hold individuals accountable. And individuals can contribute to either success or failure depending on whether or not they change their behaviors in prescribed ways.

As Figure 1 also shows, different kinds of actions are required at different levels.

One of the first ways to start making meaningful change at the employee level – where it matters most – is by adding risk management responsibilities to job descriptions. This may be a laborious and seemingly trivial step, but it can do more to effect desired behaviors than anything else management can do. There is no better way to get an employee's attention than to make a certain task a formal part of his or her job.

Once this is done, management will have the means by which it can hold employees accountable for specific risk behaviors; it will also have the foundation for assigning recognition (and even reward) to those who demonstrate exemplary risk performance at any level. Job descriptions also provide a standard and a core structure against which training can be designed and delivered – that is, instead of providing training at just a general level, management can provide training to help employees master and use skills that match up precisely with their required responsibilities. Beyond initial formal training, management

Without building the ability to make adjustments into the risk management regime at every level, you run the risk of spending large sums of money on solutions that become outdated before they're even fully installed. Lack of nimbleness can stymie even the most concerted investment in money, time, and energy.

### Organization

At this level, C-level executives have to first define what an optimal risk culture is and what effective risk management looks like. Additionally, they have to identify the gap between the ideal and their present status. From there, they have to both communicate and demonstrate commitment to the proposition to move the organization forward – and push for that commitment from the board and all other key stakeholders. This commitment takes shape through decisions about the nature, degree, timing, and the implementation of change. From there, management has to add "concreteness" and decide on the necessary actions to take.

should establish an environment in which ongoing learning on both a formal and informal basis will thrive, such that employees have the permission and means to keep themselves up-to-date on best risk practices. Having all of these elements in place constitutes a foundation on which management can make necessary adjustments as risk needs evolve.

### Social (team)

At the team level, both mid-level managers and every single employee work together to adopt the direction, protocols, and performance standards set by the organization. More than giving lip service and sharing information, it

means supporting one another in carrying out assigned tasks and holding each other accountable for job activities and decisions. Enforcement happens both formally, as lower-level managers hold their employees responsible for their actions, and informally, as colleagues watch out for and remind each other about risk-aware conduct. Finally, teammates form a highly useful pool of individuals who can readily share ideas, recommending adjustments in risk practice both up and down the line.

### Individual

Employees, first and foremost, are responsible for being aware of the business in which they work and the general set of risks associated with it. Beyond that, they must be aware of any new formal duties or competencies management requires of them, and do all they can to understand and implement them. This means completing formal risk-related training and then immediately and consistently applying what they have learned on the job. Over time, this process of learning and doing should lead to internalization at the employee level, so that enhanced risk-related tasks become second nature. Critically, because no organization can create, pay for, and deliver formal training on every possible risk practice right at the moment it is needed, individuals must take responsibility for their own professional currency. This means staying abreast of issues and trends in risk and related regulation. Finally, because they constitute the front line of many risk activities, individual employees should adjust their risk behaviors, and communicate the need for, and nature of, changes up to the team and organization levels.

You may wonder why the previous paragraphs focus so much on adjustment. The answer is that requirements, regulations, market dynamics, and customer needs change constantly, increasing complexity and resulting in the demand for ever more rigor. Without building the ability to make adjustments into the risk management regime at every level, you run the risk of spending large sums of money on solutions that become outdated before they're even fully installed. Lack of nimbleness can

stymie even the most concerted investment in money, time, and energy.

The good news is that adjustment can be one of the most organic, least expensive parts of the whole scheme. Simply listening to all parties up and down the organization and providing a means and structure that allows for readily communicating changes are all that is really required, along with constant attentiveness. Building these features into your risk management model will get employees – your most important risk asset – the information they need when they need it, minimizing risks and losses along the way.

### Measuring organizational progress

Once you start down the path of creating a formal risk management improvement process, having a mechanism in place for measuring progress is essential, or the whole effort can become abstract, unwieldy, and, ultimately, unsuccessful. The multi-dimensional approach introduced in Figure 1 provides a workable structure for tracking progress, so we'll stick with that theme. Such a monitoring approach is articulated in the "RiskPulse scorecard" (Figure 2).

The scorecard is a straightforward approach that can be broadened into a far more detailed tracker if desired. In its current form, however, it serves an important purpose – providing a high-level view of key areas in the risk management improvement process.

Very simply, each of the areas in the left-hand column is given a score: 0 (no progress), 1 (in-progress, at an early stage), 2 (in-progress, at a late stage), or 5 (in-place and working). These points are then totaled in the far right-hand column for a comparison to the highest scores possible. There is no industry standard to discuss at this point, but that is not the primary value of the scorecard; its value lies in the ability to track your organization's performance over time and see which areas need attention. Ideally, scores will rise significantly year-after-year and then remain high. Used in combination with other risk management performance reporting, it can become a useful tool for tracking and measuring progress.

**Figure 2** RiskPulse scorecard – measuring progress toward optimal risk performance

| | No (0 pts) | In-Progress Early (1 pt) | In-Progress Late (2 pts) | In-Place and Working (5 pts) | Total Points |
|---|---|---|---|---|---|
| **Organization** | | | | | |
| Definition | | | | 5 | 5 |
| Commitment | | | | | 0 |
| Job Descriptions | | 1 | | | 1 |
| Accountability | | | 2 | | 2 |
| Recognition | 0 | | | | 0 |
| Training | | | 2 | | 2 |
| Adjustment | | 1 | | | 1 |
| Organization Subtotal | | | | | 11 |
| Organization Possible | | | | | 35 |
| Organization RiskPulse Score | | | | | 31% |
| **Social (Team)** | | | | | |
| Adoption | | 1 | | | 1 |
| Support | 0 | | | | 0 |
| Enforcement | 0 | | | | 0 |
| Adjustment | 0 | | | | 0 |
| Social (Team) Subtotal | | | | | 1 |
| Social (Team) Possible | | | | | 20 |
| Social (Team) RiskPulse Score | | | | | 5% |
| **Individual** | | | | | |
| Awareness | | 1 | | | 1 |
| Training | | 1 | | | 1 |
| Application | 0 | | | | 0 |
| Internalization | | 1 | | | 1 |
| Professional Currency | | 1 | | | 1 |
| Adjustment | | 1 | | | 1 |
| Individual Subtotal | | | | | 5 |
| Individual Possible | | | | | 30 |
| Individual RiskPulse Score | | | | | 17% |
| Total Actual | | | | | 17 |
| Total Possible | | | | | 85 |
| Total RiskPulse score | | | | | 20% |

Source: Moody's Analytics

### The future of successful risk management: What it will look like

Below are 10 observations on what successful risk management should look like in the future. These have been culled and refined from conversations with chief risk offers and those responsible for providing risk-related training to the rank and file in large banks. A top-10 list such as this is a fitting conclusion to this article, because it reflects legitimate risk management aspirations.

The future of successful risk management is:

1. Many more employees better understanding risk, identifying it on the fly, responding to it, and mitigating it – all of this happening in an integrated, intentional way throughout the organization.

2. Declining risks and losses – and everyone in the organization knowing why.

3. Ensuring that everybody has the right data – on time and all the time.

4. Creating, promoting, and maintaining a risk mitigation ecosystem in which every conversation about growth and profits addresses risk, and every conversation about risk addresses growth and profits.

5. Both evolutionary and revolutionary, where the fit survive and the visionary thrive.

6. Employees continuously learning and sharing information, both formally and informally, so that everyone is current, consistent, and persistent in their risk management practices.

7. Improving risk behavior and keeping up with change, entailing not only compliance exercises, but also feedback, accountability, transparency, and adjustment.

8. All employees being risk managers, be they tellers, clerks, relationship managers, credit analysts, underwriters, middle managers, policy setters, or C-level executives.

9. The institution itself becoming a dynamic, self-aware, and adaptive risk managing organism.

10. The future of successful *risk* management is successful management.

Structured, intentional, and measured progress toward these ends will yield positive results, as will empowering all of an institution's employees and holding them accountable. Executive commitment and effective processes, supported by an increasingly capable staff that has been both led and listened to, will inevitably result in improving risk outcomes over time.

# BIG IDEAS

## SMALL RISK

With regulatory and industry change accelerating, banks need to ensure their enterprise risk management practices also maximize opportunities, drive growth, and fuel the next big idea.

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fin tech FORWARD 2015 TOP 100 SOLUTION PROVIDER

RiskTech 100 2015 Top 10

Structured products TECHNOLOGY RANKINGS 2015

# REGULATORY SPOTLIGHT

# GLOBAL BANKING REGULATORY RADAR

By María de la Concepción Cañamero

**María de la Concepción Cañamero**
*Associate Director, Lead Strategist and EMEA Team Lead, Strategy and Analytics*

Maria is Lead Strategist and team leader in the EMEA Strategy & Analytics group of Moody's Analytics. She leads the team efforts to analyze and monitor key demand trends affecting our customer segments and regulatory developments in the financial services industry. She is directly involved in the creation of expert content on topical industry trends such as stress testing or Solvency II.

The Moody's Analytics Regulatory Radar provides an overview of the main regulatory guidelines affecting the banking industry. It is a proprietary tool developed to monitor regulations in the immediate, medium, and long term, across multiple jurisdictions.

Over the past few years, the global financial services industry has experienced an unparalleled level of regulatory reform. This trend does not show signs of changing anytime soon.

The G-20 and the Financial Stability Board are leading the overhaul of global financial services regulation that is fundamentally reshaping the industry, starting with the largest institutions. These reforms aim to reduce systemic risk, restructure banks, strengthen capital requirements, and increase transparency.

### Systemic risk reforms

In November 2008, the G-20 stressed the need to review the differentiated nature of regulation in the banking, securities, and insurance sectors and to identify areas where systemic risks may not be fully captured. This has led regulators to consider new sources of systemic risk such as shadow banking, investment managers, and insurers. Hence, a worldwide program is underway to standardize regulations in these sectors.

Systemically important institutions face specific requirements:

» Higher capital requirements with the introduction of the Total Loss Absorbing Capacity for global systemically important banks and Higher Loss Absorbency requirements for global systemically important insurers.
» Enhanced data management and reporting requirements, such as the BCBS 239 data principles and the Financial Stability Board's data reporting requirements.
» Risk concentration and resolution and recovery planning requirements.

### "Basel IV"

It is now nearly six years since the Basel Committee on Banking Supervision developed Basel III in response to the global financial crisis. Despite the fact that many of the Basel III requirements are not fully implemented yet, new regulatory proposals are emerging on what is starting to be called the "Basel IV" reform. These new proposals focus on improvements to the methods banks use to calculate their risk, namely:

» The fundamental review of the trading book, which includes plans to apply a standardized approach for calculating market risk.
» A new standardized approach to counterparty credit risk (SA-CCR).
» A review of the standardized approach for the calculation of credit risk and revisions to the estimate of risk weightings used for determining capital adequacy requirements.
» A new international approach to large exposures.

These proposals are expected to come into force from 2017 onwards. And given their importance, banks need to pay close attention to them.

### Stress testing continues to be a key regulatory tool

Stress testing requirements are becoming tougher, not only on the quantitative side, but also on the qualitative assessment that

regulators do of banks' risk governance, processes, models, and tools.

In the Americas, the US expanded stress testing requirements to large foreign banks. In Europe, the European Central Bank/European Banking Authority and the UK's Prudential Regulation Authority run annual stress tests. Regulators in other regions are looking at these guidelines and developing local requirements, such as in China, Australia, and New Zealand.

Regulators are also considering expanding stress testing requirements to other segments of the industry, such as asset managers and pension funds.

### IFRS 9 and CECL

The International Financial Reporting Standard 9 (IFRS 9) that will enter into force on January 1, 2018, replaces the International Accounting Standard 39 (IAS 39).

The new standard will substantially affect banks' financial statements. The new impairment model will require more attention from banks given the fundamental changes that it proposes – estimating provisions based on expected losses and not incurred losses as required in IAS 39.

In the US, the Financial Accounting Standards Board (FASB) has also been working to develop a new impairment model known as the "Current Expected Credit Loss" (or CECL) model. A final standard is expected to be released between Q4 2015 - Q1 2016.

### Impact for banks

Banks will have to respond to this new wave of regulatory changes with enhanced enterprise risk management systems and processes to effectively manage risk and comply with the requirements.

They must continue transforming their risk management, finance and compliance technologies, processes, and practices, in terms of capital calculation, expected loss estimation, data management, stress testing, and reporting.

**Figure 1** Moody's Analytics Global Banking Regulatory Radar



Source: Moody's Analytics

# SMALL SAMPLES AND THE OVERUSE OF HYPOTHESIS TESTS

By Dr. Tony Hughes

**Dr. Tony Hughes**
*Managing Director of Credit Analytics, Economic and Consumer Credit Analytics*

Tony oversees the Moody's Analytics credit analysis consulting projects for global lending institutions. An expert applied econometrician, he has helped develop approaches to stress testing and loss forecasting in retail, C&I, and CRE portfolios and recently introduced a methodology for stress testing a bank's deposit book.

With powerful computers and statistical packages, modelers can now run an enormous number of tests effortlessly. But should they? This article discusses how bank risk modelers should approach statistical testing when faced with tiny data sets.

In the stress testing endeavor, most notably in PPNR modeling, bank risk modelers often try to do a lot with a very small quantity of data. It is not uncommon for stress testing teams to forecast portfolio origination volume, for instance, with as few as 40 quarterly observations. Because data resources are so thin, this must have a profound impact on the data modeling approaches.

The econometrics discipline, whose history extends back only to the 1930s, was developed in concert with embryonic efforts at economic data collection. Protocols for dealing with very small data sets, established by the pioneers of econometrics, can easily be accessed by modern modelers. In the era of big data, in which models using billions of observations are fairly common, one wonders whether some of these econometric founding principles have been forgotten.

## The overuse and misuse of statistical tests

The issue at hand is the overuse and misuse of statistical tests in constructing stress testing models. While it is tempting to believe that it is always better to run more and more tests, statistical theory and practice consistently warn of the dangers of such an attitude. In general, given a paucity of resources, the key for modelers is to remain "humble" and retain realistic expectations of the number and quality of insights that can be gleaned from the data. This process also involves using strong, sound, and well-thought-out prior expectations, as well as intuition while using the data sparingly and efficiently to help guide the analysis. It also involves taking action behind the scenes to source more data.

An article by Helen Walker, published in 1940, defines degrees of freedom as "the number of observations minus the number of necessary relations among these observations." Alternatively, we can say that the concept measures the number of observations minus the number of pieces of information on which our understanding of the data has been conditioned. Estimating a sample standard deviation, for example, will have ($n$-1) degrees of freedom because the calculation is conditioned on an estimate of the population mean. If the calculation relies on the estimation of $k$ separate entities, I will have ($n$-$k$) degrees of freedom available in constructing my model.

Now suppose that I run a string of 1,000 tests and I am interested in the properties of the 1,001st test. Because, technically, the 1,001st test is conditional on these 1,000 previously implemented tests, I have only ($n$-1,000) degrees of freedom available for the next test. If, in building my stress test model, $n$=40, I have a distinct logical problem in implementing the test. Technically, I cannot conduct it.

Most applied econometricians, however, take a slightly less puritanical view of their craft. It is common for statisticians to run a few key tests without worrying too much about the consequences of constructing a sequence of tests. That said, good econometricians tip their hat to the theory and try to show restraint in conducting an egregious number of tests.

### The power and size of tests is also a critical concern

When setting out to conduct diagnostic tests, even very well-built statistical tests yield errors. Some of these error rates can usually be well controlled (typically the probability of a false positive result, known as the "size" of the test), so long as the assumptions on which the test is built are maintained. Some error rates (the rate of false negatives) are typically not controlled but depend critically on the amount of data brought to bear on the question at hand. The probability of a correct positive test (one minus the rate of false negatives) is known as the "power" of the test. Statisticians try to control the size while maximizing the power. Power is, unsurprisingly, typically low in very small samples.

If I choose to run a statistical test, am I required to act on what the test finds? Does this remain true if I know that the test has poor size and power properties?

Suppose I estimate a model with 40 observations and then run a diagnostic test for, say, normality. The test was developed using asymptotic principles (basically an infinitely large data set) and because I have such a small series, this means that the test's size is unlikely to be well approximated by its stated nominal significance level (which is usually set to 5%).Suppose the test indicates non-normality. Was this result caused by the size distortion (the probability of erroneously finding non-normality), or does the test truly indicate that the residuals of the model follow some other (unspecified) distribution?

If I had a large amount of data, I would be able to answer this question accurately and the result of the test would be reliable and useful. With 40 observations, the most prudent response would be to doubt the result of the test, regardless of what it actually indicates.

### Finding non-normality

Suppose instead that you are confident that the test has sound properties. You have found non-normality: Now what? In modeling literature, there are usually no suggestions about which actions you should take to resolve the situation. Most estimators retain sound asymptotic properties under non-normality. In small samples, a finding of non-normality typically acts only as a beacon – warning estimators to guard against problems in calculating other statistics. Even if the test is sound, it is difficult to ascertain exactly how our research is furthered by knowledge of the result. In this case, given the tiny sample, it is unlikely that the test actually is sound.

If a diagnostic test has dubious small sample properties, and if the outcome will have no influence over our subsequent decision-making, in our view, the test simply should not be applied. Only construct a test if the result will actually affect the subsequent analysis.

### Dealing with strong prior views

The next question concerns the use and interpretation of tests when strong prior views exist regarding the likely underlying reality. This type of concept may relate to a particular statistical feature of the data – like issues of stationarity – or to the inclusion of a given set of economic variables in the specification of the regression equation. In these cases, even though we have little data, and even though our tests may have poor size and power properties, we really have no choice but to run some tests in order to convince the model user that our specification is a reasonable one.

Ideally, the tests performed will merely confirm the veracity of our prior views based on our previously established intuitive understanding of the problem.

If the result is confounding, however, given that we have only 40 observations, the tests are unlikely to shake our previously stated prior views. If, for example, our behavioral

model states that term deposit volume really must be driven by the observed term spread, and if this variable yields a p-value of 9%, should we drop the variable from our regression? The evidence on which this result is based is very weak. In cases where the prior view is well thought out and appropriate, like this example, we would typically not need to shift ground until considerably more confounding evidence were to surface.

If, instead, the prior suggested a "toss-up" between a range of hypotheses, the test result would be our guiding light. We would not bet the house on the outcome, but the test result would be better than nothing. Toss-ups, however, are very rare in situations where the behavioral model structure has been carefully thought out before any data has been interrogated.

### Running tests with limited data

With the advent of fast computers and powerful statistical packages, modelers now have the ability to run a huge number of tests effortlessly. Early econometricians, like the aforementioned Ms. Walker, would look on in envy at the ease with which quite elaborate testing schemes can now be performed.

Just because tests can be implemented does not mean that they necessarily should be. Modern modelers, faced with tiny data sets, should follow the lead of the ancients (many of whom are still alive) and limit themselves to running only a few carefully chosen tests on very deliberately specified models.

Regulators, likewise, should not expect model development teams to blindly run every diagnostic test that has ever been conceived.

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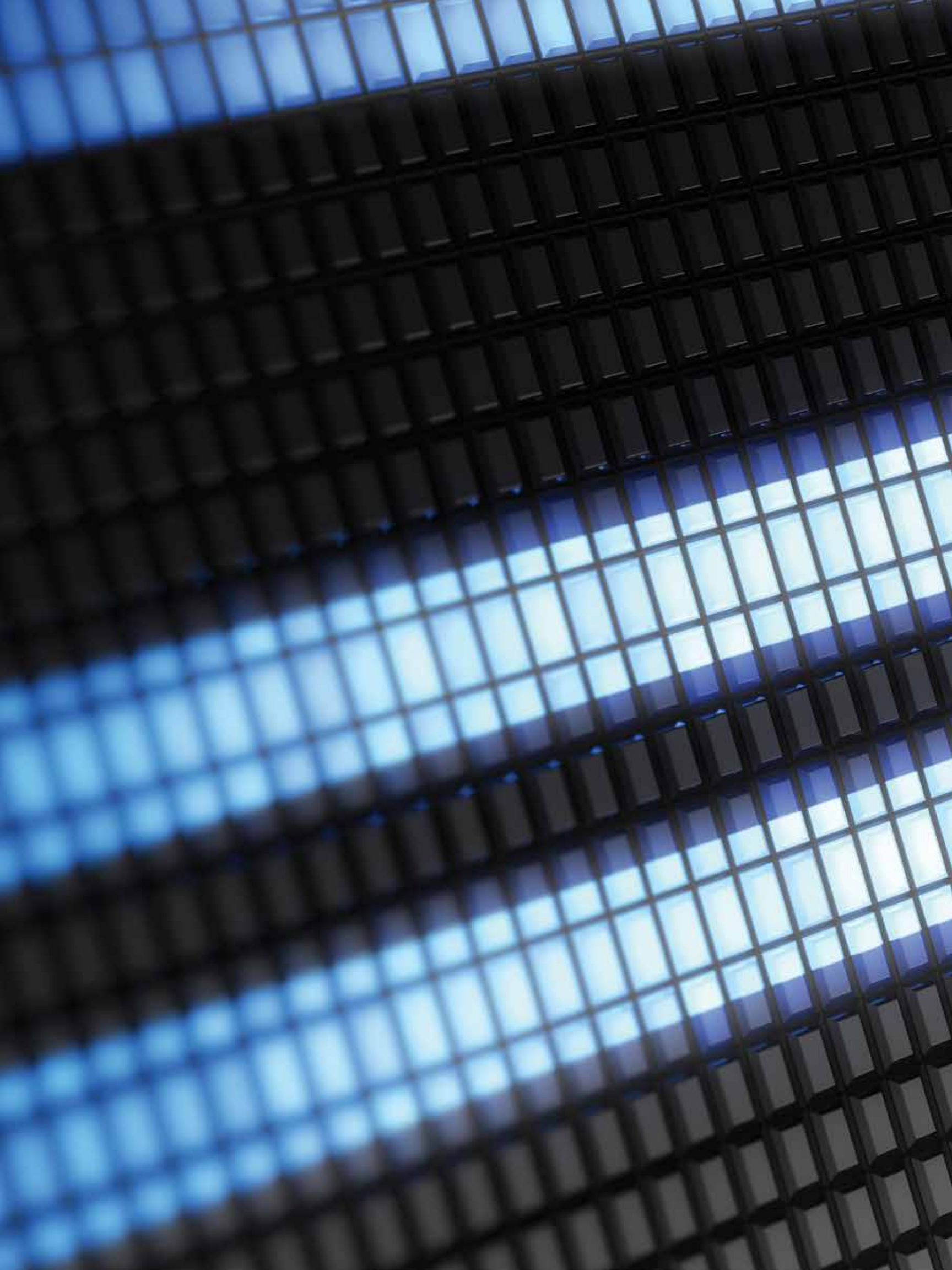
# APPROACHES TO IMPLEMENTATION

# REVISING THE PLAYBOOK: USING A RISK APPETITE FRAMEWORK TO ALIGN STRATEGY AND RISK

By Ed Young and Anna Krayn

**Ed Young**
*Senior Director, Capital Planning and Stress Testing*

Ed Young is a Senior Director on the Stress Testing and Capital Planning Team. In this capacity, he focuses on structuring solutions that bring together capabilities across Moody's Analytics to support robust capital planning and stress testing processes. His primary focus is on clients in the banking and insurance sectors across the Americas.

**Anna Krayn**
*Senior Director and Team Lead, Capital Planning and Stress Testing*

Anna is responsible for the business development of the stress testing and capital planning solutions. Her clients include a variety of financial services institutions, including those in the insurance, banking, and consumer finance sectors across the Americas.

Connecting an enterprise-level risk appetite statement tangibly to business strategies and risk limits can be very challenging. In fact, 65% of respondents in the IACPM / PWC Survey cited integration of risk appetite into decision-making process as the biggest challenge in RAF implementation.[1]

For large firms, regulators have an expectation that capital distribution decisions are informed by risk identification and management processes that tie to a firm's overarching risk appetite. While many firms may have strong risk management processes in place for specific risk discipline they struggle to develop a robust firm-wide process that is transparent to a third party.

This article is the first in a series that will analyze this topic. In it we provide an overview of some common problems organizations face and introduce a solution to develop an integrated, transparent, measurable, and actionable Risk Appetite Framework.

## Introduction

Senior management and Boards of large financial firms are confronted with the challenge of taking the concept of a universal risk appetite statement and translating it into a meaningful framework for managing their businesses. Both Board members and senior management have important roles to play in this process. The Board must develop the overall risk appetite for the organization and make certain there is a governance process in place to ensure the business does not take unacceptable risks to meet profitability targets. Senior management is responsible for developing and implementing a process that aligns business strategies and risk management with the Board's stated risk appetite. It is imperative that these senior leaders work together to develop a process that accurately represents the risk appetite of the firm.

Financial services companies are facing business complexities in a rapidly changing industry which often leads to a fragmented, opaque view of risk at the enterprise level. Often, this is compounded by lack of quality internal data, changing market dynamics, and the seemingly continuous change in regulatory expectations. This amalgamation of circumstances has hindered many organizations from developing

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1    *Risk Appetite Frameworks Insights into evolving global practices*, An IACPM/PwC Study, November 2014.

a comprehensive, clear picture of the risks they face. In this article, we describe some common problems and set forth an overarching roadmap to develop a robust Risk Appetite Framework.

### Assessing the problem

The supervisory expectation for large financial firms is for them to develop and maintain a comprehensive Risk Appetite Framework that

While firms have strong risk management in place for individual material risks, most struggle to provide a compelling narrative of how they have an effective firm-wide process to their regulators. This is true globally, as noted by the Financial Stability Board: "… *effective Risk Appetite Frameworks (RAFs) that are actionable and measurable by both financial institutions and supervisors have not yet been widely adopted.*" [3]

Figure 1  Comprehensive Risk Appetite Framework



| 1 | Risk ID Process |
| 2 | Risk Appetite Calibration |
| 3 | Risk Measurement and Management |
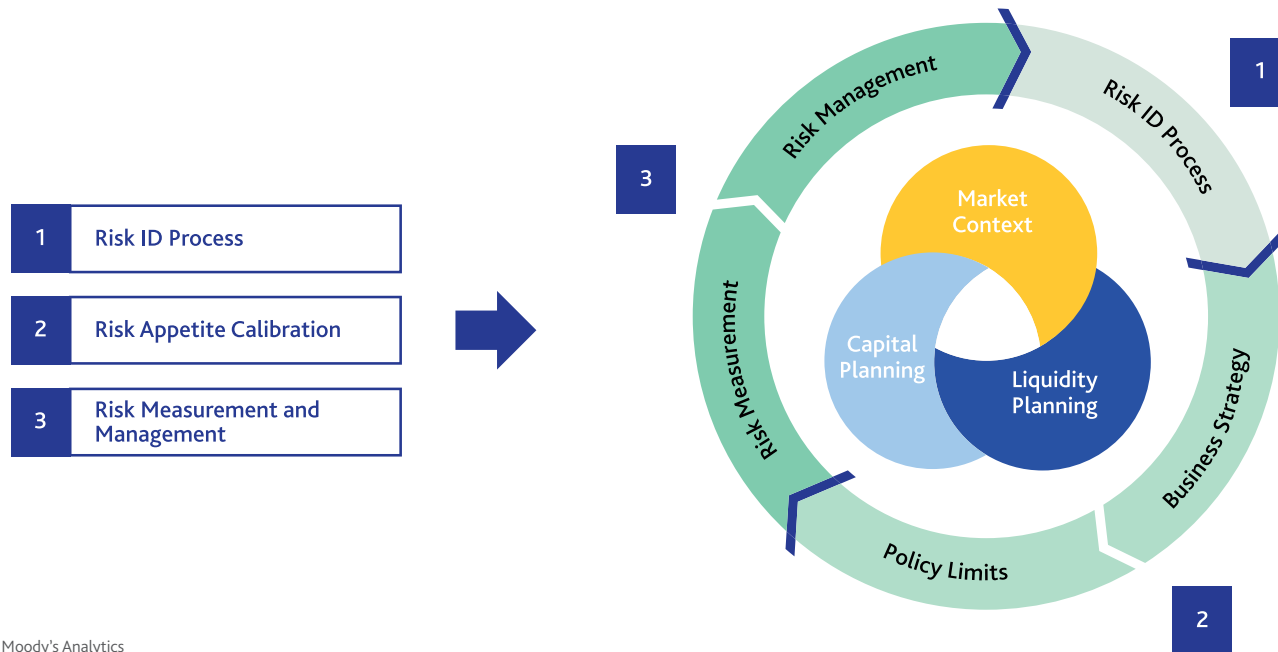
Source: Moody's Analytics

is integrated, transparent, measurable, and actionable. However, there is no clear guidance for what actually constitutes an acceptable process. For example, an expectation outlined by the Federal Reserve in the 2015 CCAR instructions is as follows: "… *large BHCs are to have thorough and robust processes for managing their capital resources, and that the processes are supported by effective firm-wide risk-identification, risk-measurement, and risk-management practices.*" [2] The expectation is outlined clearly, but the path to success is left up for very broad interpretation.

The key impediment is lack of a holistic view of a firm's risk position that incorporates all material risks. No one risk measure or model does an acceptable job of considering all material risks for a firm. However, using a variety of lenses to view risk enables senior leaders to view specific risks with a reasonable amount of depth and to view risks broadly and assess their interdependencies and impact on pro-forma financial results. Most firms can leverage a group of complementary risk tools to construct a mosaic that encompasses key risks and conveys an effective enterprise-wide

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2   *CCAR 2015 instructions Federal Reserve,* October 2014.

3   *Principles for an effective Risk Appetite Framework,* Financial Stability Board, November 2013.

process. Despite an industry-wide effort, few, if any, firms have developed a robust process that is transparent to a third party, repeatable and easily auditable. In most cases, the end result is a qualitative process that combines a multitude of reports together in an ad-hoc fashion to appease regulators.

### Step 1: Establishing a foundation

Risk measurement and management generally continues to be fragmented along the lines of risk buckets outlined by the Basel Committee (credit risk, market risk, and operational risk). The factors that led to this current state include limitations of legacy risk measurement systems, siloed organizational structures and fragmented regulatory oversight. Advancements in technology and revised supervisory expectations are now enabling (and forcing) these historical barriers to be broken down. This enables senior leaders to apply the tenets of a robust Risk Appetite Framework including a comprehensive risk identification process, a wide-ranging risk calibration process, and a risk measurement and management structure that supports and reinforces the firm's overarching risk appetite statement. Adopting this framework allows a firm to tangibly link enterprise-level risk appetite statement to business strategies and associated risks.

The first step in developing a robust Risk Appetite Framework is to get a comprehensive understanding of the risks that are faced by the firm, commonly referred to as an organization's risk identification process. The risk identification (or Risk ID) process should highlight risks and relationships in multiple dimensions and ultimately inform decision-making of the senior leaders of the organization. To adequately support the Risk ID process, the organization must develop an overarching structure that incorporates a common risk taxonomy, specified roles, responsibilities and ultimate accountability for identifying and assessing the materiality of the first and second order risks that impact the firm. An effective Risk ID framework combines multiple quantitative tools with qualitative processes to enable a firm to see risks that span many traditional risk buckets and can provide the depth of information needed to assess specific risks in detail. This requires a suite of tools used throughout the business lines, from which outputs can be aggregated to provide a robust picture of how risks can impact the firm.

To accomplish the goal of corralling risks across business lines into a central repository an organization needs a platform that provides a consolidated view to ensure all material risks are identified. Developing a process that is transparent, repeatable, and manageable is paramount to ensuring it is adopted across the various business lines of the organization. Transparency enables individuals throughout the organization to understand how their input is used to inform the "bigger picture" of risk at the organization. A Risk ID process will only be successful if a repeatable feedback loop is established to ensure the risk inventory is accurate and dynamically updated to include emerging risks and changes in market conditions. Finally, the process must be manageable to make it a complement that adds value to business decisions, as opposed to being considered a compliance exercise.

### Step 2: Developing a strategy

Once a Risk ID process is established, the next step is to calibrate business strategies and the associated risk limits to ensure they meet their goals without taking undue risk in the process. While business strategies are not often discussed in the context of risk limits, it is critical for an organization to consider them in tandem when making strategic decisions. This "calibration" of risk limits in the context of business strategies must be somewhat dynamic, and must consider internal factors such as credit underwriting standards, portfolio concentration risk or any emerging risks that may be a result of entering a new

product line, while also keeping sight of macro trends related to economy or competition in specific market segments.
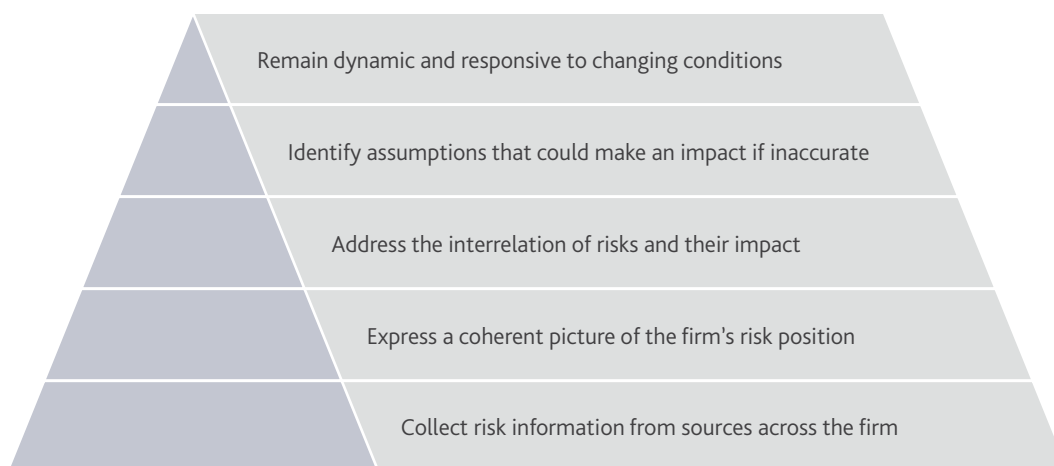
The preceding requires integration of multiple tools into a flexible enterprise software platform to calibrate a firm's risk appetite effectively. The concept of tying an assertion of 'risk appetite' to formalized strategies and limits that can be expressly measured is not easy. The framework needs the structure to develop and formalize the process. A consolidated aggregation platform also creates a much more transparent and auditable process. It establishes a 'corporate memory' for the governance of the Risk Appetite Framework.

To be able to calibrate the risk appetite of an organization, initially the Board must define specific metrics that can be used to anchor the process. This expression of the firm's risk appetite must include units of measure that include both magnitude and a stated time horizon. A risk appetite statement should include multiple metrics that articulate the amount of risk the organization is willing to take to meet specified goals. To do this a firm may couple explicit earnings loss limits over a one-year horizon with an average return

on equity ratio over a five-year horizon. For example, the goal may be to limit total losses over a one year time horizon to less than 1.5 times the previous year's earnings, as long as the average five-year return on equity exceeds 8%.

There are a multitude of factors that can influence the financial performance of an organization, including asset quality deterioration, market shocks and liquidity events. Unfortunately, these factors do not usually occur in isolation and require management to consider a few key items when formulating a risk limit framework. Initially, a firm should implement a process of collecting relevant risk specific information from models and processes throughout the organization. Firms should ensure that both quantitative and qualitative information is collected to enable senior leaders to form a rudimentary, yet coherent picture of the firm's risk position. This collection process should include a wide range of elements, such as operational key risk indicators, credit portfolio metrics, reputational risk concerns, market and liquidity risk metrics as well as anecdotal information from each line of business. This, in turn, requires cultivating a culture of risk awareness throughout each group within the organization.

Figure 2  Risk appetite calibration



- Remain dynamic and responsive to changing conditions
- Identify assumptions that could make an impact if inaccurate
- Address the interrelation of risks and their impact
- Express a coherent picture of the firm's risk position
- Collect risk information from sources across the firm

Source: Moody's Analytics

Next, current and future business strategies as well as external market conditions need to be evaluated to help establish a comprehensive set of risk limits that include input from processes used to evaluate specific risks such as credit, liquidity, and business risk. Once specific risk limits are solidified, an organization should assess the impact of multitude of risks on the firm's performance through the stress scenario design process and apply additional risk limits that capture elements that were not evident through the evaluation of specific risks. This approach is primarily accomplished by taking a broad view of risks through a set of deterministic scenarios that incorporate both macroeconomic and idiosyncratic factors and should be developed with input from a suite of models paired with expert judgment.

Once this process is established it is important to ensure effective governance is put in place. To ensure that business strategies and risk limits remain in sync with the firm's risk appetite, a firm should identify key assumptions that could impact the effectiveness of the framework to senior leaders. Finally, this process should be repeated frequently to ensure business strategies and risk limits remain effective and aligned with the stated risk appetite.

### Step 3: Measurement and management

After the firm's risk appetite is calibrated to its business strategy and associated risk limits it is critical that an effective risk measurement system is put in place. The risk measurement component is critical to establishing a strong feedback loop to solidify the Risk Appetite Framework. Dynamic risk measurement begins with a robust scenario design process. Stress scenario analysis is typically completed on a relatively small number of future "states of the world," so developing meaningful scenarios is critical. Many firms rely on a combination of internal and external sources to develop stress scenarios. While most have developed an effective process to consider macro factors and their impact on the organization, some fall short of fully incorporating information provided by other risk tools and strategic plans into the scenario design process. For example, firms can leverage information from credit portfolio models (e.g., economic capital models) that use a robust simulation approach to identify additional idiosyncratic and emerging risks to support the scenario design process. This enables senior leaders to strategically assess the impact of current portfolio construction and future business strategies to ensure profits are maximized for the level of risk taken by the firm.

Identifying the risk metrics of an effective risk measurement system is needed to ensure risk managers have the information needed to take prompt action when needed. Risk metrics should include various measures that take into account the timing and accounting impacts of deterministic scenarios over a specified time horizon(s) and the interaction of multiple risks on the consolidated income statement and balance sheet. Additionally, profitability and in-depth portfolio risk metrics using advanced techniques that consider many possible outcomes must be included to ensure exposures that may not be revealed in deterministic stress scenario analysis are linked to the Risk Appetite Framework.

### Looking into the future

*"Firms that tended to deal more successfully with the ongoing market turmoil through year-end 2007 adopted a comprehensive view of their exposures. They used information developed across the firm to adjust their business strategy, risk management practices, and exposures promptly and proactively in response to changing market conditions."[4]*

The quote above from the Senior Supervisors

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4   *Observations on risk management practices during the recent market turbulence,* Senior Supervisors Group, 2008.

Group report in 2008 suggests that regulatory attention to risk appetite and risk identification is not going to abate. Thus, while linking the firm's risk appetite statement to meaningful risk limits is a difficult task, it is an imperative. Hundreds of full-time resources already dedicated to regulatory compliance and ongoing investments in the tens of millions of dollars create an opportunity to create next-generation business-as-usual risk management practices. Dynamic Risk Appetite Framework that connects risk tools with firm's business strategies is a foundational step. The framework should be further informed by enterprise stress scenario analysis to ensure the framework is comprehensive and is explicitly linked to the capital and liquidity planning processes.

The three step approach outlined in this paper is the baseline for establishing a framework that is integrated, transparent, measurable, and actionable. Distilling the process down to three interlocking sections allows stakeholders throughout the organization to easily understand how their contributions fit into the process. This paper was designed to outline a high-level concept that can be used as a blueprint to link a firm's risk appetite to their day-to-day business activities. However, as with any high-level concept, the devil is in the details. In follow up papers, we will explore practical applications of existing technologies to this framework to align business strategies and risk to a Board's stated risk appetite.

# CREDIT RISK MANAGEMENT UNDER REGULATORY CAPITAL CONSTRAINTS

By Dr. Amnon Levy, Dr. Pierre Xu, and Dr. Jing Zhang

**Dr. Amnon Levy**
*Managing Director, Head of Portfolio and Balance Sheet Research and Modeling Services*

Amnon heads the Portfolio Research Group that is responsible for research and model development for Moody's Analytics portfolio and balance sheet models. His current research interests include modeling credit portfolio risk, integrated models for balance sheet management, and liquidity risk.

**Dr. Pierre Xu**
*Associate Director, Research and Modeling Group*

Pierre is an associate director in the Research and Modeling Group of Moody's Analytics. His current research topics cover PPNR modeling, economic capital, regulatory capital, and portfolio optimization.

**Dr. Jing Zhang**
*Managing Director and Global Head of Research and Modeling, Enterprise Risk Solutions*

Jing's group is responsible for the quantitative modeling behind the EDF and LGD models for both public and private firms, commercial real estate, and portfolio analytics. He has many years of experience advising clients on risk management issues.

This article outlines recent approaches to managing credit risk when facing regulatory capital requirements. We explore how institutions should best allocate capital and make economically-optimized investment decisions under regulatory capital constraints, such as those imposed by Basel or CCAR-style rules.

## Introduction

Credit portfolio risk is measured by the required Economic Capital (EC), which reflects diversification, concentration, and other economic risks. In recent years, however, higher capital standards imposed by new stress testing requirements and Basel III have forced organizations to address how to better manage capital to meet regulatory constraints.

While maintaining the required level of Regulatory Capital (RegC) is necessary and indeed mandatory, simply satisfying the requirement does not necessarily align with stakeholders' preferences for optimal capital deployment and investment decisions. In other words, RegC and CCAR-style stress testing are requirements that organizations have to adhere to and likely do not reflect how stakeholders trade off risk and return.

For instance, a typical RegC measure, such as the Basel Risk-Weighted Asset (RWA), does not account for diversification and concentration risk, which are important to stakeholders. In general, regulatory measures such as RWA are not as risk-sensitive as economic measures. This shortcoming of RegC underscores the importance of EC, which better captures risks that reflect stakeholders' preferences.

Ideally, institutions should account for both EC and RegC when making business decisions – including strategic planning, pricing, portfolio management, and performance management. For example, if two potential deals have an identical expected return and RWA but different EC, management should favor the lower EC. Similarly, if two deals have the same EC but different RWA, lower RWA is more desirable.

The challenge lies in quantifying a unifying measure where return, RWA, and EC all enter into a single measure that assesses a deal's profitability – organizations need a unifying EC and RegC measure. Levy, Kaplin, Meng, and Zhang (2012) propose the concept of integrating EC and RegC. They incorporate regulatory capital requirements into a traditional economic framework underpinning EVA- and RORAC-style decision measures. Xu, Levy, Kaplin, and Meng (2015) provide a practical approach of measuring the degree to which an organization is capital-constrained and the degree to which weight should be placed on RegC in business decisions.

At a high level, RegC should not enter into decision rules when it is not constraining. Organizations do not need to account for the RegC constraint if they meet all RegC requirements regardless of business decisions.

Alternatively, a deal that consumes a high level of RegC is particularly unattractive to an organization that is heavily constrained by RegC.

Xu and Levy (2015) extend the work of Levy, Kaplin, Meng, and Zhang and propose a composite capital allocation measure (mostly referred to as composite capital measure, or CCM) integrating EC and RegC. The metric allocates an institution's top-of-the-house capital in a way that accounts for both economic risks and the degree to which RegC is constraining. This article provides an overview of these recently developed approaches and discusses how financial institutions can use them to improve risk management and business decisions.

### Capital deployment under regulatory capital constraints

The challenge financial institutions face when managing economic and regulatory capital lies in designing and deploying a capital measure that aligns incentives of both management and stakeholders that account for both economic risks and regulatory constraints. While measuring economic risks and RegC on a stand-alone basis is imperative, a capital charge must ultimately be allocated to align incentives to maximize an organization's value. The approach proposed by Levy, Kaplin, Meng, and Zhang (2012) and Xu and Levy (2015) highlighted above leverages a traditional economic framework, one where an organization's stakeholders maximize returns while recognizing risk. The novelty in the approach is in imposing a regulatory constraint. The formal model produces a composite capital measure; whereby the degree to which an organization's RegC is constraining determines the degree to which weight is placed on RegC.

Figure 1 depicts the relationship between the instrument EC and the required regulatory capitalization rate, also referred to as Risk-

**Figure 1** EC vs. RWC and composite capital measure
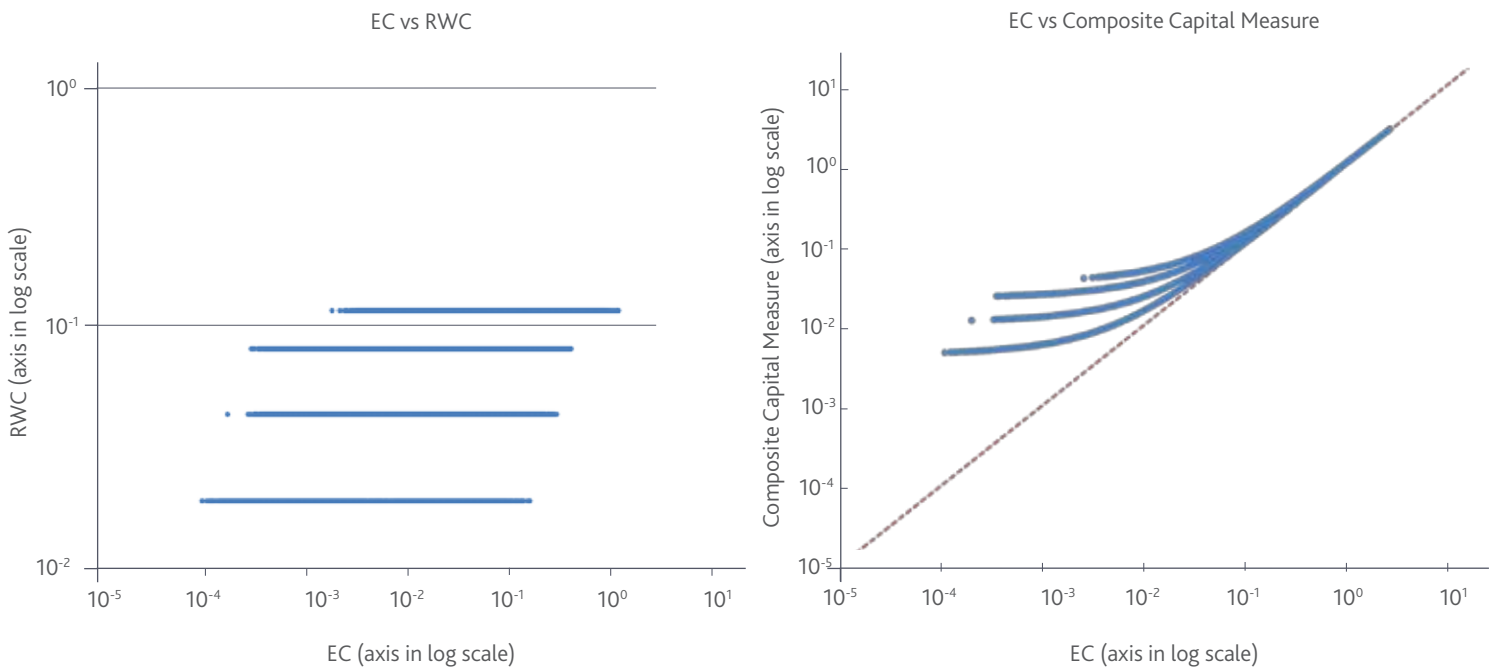


On the left side, instrument RWC plotted against EC. RWC is computed by the Basel II standardized approach. On the right side, instrument CCM plotted against EC. RWC computed by the Basel II standardized approach is used as the input to determine CCM.

Source: Moody's Analytics

Weighted Capital (RWC) (computed by the Basel II standardized approach), on the left side for a typical credit portfolio. In general, RWC is relatively higher for safer instruments, and vice-versa. This finding is also true when RWC is determined according to the Advanced Internal Ratings-Based (IRB) approach, as is shown by Xu, Levy, Meng, and Kaplin (2015) and Xu and Levy (2015).

increase the capital needed on top of traditional EC. Another important observation is that two sets of asymptotes exist in this figure. CCM converges with EC as EC increases to a high level. This asymptote reflects CCM's ability to capture the full spectrum of risk, including diversification and concentration risk unaccounted for by RegC.

Historically, the deleverage ratio attributed to Basel and stress testing requirements, defined as the percentage decrease in leverage, is approximately 15% to 30% for US and European banks. This observed deleveraging speaks to the degree to which RegC is constraining.

The right side of Figure 1 compares instrument CCM with EC. Note that CCM is generally higher than EC. This finding is not surprising, as the regulatory capital constraint is expected to

As EC decreases, CCM flattens to four levels. Recall, we use the Basel II standardized approach to determine RegC, which results in four unique levels of RWC. Thus, each of

**Figure 2** EC vs. Effective RWC under CCAR requirements and composite capital measure
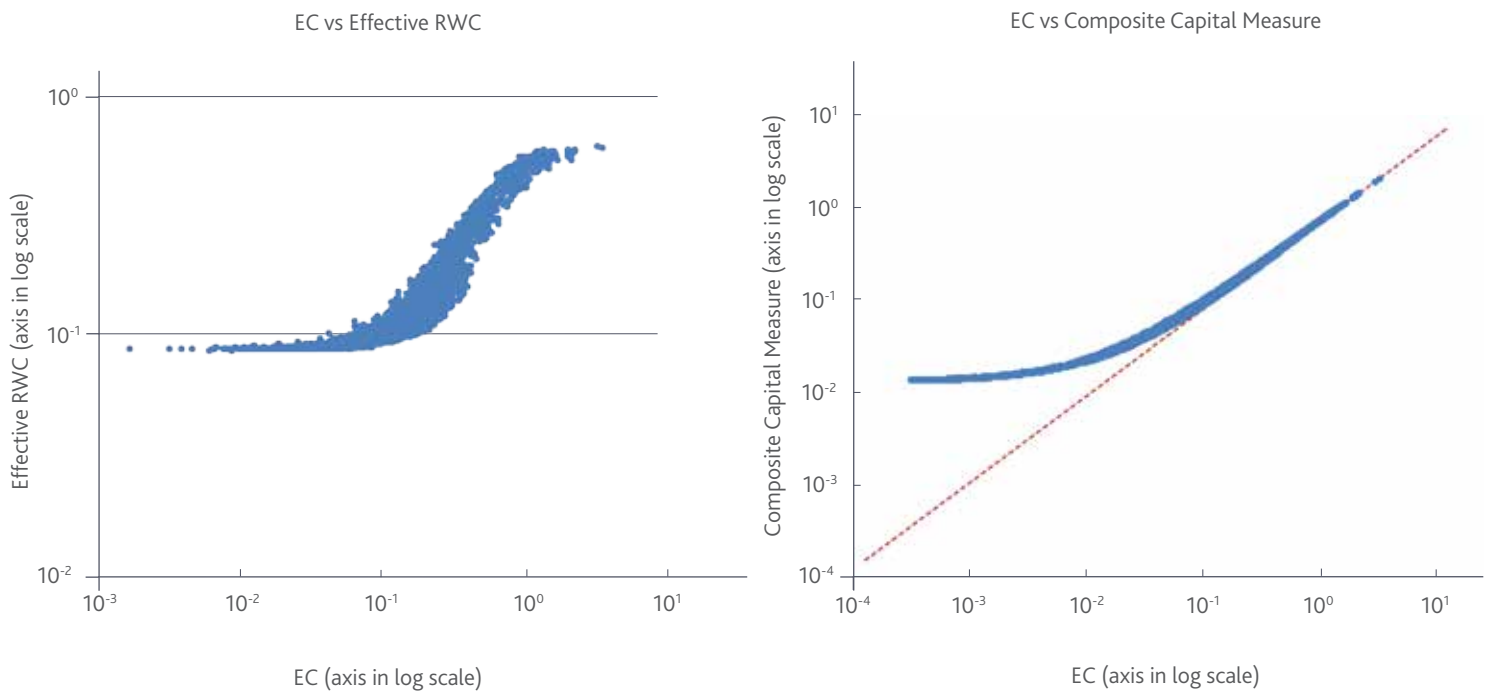


On the left side, instrument-effective RWC plotted against EC. Effective RWC computed under the 2015 CCAR severely adverse scenario. On the right side, instrument CCM plotted against EC. CCM computed based on effective RWC under the CCAR severely adverse scenario.

Source: Moody's Analytics

the four asymptotes to the left represents the minimum level of capital needed for instruments with a certain RWC level, reflecting CCM's ability to ensure enough capital is allocated to meet RegC requirements.

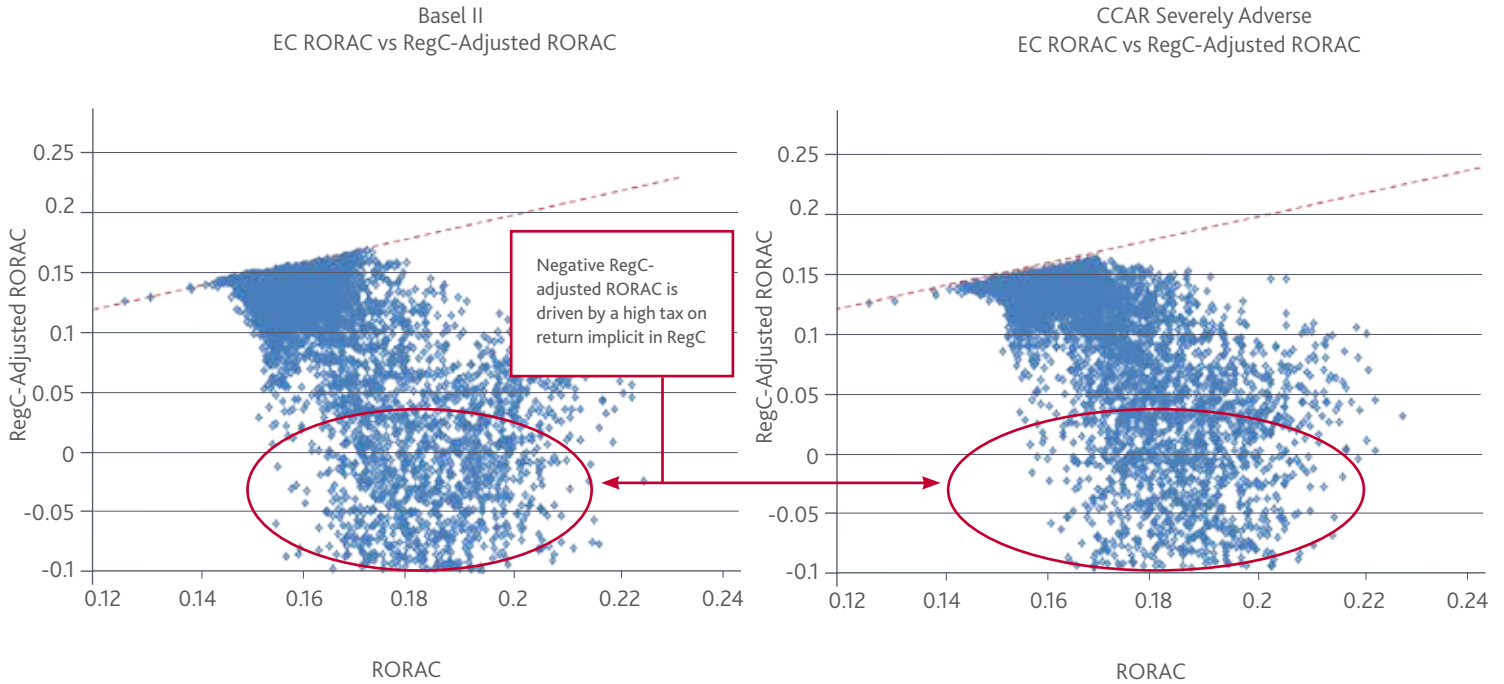The difference between RegC and EC brings up a dilemma when financial institutions plan

risk management system calls for a more appropriate capital allocation measure, such as EC, which accounts for not only default risk, but also diversification and concentration risk. The ideal solution leverages a capital allocation measure such as CCM, which takes into account the full spectrum of risk and, at

> Using RegC-adjusted RORAC, institutions can improve the risk-return attractiveness of the portfolio while meeting RegC requirements ... a 2.5% portfolio turnover rate can increase the expected return of the portfolio by 60 bps, while keeping the required RegC constant. Furthermore, as institutions increase the portfolio turnover rate, the portfolio rate of return on both RegC and EC increases.

capital allocation. On the one hand, the need to meet the ever-increasing regulatory capital standard pulls institutions toward capital allocation by RegC. On the other hand, a sound

the same time, ensures that the proper amount of capital is allocated to meet regulatory requirements. What is worth highlighting is the tremendous amount of CCM allocated to

**Figure 3**  RegC-adjusted RORAC vs. RORAC



Basel II
EC RORAC vs RegC-Adjusted RORAC

CCAR Severely Adverse
EC RORAC vs RegC-Adjusted RORAC

Negative RegC-adjusted RORAC is driven by a high tax on return implicit in RegC

Instrument RegC-adjusted RORAC plotted against unadjusted RORAC under different regulation requirement. On the left, the RegC-adjustment is made under the constraint of the Basel II standardized capital requirement. On the right, the RegC-adjustment is made under the constraint of the CCAR stress testing requirement.

Source: Moody's Analytics

high credit quality names. While not surprising given the high level of RegC being allocated, the results are striking when compared with EC.

Intuitively, CCM can be regarded as a combination of EC and RWC. The relative weight of EC and RWC in CCM is institution-specific. It is determined by how constraining the RegC requirement is for the institution. As Xu, Levy, Meng, and Kaplin (2015) illustrate, the degree

EC decreases, the effective RWC converges to 8%, which is the minimum RegC required. As EC increases, effective RWC becomes much more correlated with EC; instruments with larger EC are associated with more severe losses during a stressed scenario, requiring more capital buffer and a higher effective RWC. Once we know the instrument-effective RWC, we can compute CCM accordingly.

**Table 1** Improved portfolio composition using RegC-adjusted RORAC

| Portfolio Turnover* | ES | RegC | EC | RegC RORAC | EC RORAC |
|---|---|---|---|---|---|
| 0.0% | 1.06% | 7.25% | 5.92% | 16.6% | 19.8% |
| 2.5% | 1.12% | 7.25% | 6.14% | 17.4% | 20.2% |
| 5.0% | 1.16% | 7.25% | 6.30% | 17.9% | 20.4% |
| 7.5% | 1.20% | 7.25% | 6.44% | 18.6% | 20.7% |

*Portfolio turnover is defined as the percentage of portfolio rebalanced (sold and reinvested) in terms of notional amount.

Source: Moody's Analytics

of RegC constraint can be measured by how much the institution must deleverage due to the RegC requirement. Historically, the deleverage ratio attributed to Basel and stress testing requirements, defined as the percentage decrease in leverage, is approximately 15% to 30% for US and European banks. This observed deleveraging speaks to the degree to which RegC is constraining.

Similar to Basel-style rules, CCAR requires adequate capital under severe economic downturns. This boils down to a required capital buffer that adheres to the portfolio's RWC, while accounting for erosion due to stressed expected losses conditioned on the downturn scenario.

The left side of Figure 2 compares instrument EC with effective RWC for a sample portfolio under a severely adverse CCAR scenario. As

The right side of Figure 2 presents instrument CCM against EC under the CCAR requirement. Similar to CCM under the Basel II capital requirement, instrument CCM under the CCAR requirement also exhibits two asymptotes – CCM converges to EC as EC increases to a high level, and CCM flattens out as EC becomes very small. The intuition behind this pattern is the same as explained previously for CCM under Basel-style capital requirements.

### Business decisions under regulatory capital constraints

In practice, stakeholders prefer an institution to deploy capital across the organization and make investment decisions that maximize the institution's overall return-risk trade-off while satisfying regulatory requirements. Integrating EC with RegC allows financial institutions to allocate capital across businesses with a risk

metric that accounts for diversification and concentration risk, as well as the regulatory constraints.

In addition, the integrated approach provides decision rules that optimize portfolios from an economic perspective while adhering to RegC requirements. Traditional Return on Risk-Adjusted Capital (RORAC) measures are adjusted to account for investments' RegC burden. Intuitively, the RegC adjustment can be thought of as a tax that lowers an instrument's effective return.

Figure 3 compares RegC-adjusted RORAC with standard RORAC under Basel II and CCAR. The two measures are generally very different. In particular, safe instruments tend to have very low or even negative RegC-adjusted RORAC; the low return of safe instruments is not sufficient to cover the implicit cost of the RegC constraint.

Using RegC-adjusted RORAC, institutions can improve the risk-return attractiveness of the portfolio while meeting RegC requirements. Table 1 illustrates the impact of re-weighting the sample portfolio where instruments with the lowest RegC-adjusted RORAC are traded for those with the highest RegC-adjusted RORAC. What is impressive is that a 2.5% portfolio turnover rate can increase the expected return of the portfolio by 60 bps, while keeping the required RegC constant. Furthermore, as institutions increase the portfolio turnover rate (i.e., trade more instruments according to RegC-adjusted RORAC), the portfolio rate of return on both RegC and EC increases.

## Conclusion

Under higher capital standards imposed by new stress testing requirements and Basel III, organizations should account for both economic risk and regulatory constraints when managing capital and making business decisions. CCM and RegC-adjusted RORAC measures help institutions achieve this goal. CCM allocates an institution's top-of-the-house capital in a way that accounts for economic risks, as well as the degree to which RegC is constraining. RegC-Adjusted RORAC helps institutions improve the risk-return attractiveness of their portfolios, while maintaining the required RegC level.

1    Moody's Analytics Quantitative Research Group, *Modeling Credit Portfolios*, 2013.

2    Amnon Levy, Andrew Kaplin, Qiang Meng, and Jing Zhang, *A Unified Decision Measure Incorporating Both Regulatory Capital and Economic Capital*, 2012.

3    Pierre Xu, Amnon Levy, Qiang Meng, and Andrew Kaplin, *Practical Considerations When Unifying Regulatory and Economic Capital in Investment Decisions*, 2015.

4    Pierre Xu and Amnon Levy, *A Composite Capital Allocation Measure Integrating Regulatory and Economic Capital*, 2015.

# DATA VISUALIZATION IN CREDIT RISK MANAGEMENT: A SNAPSHOT

By Mehna Raissi and Grace Wang

**Mehna Raissi**
*Senior Director, Enterprise Risk Management Solutions*

Mehna is responsible for the management and product innovation of Moody's Analytics premier credit risk management tools – the single obligor credit risk products suite, which includes RiskCalc, Commercial Mortgage Metrics, and LossCalc. Mehna has a background in banking and has worked within the product management, business process improvement, and change management groups.

**Grace Wang**
*Director, Enterprise Risk Management Solutions*

Grace works on the single obligor product suite and is responsible for the Credit Research Database (CRD™) data and reporting products and loss given default (LGD) models and solutions in the risk measurement group. She has held project and product management roles across the risk measurement, structured finance, and stress testing groups.

> In order to thrive in today's competitive environment, financial institutions are adapting to rapidly changing business demands and regulatory requirements and finding new ways to transform their data into business insights and opportunities. Data visualization is an emerging trend in credit risk management.

## What is data visualization?

According to Wikipedia, "Data visualization is viewed by many disciplines as a modern equivalent of visual communication. A primary goal of data visualization is to communicate information clearly and efficiently to users via the statistical graphics, plots, information graphics, tables, and charts selected. Effective visualization helps users in analyzing and reasoning about data and evidence. It makes complex data more accessible, understandable and usable".

Our experience has been that data visualization is a powerful tool that enables you to take a vast set of data, analyze it, quantify it, and present it in a visually-appealing and easy-to-understand manner. Not surprisingly, data visualization has become essential for gaining business intelligence and insights, expanding business beyond traditional practices, and achieving a competitive advantage in the marketplace.

## Data challenges

As financial institutions seek to leverage their data assets to manage credit risk more effectively, they face a number of barriers. Data quality is one of the top challenges that we find across financial institutions. This challenge becomes magnified as the volume and sources of data grow. It should not come as a surprise that data quality is fundamental to sound credit risk management, as data is often the basis of credit risk decisions. It is therefore critical for the data to be correct and reliable. Secondly, financial institutions have seen significant changes since the last economic crisis. Organizational structure, including newly developed business groups or silos, makes it difficult to collect data across the organization. This results in fragmented data and an incomplete view of enterprise risk. Technology is a third impediment. The list of technology complaints is long: multiple systems trying to accomplish the same goal but producing different results, disconnected legacy applications that have been adopted through mergers and acquisitions, lack of knowledge about these systems, dependency on IT for problem resolution and decision support, etc. The result of these challenges is inconsistency throughout the organization, lack of transparency, and slow turn-around time for analytics and reporting.

## Using data visualizations tools

Historically, banks have relied on IT and third-party consultants for data management, data aggregation, and decision support, but increasingly financial institutions are turning to data visualization tools to help them aggregate, analyze, and glean insight from their data. According to Qlik, a business intelligence and visualization software

provider, data visualization tools are being used by thousands of financial institutions across the globe, including 47 out of the top 50 financial institutions. In the 2012 Big Data @ Work survey conducted by IBM, 71% of the 124 respondents from the financial sector reported that use of big data and analytics (including data visualization) creates a competitive advantage for their organization. Financial institutions, ranging from commercial banks to asset managers to insurers, use data visualization to address a variety of market needs, such as regulatory compliance, portfolio analysis, benchmarking, and model development.

Banks can use data visualization to reduce

that you are using is developed off a data set dominated by large corporate borrowers. You can use data visualization to demonstrate and document that the model is sensitive to mid-sized borrowers and performs well on your portfolio.

Portfolio managers, risk managers, and underwriters at banks and other financial institutions use data visualization to uncover risk concentrations and to inform loan approval decisions. Real-time dashboards can highlight portfolio improvement opportunities. Suppose you discover that your portfolio is overly concentrated in Real Estate counterparties, which is higher risk than your

**Figure 1** Industry distribution
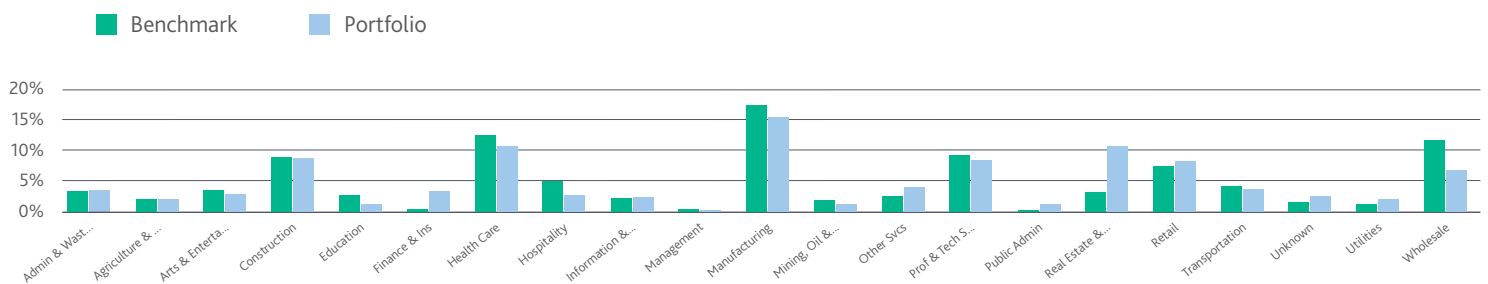


Source: Moody's Analytics

**Figure 2** Industry EDF median
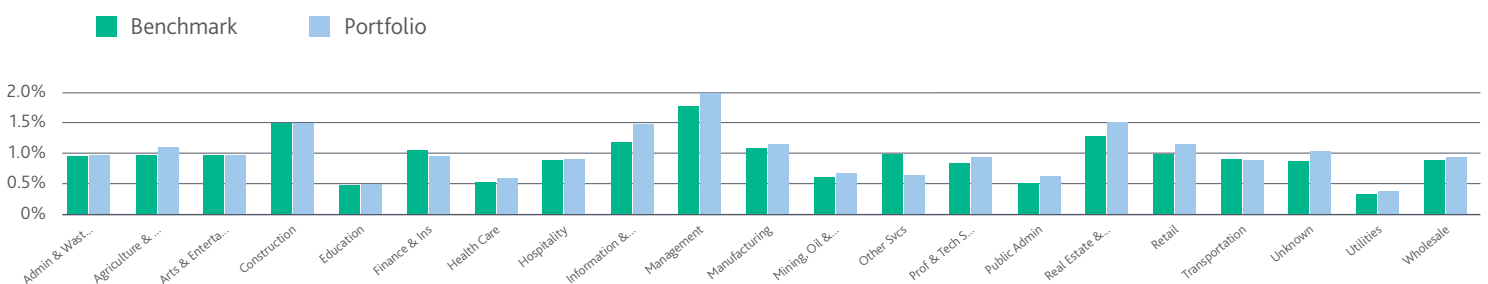


Source: Moody's Analytics

validation effort and to support regulatory discussions. Imagine that you run stressed loss estimation analytics at your bank. You use a third-party model as a challenger to forecast losses for your C&I portfolio. Your C&I portfolio consists of a significant number of mid-sized borrowers from the trade sector, while the model

Northwest portfolio. You next evaluate your exposures in Utilities, managed by a separate line of business within your organization, and find that you have minimal exposure to this sector, even though the Utilities sector has historically been the least risky in your relevant markets. A question to consider – have you been making the

Figure 3  Risk distribution by geography



Legend:
- Aaa
- Aa1
- Aa2
- Aa3
- A1
- A2
- A3
- Baa1
- Baa2
- Baa3
- Ba1
- Ba2
- Ba3
- B1
- B2
- B3
- Caa/C
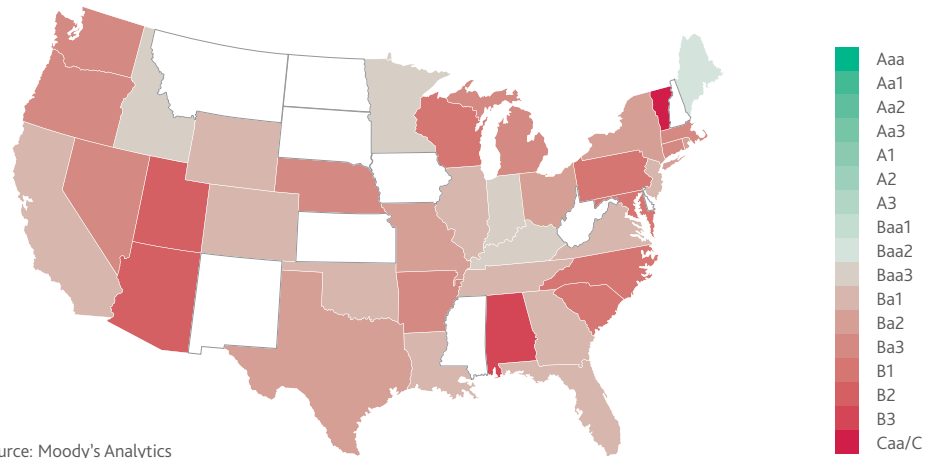
Source: Moody's Analytics

Figure 4  EDF trend



Wtd Avg (2.54%)

- 1987: 0.53%
- 1988: 1.83%
- 1989: 1.77%
- 1990: 1.92%
- 1991: 0.90%
- 1992: 1.33%
- 1993: 2.20%
- 1994: 2.02%
- 1995: 2.39%
- 1996: 2.25%
- 1997: 2.15%
- 1998: 2.18%
- 1999: 2.56%
- 2000: 3.16%
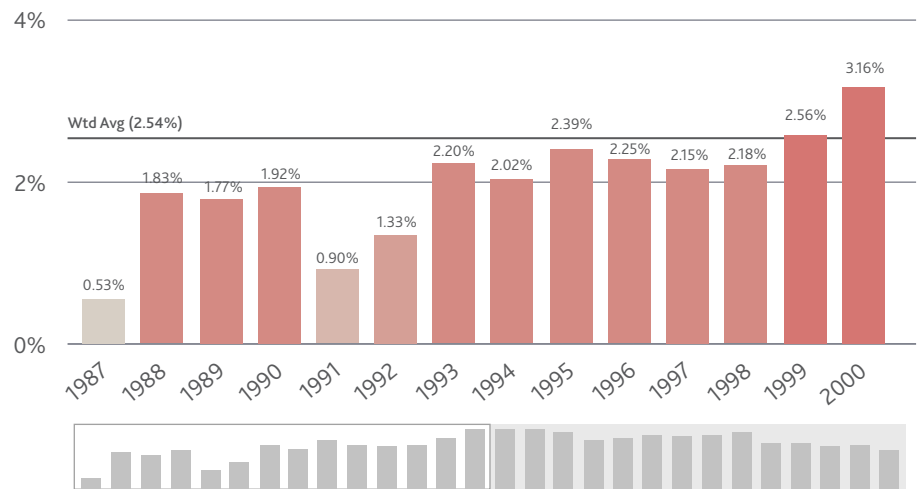
Source: Moody's Analytics

right lending and investment decisions given this new insight?

### Using data visualization for benchmarking

Data visualization is an effective tool for benchmarking, a common practice at financial institutions. Data visualization enables you to quickly answer questions such as "How does our current portfolio compare to our portfolio a year ago?" or "How does our portfolio compare to industry benchmarks?" If you find that interest rates on your new CRE originations have decreased over the past year, then you might suspect that lending practices have changed. However, if you see similar trends in your peers' portfolios, then you might conclude that an external force (e.g., macroeconomic factors) is

at play. Benchmarking helps you understand your portfolio results and trends in a broader context, allowing you to respond more appropriately.

### Model development

Data visualization is also useful for model development. Data visualization tools make it easier for you to visualize large amounts of data across multiple dimensions and to identify trends and relationships in your data. For example, data visualization could help you identify correlations between dependent and independent variables in your retail portfolio that were not previously considered. Using this new information, you could improve the performance and predictive power of your credit risk models.

Figure 5  Rating distribution
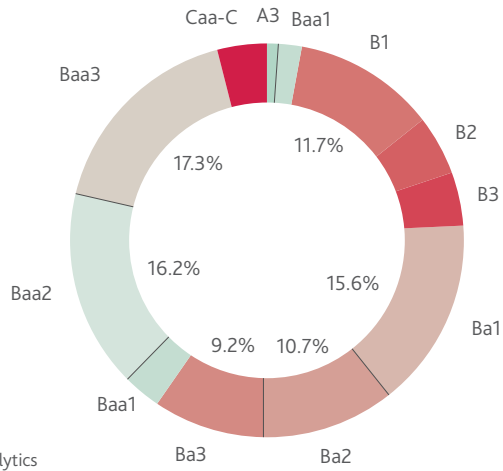


Source: Moody's Analytics

Figure 6  EAD by rating count and EDF
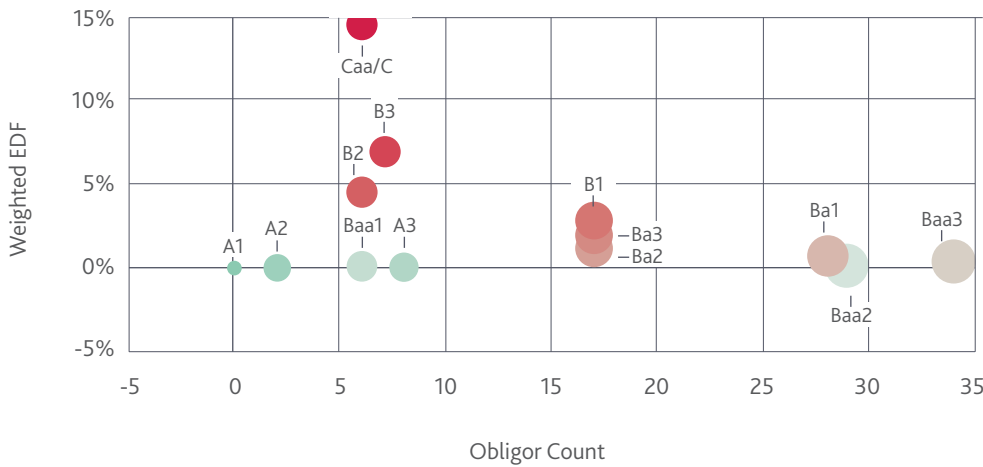


Source: Moody's Analytics

At Moody's Analytics we have invested in and adopted data visualization tools for data quality checks, model development, benchmarking, and business reporting. We also offer data visualization functionality as part of our products. As a leader in enterprise risk management solutions, Moody's Analytics is combining its in-house expertise, proprietary data, and credit risk analytics to provide innovative new products that will help our clients bridge the gap between data and credit risk management.

### Visualize a new world of credit risk analytics

Business transformations driven by data visualization could include real-time data quality dashboards, a comprehensive view of risk across the organization, and self-service analytics that cater to business users and decision makers. Data dashboards allow practitioners to easily pinpoint portfolio outliers and identify potential data quality issues. Data from multiple systems and sources can be linked via a data visualization tool which will serve as a hub for customer intelligence. The hub will facilitate reporting at the enterprise-level rather than across disconnected lines of business, breaking down silos and producing new business insights. IT dependency and long service request queues will be a distant memory, as business users will have direct access to empowering data and analytics for decision making, root cause analysis, and reporting. Last but not least, self-service data visualization will free resources to work on more important business goals.

# ADVANCED ESTIMATION AND SIMULATION METHODS FOR RETAIL CREDIT PORTFOLIOS: FREQUENTIST VS. BAYESIAN TECHNIQUES

Dr. Juan M. Licari, Dr. Gustavo Ordonez-Sanz, and Chiara Ventura

**Dr. Juan M. Licari**
*Senior Director, Head of Economic and Consumer Credit Analytics for EMEA*

Juan and his team are responsible for generating alternative macroeconomic forecasts for Europe and for building econometric tools to model credit risk phenomena.

**Dr. Gustavo Ordonez-Sanz**
*Director, Stress Testing Specialist Team*

Based in London, Gustavo advises financial organizations on the different aspects of stress testing scenario analysis at the firm-wide level. This includes: scenario generation; risk, revenue, and capital modeling and forecasting; embedding scenario analysis in the firm's decision-making processes (risk appetite, portfolio management, pricing, etc.); and governance, infrastructure, and reporting.

**Chiara Ventura**
*Economist, Economic and Consumer Credit Analytics*

Chiara Ventura is an Economist within the Economic and Consumer Credit Analytics team. She joined the company team after completing her summer Internship program.

In this article, we compare the results of estimating retail portfolio risk parameters (e.g., PDs, EADs, LGDs) and simulating portfolio default losses using traditional – frequentist – methods versus Bayesian techniques. The statistical properties of the simulated risk parameter will have a significant effect on the shape of the portfolio loss distribution. Our results suggest that Bayesian estimations produce more robust estimators and result in risk parameters and loss distributions that are less volatile. Bayesian estimation has another key advantage: Posterior distributions for the model parameters can be leveraged to perform comprehensive portfolio loss simulation exercises taking into account model risk.

## Default rate model set-up

We consider two common examples of retail portfolios, an auto loan book, and a credit card portfolio. Performance data is collected at a vintage/cohort level with quarterly frequency (i.e., quarterly cohorts of loans/accounts observed on a quarterly basis). The target variable to model is the vintage-level default rate, defined as the ratio of the number of accounts that have defaulted to outstanding accounts. Our methodology is in line with Licari and Suarez-Lledo (2013).[1] Our target variable, (logit of) default rate, gets decomposed into three dimensions:

i. Lifecycle component (seasoning of the accounts)
ii. Vintage quality (rank-ordering of the cohorts)
iii. Sensitivity to macroeconomic drivers

Parameters in (ii) and (iii) are assumed to be stochastic in the frequentist and Bayesian settings, while parameters (i) are assumed to be deterministic in both and fixed to the values found after performing the frequentist regression.

## Model estimation results

Both frequentist and Bayesian methods produce similar average values for the key parameters. For auto loans, the results from both approaches are very similar. For credit cards, the Bayesian estimation has a significantly lower standard deviation in the parameter estimation than the frequentist standard errors, resulting in parameters that are less volatile and more precise and thus presenting a lower model risk when used in portfolio loss estimations.

Bayesian methods have the added advantage of producing posterior distributions for all parameters. The figures below illustrate the statistical shape of the posterior distribution for macroeconomic drivers and how these compare with frequentist parameters and 95% confidence intervals.

---

1   See Licari & Suarez-Lledo, *Stress Testing of Retail Credit Portfolios*, Risk-Perspectives Magazine, September 2013, Moody's Analytics.

## Model simulation results

The estimated models for the risk parameters are then used for the estimation of the portfolio loss distribution through a dynamic Monte Carlo simulation. Three distinct steps are considered:

1. Macroeconomic scenarios are built using a Dynamic Stochastic General Equilibrium Model to produce forward-looking "states of the world" with quarterly updates (Licari and Ordonez-Sanz (2015)[2]).

2. The Bayesian and frequentist models are then used to estimate risk parameters in each of these macroeconomic scenarios (e.g., conditional default rates).

3. The portfolio is simulated dynamically (multi-period default simulation) to estimate the cumulative loss distribution over nine future quarters.

For this last step, two different comparisons between the frequentist and Bayesian approaches were performed with and without model risk. The table below highlights the set-up of these two exercises, as well as key similarities and differences.

Figure 2 illustrates the set of macroeconomic scenarios used in the first step of the process for two different factors: unemployment rate and home price dynamics.

The estimated forward-looking default rates estimated in the second step of the process are shown below for both the frequentist and Bayesian approaches for the set of macroeconomic scenarios.

The first simulation exercise (macroeconomic risk only) shows consistency across both estimation methods. The simulated default rate distributions are fairly similar for both portfolios. They generate a tailed, asymmetric density with higher values at the block of stressed scenarios. The Bayesian method for credit cards seems to produce slightly less volatile default rate projections, but the overall shape of both densities is quite similar. The key difference appears when we move from exercise 1 to 2, adding model risk dimensions such as parameter volatility and error/residual properties.

Figure 4.2 drives home the key message of this section. Once we add the uncertainty coming from model risk to the simulation mechanism, frequentist and Bayesian methods produce very different outcomes. The higher precision of the Bayesian estimators flow into more concentrated, less volatile simulated default rates while still presenting the "fat-tails" that would be expected from the impact of very severe macroeconomic scenarios.

## Effects on credit portfolio losses

The statistical properties of conditional default rates (conditional on a given macroeconomic scenario) influence the shape of the portfolio loss distribution. To quantify this effect, in step 3, dynamic Monte Carlo simulations are performed on both sets of conditional default rate distributions estimated in exercises 1 and 2. The charts below highlight the significant effect that these estimation results can have on the shape of portfolio losses. The severity of CCAR Adverse, Severely Adverse, ECCA S3 and S4 scenario as well as the VaR loss at 99.9% confidence levels are also shown for comparison purposes. In summary, Bayesian methods prove to be more stable, particularly after including model risk in the loss simulations.

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2    See Licari & Ordonez-Sanz, *Multi-Period Stochastic Scenario Generation*, Risk-Perspectives Magazine, June 2015, Moody's Analytics.

**Table 1** Macroeconomic parameters – Bayesian vs. frequentist estimations

**Table 1A** Auto loan portfolio

| Parameter | Frequentist | | Bayesian | |
|---|---|---|---|---|
| | Beta | Std. Error | Average | Std. Dev. |
| 2007-Q4 Fixed-Effect | 0.4288 | 0.0300 | 0.3963 | 0.0362 |
| 2008-Q4 Fixed-Effect | 0.0071 | 0.0304 | -0.0613 | 0.0383 |
| 2009-Q4 Fixed-Effect | -0.2902 | 0.0316 | -0.3576 | 0.0370 |
| 2010-Q4 Fixed-Effect | -0.2210 | 0.0289 | -0.2889 | 0.0362 |
| 2011-Q4 Fixed-Effect | -0.0749 | 0.0262 | -0.1343 | 0.0356 |
| 2012-Q4 Fixed-Effect | 0.0165 | 0.0281 | -0.0395 | 0.0367 |
| 2013-Q4 Fixed-Effect | 0.1169 | 0.0363 | 0.0821 | 0.0432 |
| 2014-Q4 Fixed-Effect | 0.1840 | 0.0338 | 0.1516 | 0.0379 |
| Investment Growth | -0.0232 | 0.0028 | -0.0212 | 0.0024 |
| Unemployment Rate (lag 1) | 0.0192 | 0.0044 | 0.0251 | 0.0037 |
| Home Price Growth (lag 1) | -0.0114 | 0.0035 | -0.0089 | 0.0026 |

**Table 1B** Credit card portfolio

| Parameter | Frequentist | | Bayesian | |
|---|---|---|---|---|
| | Beta | Std. Error | Average | Std. Dev. |
| 2007-Q4 Fixed-Effect | 0.32588 | 0.28436 | 0.31570 | 0.02027 |
| 2008-Q4 Fixed-Effect | -0.06025 | 0.28238 | -0.06681 | 0.02615 |
| 2009-Q4 Fixed-Effect | -0.31346 | 0.28497 | -0.35590 | 0.03210 |
| 2010-Q4 Fixed-Effect | -0.23620 | 0.28335 | -0.23450 | 0.03864 |
| 2011-Q4 Fixed-Effect | -0.39039 | 0.29823 | -0.35090 | 0.05608 |
| 2012-Q4 Fixed-Effect | -0.46133 | 0.30174 | -0.48530 | 0.08276 |
| 2013-Q4 Fixed-Effect | -0.32504 | 0.33274 | -0.34180 | 0.15900 |
| 2014-Q4 Fixed-Effect | -0.42056 | 0.29330 | -0.50000 | 0.09709 |
| GDP Growth | -0.06518 | 0.01712 | -0.07857 | 0.02033 |
| Investment Growth (lag 2) | -0.03672 | 0.00585 | -0.02031 | 0.00566 |

Source: Moody's Analytics

**Table 2** Alternative simulation exercises – macro only vs. fully-fledged

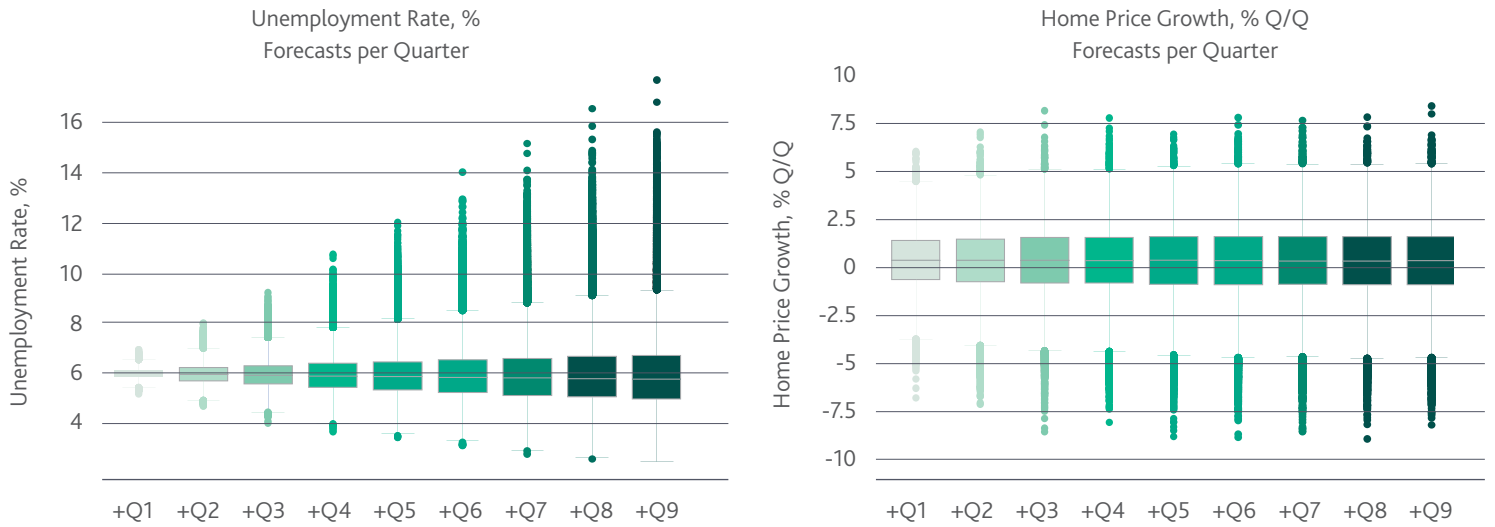| | Exercise 1 (Macroeconomic risk only) | | Exercise 2 (Fully-fledged simulations, macro and model risks) | |
|---|---|---|---|---|
| | Frequentist | Bayesian | Frequentist | Bayesian |
| Model Parameters | Parameters fixed at the estimated values, no room for parameter uncertainty | Parameters fixed at the average posterior values, no room for parameter uncertainty | Monte Carlo simulation for parameters, following Normality assumptions | Values drawn from the posterior Bayesian distribution across parameters |
| Residual/Error Shocks | Residuals fixed at zero for all out-of-sample periods | | Monte Carlo simulation for residuals, following Normality assumptions | Values for the standard error of residuals drawn from their posterior Bayesian distribution across (by age) |
| Macroeconomic Shocks | Alternative dynamic macroeconomic scenarios, systemic risk shocks | | Alternative dynamic macroeconomic scenarios, systemic risk shocks | |

Source: Moody's Analytics

**Figure 1** Auto loan portfolio – posterior Bayesian distributions for macroeconomic parameters

Density functions (top) and box-plots (bottom). Red dots for frequentist betas, red vertical lines for frequentist 95% confidence intervals
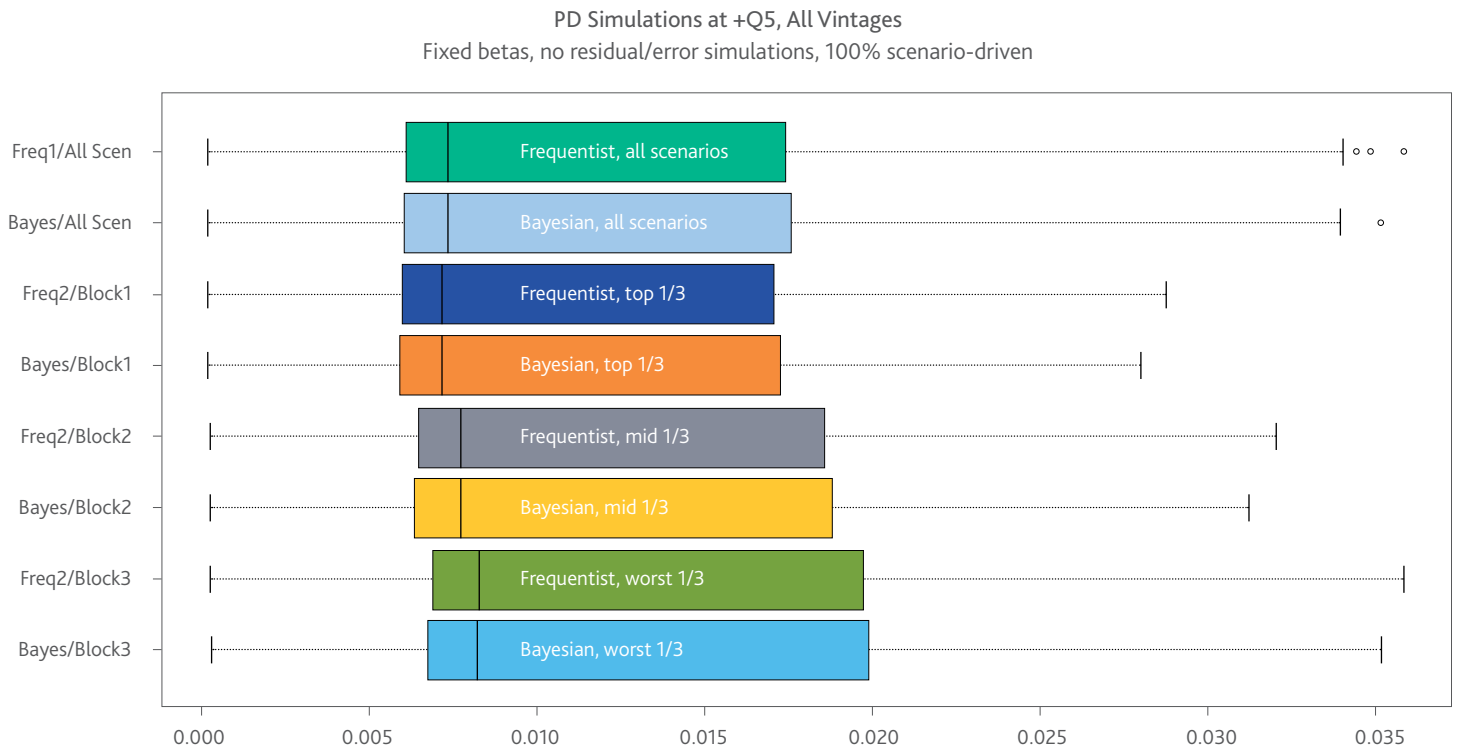


Source: Moody's Analytics

**Figure 2** Macroeconomic simulations – nine out-of-sample quarters
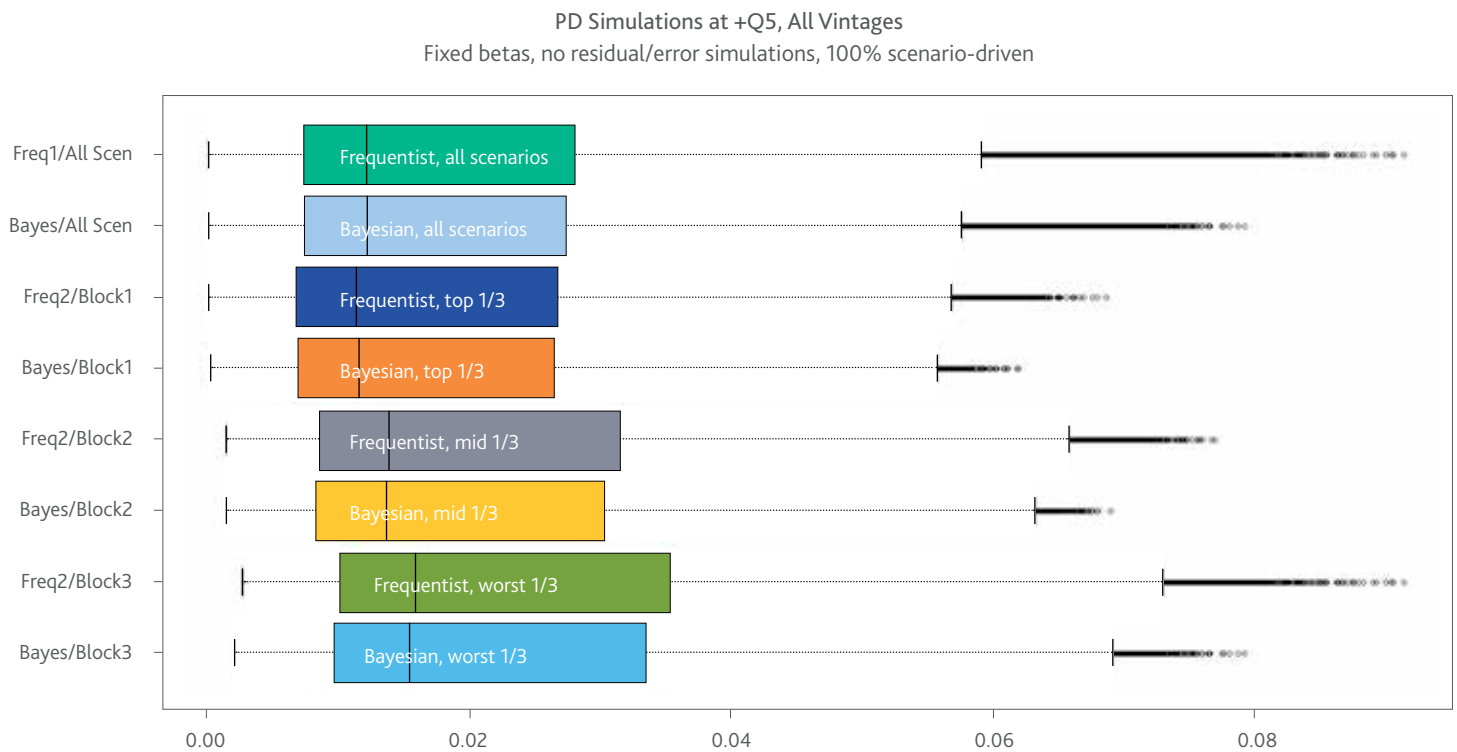


Source: Moody's Analytics

**Figure 3.1** Auto loan portfolio – across blocks of scenarios, five quarters out-of-sample (+Q5)



PD Simulations at +Q5, All Vintages
Fixed betas, no residual/error simulations, 100% scenario-driven

Source: Moody's Analytics

**Figure 3.2** Credit card portfolio – across blocks of scenarios, five quarters out-of-sample (+Q5)



PD Simulations at +Q5, All Vintages
Fixed betas, no residual/error simulations, 100% scenario-driven

Source: Moody's Analytics

**Figure 4**  Simulation exercise 2 – macroeconomic and model risks – frequentist vs. Bayesian

**Figure 4.1**  Auto loan portfolio – selected vintages, five quarters out-of-sample (+Q5)



PD Simulations at +Q5, Selected Vintages: Old, Mid-age, Young, and Future Cohorts
Simulated betas, with residual/error simulations
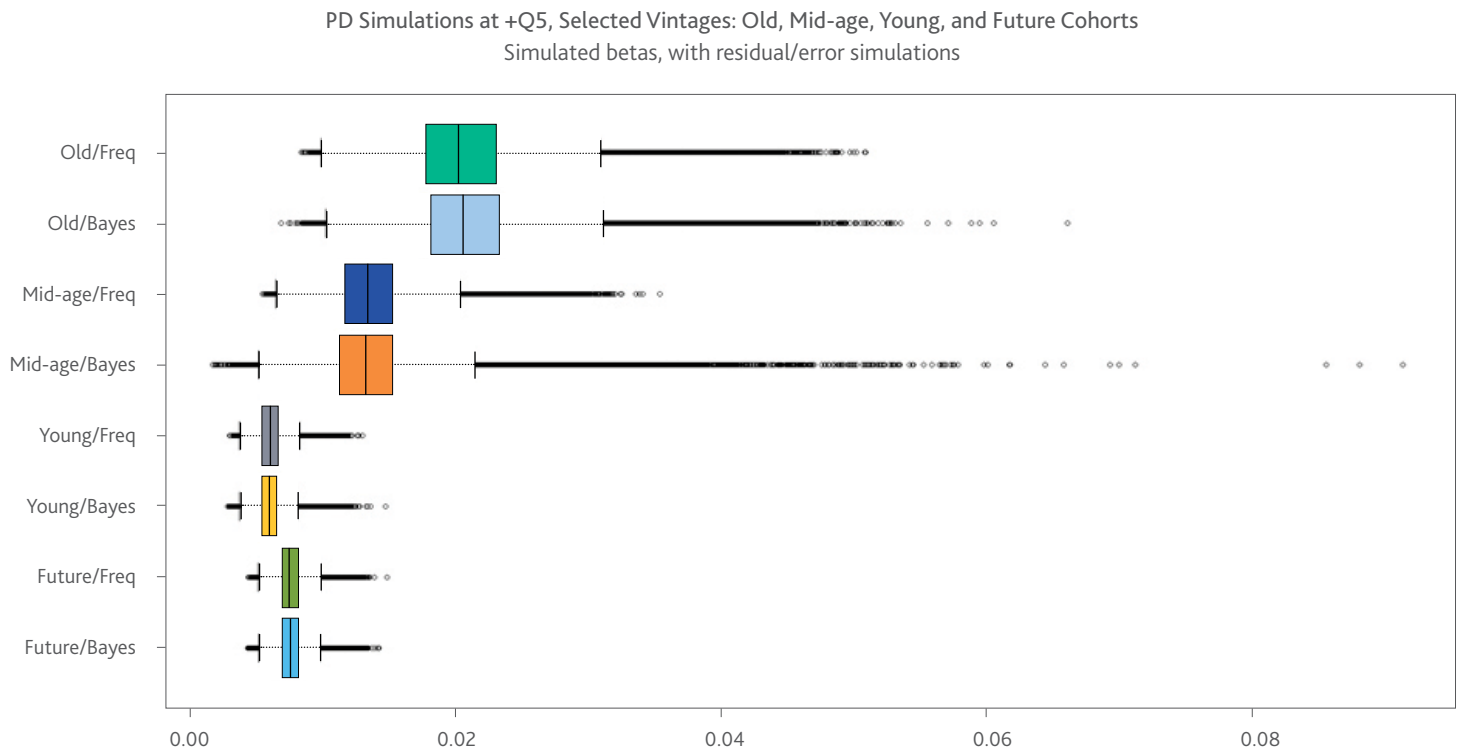
Source: Moody's Analytics

**Figure 4.2**  Credit card portfolio – selected vintages, five quarters out-of-sample (+Q5)



PD Simulations at +Q5, Selected Vintages: Old, Mid-age, Young, and Future Cohorts
Simulated betas, with residual/error simulations
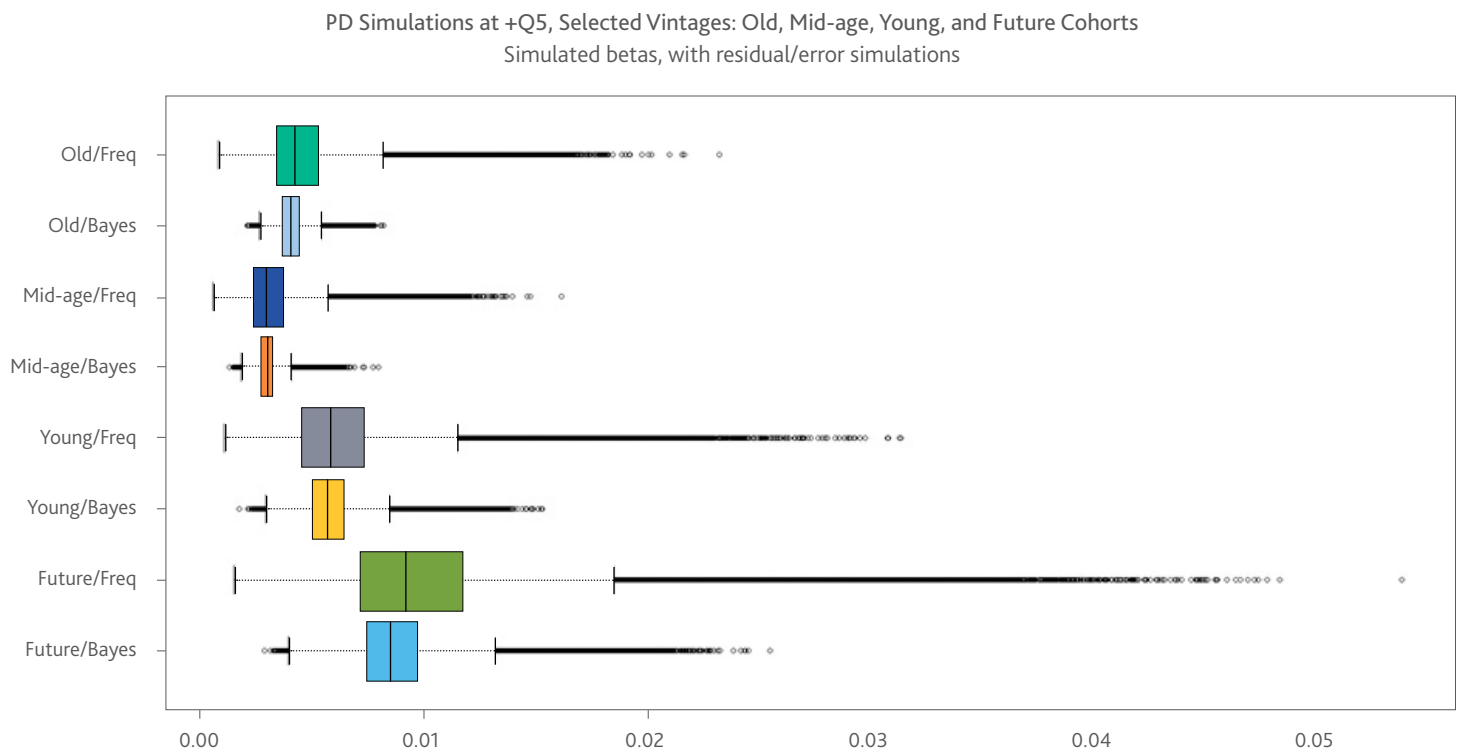
Source: Moody's Analytics

**Figure 5** Cumulative portfolio default losses – simulation exercise 1 – macroeconomic risk only – frequentist vs. Bayesian

**Figure 5.1** Auto loan portfolio – after nine quarters (+Q9)



Frequentist – cumulative loss at +Q9
Fixed betas, no residual/error simulations

CCAR Adv  P(L)=90.46%  L=$56.6bn
CCAR Sev Adv  P(L)=98.67%  L=$62bn
ECCA s3  P(L)=92.11%  L=$57.4bn
ECCA s4  P(L)=98.37%  L=$61.6bn
VaR(99.9%)  L=$61.3bn

Bayesian – cumulative loss at +Q9
Fixed betas, no residual/error simulations

CCAR Adv  P(L)=92.36%  L=$57.2bn
CCAR Sev Adv  P(L)=99.98%  L=$62.8bn
ECCA s3  P(L)=95.03%  L=$57.7bn
ECCA s4  P(L)=99.96%  L=$62bn
VaR(99.9%)  L=$61.3bn
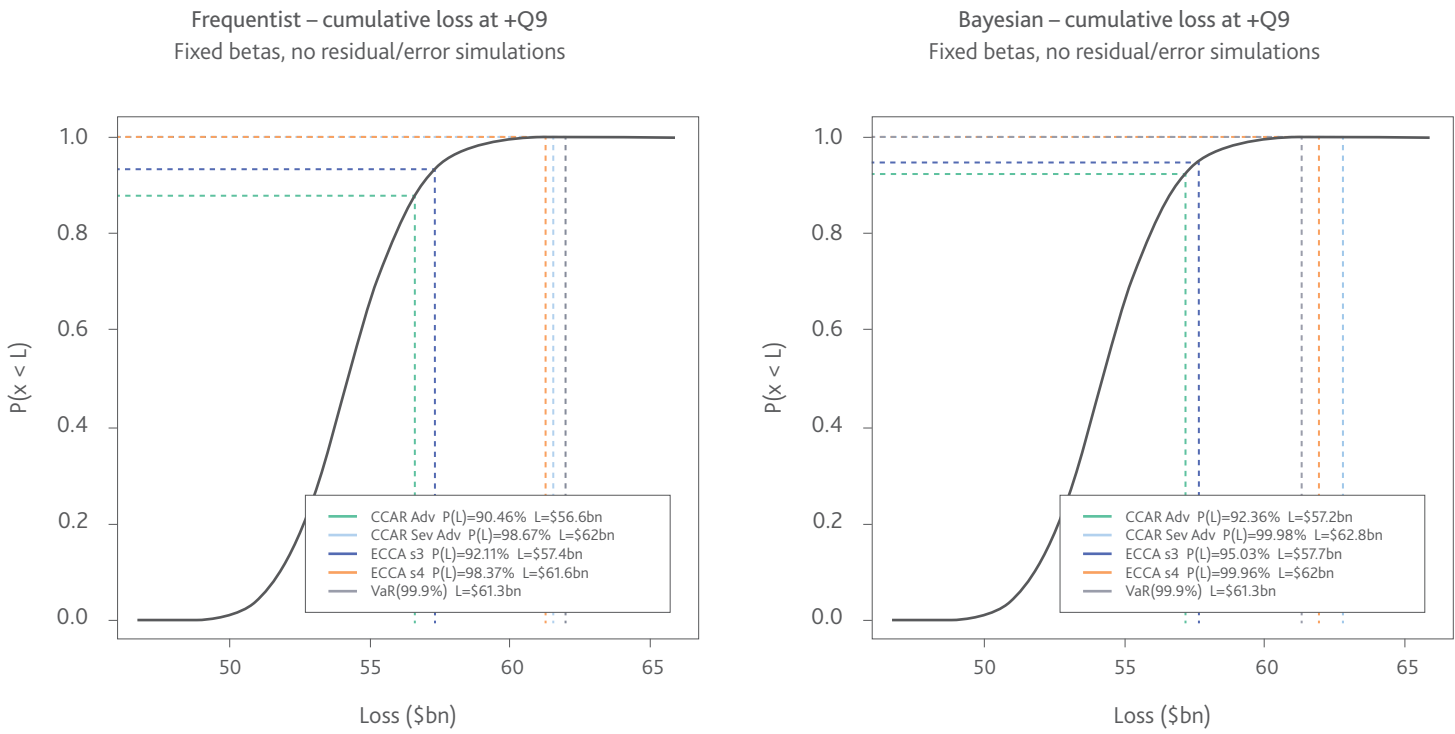
Source: Moody's Analytics

**Figure 5.2** Credit card portfolio – after nine quarters (+Q9)



Frequentist – cumulative loss at +Q9
Fixed betas, no residual/error simulations

CCAR Adv  P(L)=49.02%  L=$17.2bn
CCAR Sev Adv  P(L)=79.9%  L=$18.4bn
ECCA s3  P(L)=86.51%  L=$18.8bn
ECCA s4  P(L)=97.58%  L=$20.2bn
VaR(99.9%)  L=$22.3bn

Bayesian – cumulative loss at +Q9
Fixed betas, no residual/error simulations

CCAR Adv  P(L)=51.94%  L=$16.6bn
CCAR Sev Adv  P(L)=73.68%  L=$17.3bn
ECCA s3  P(L)=83.37%  L=$17.7bn
ECCA s4  P(L)=96.43%  L=$18.7bn
VaR(99.9%)  L=$20.6bn
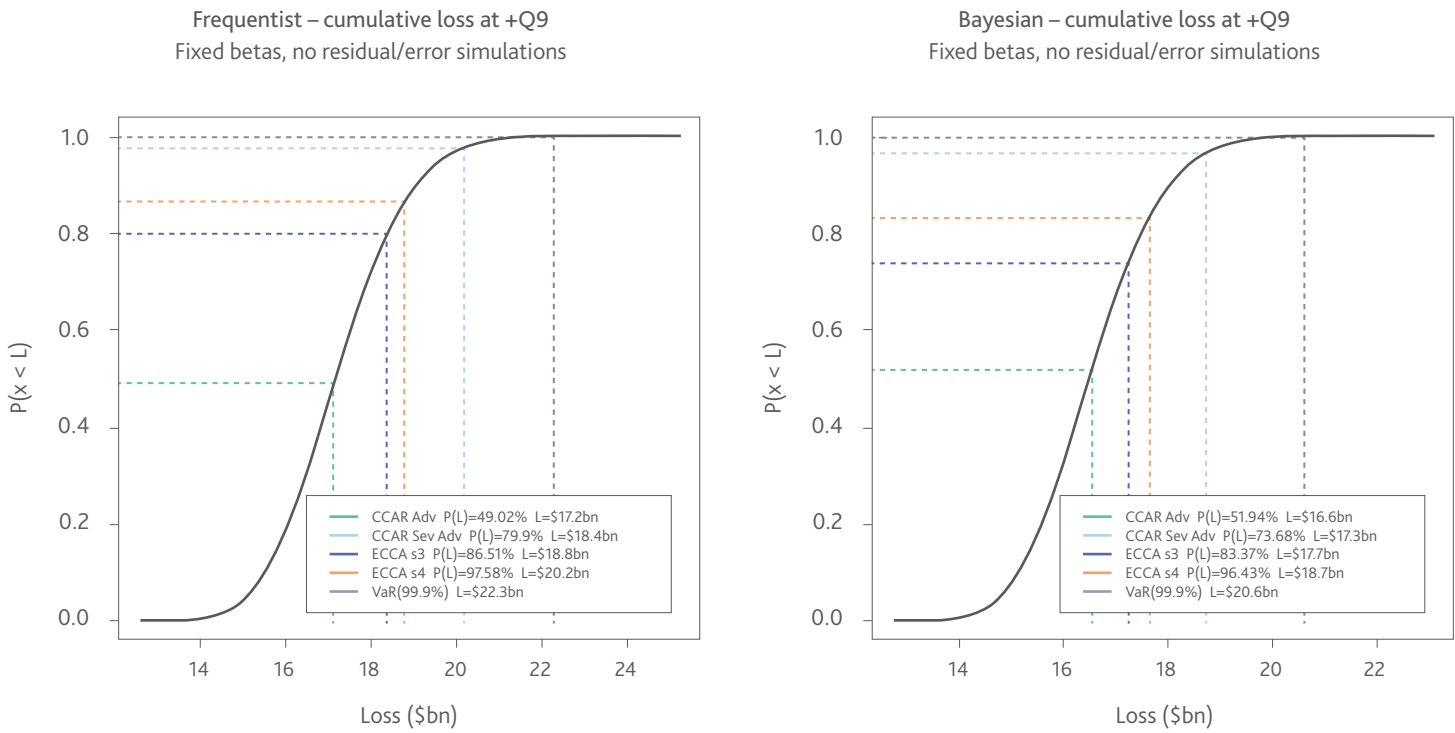
Source: Moody's Analytics

**Figure 6** Cumulative portfolio default losses – simulation exercise 2 – macroeconomic and model risks – frequentist vs. Bayesian

**Figure 6.1** Auto loan portfolio – after nine quarters (+Q9)
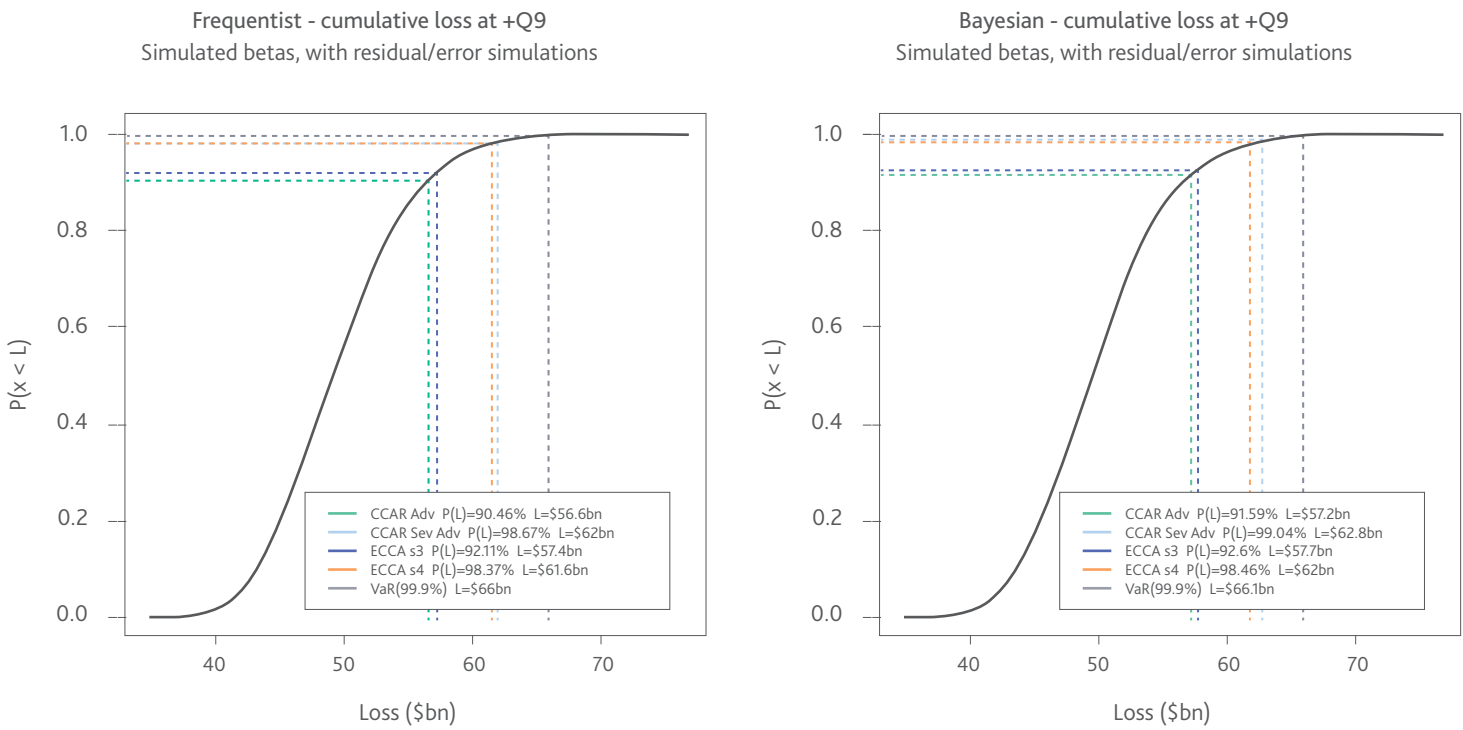


Source: Moody's Analytics

**Figure 6.2** Credit card portfolio – after nine quarters (+Q9)



Source: Moody's Analytics

**RPC**
**16** RISK PRACTITIONER CONFERENCE
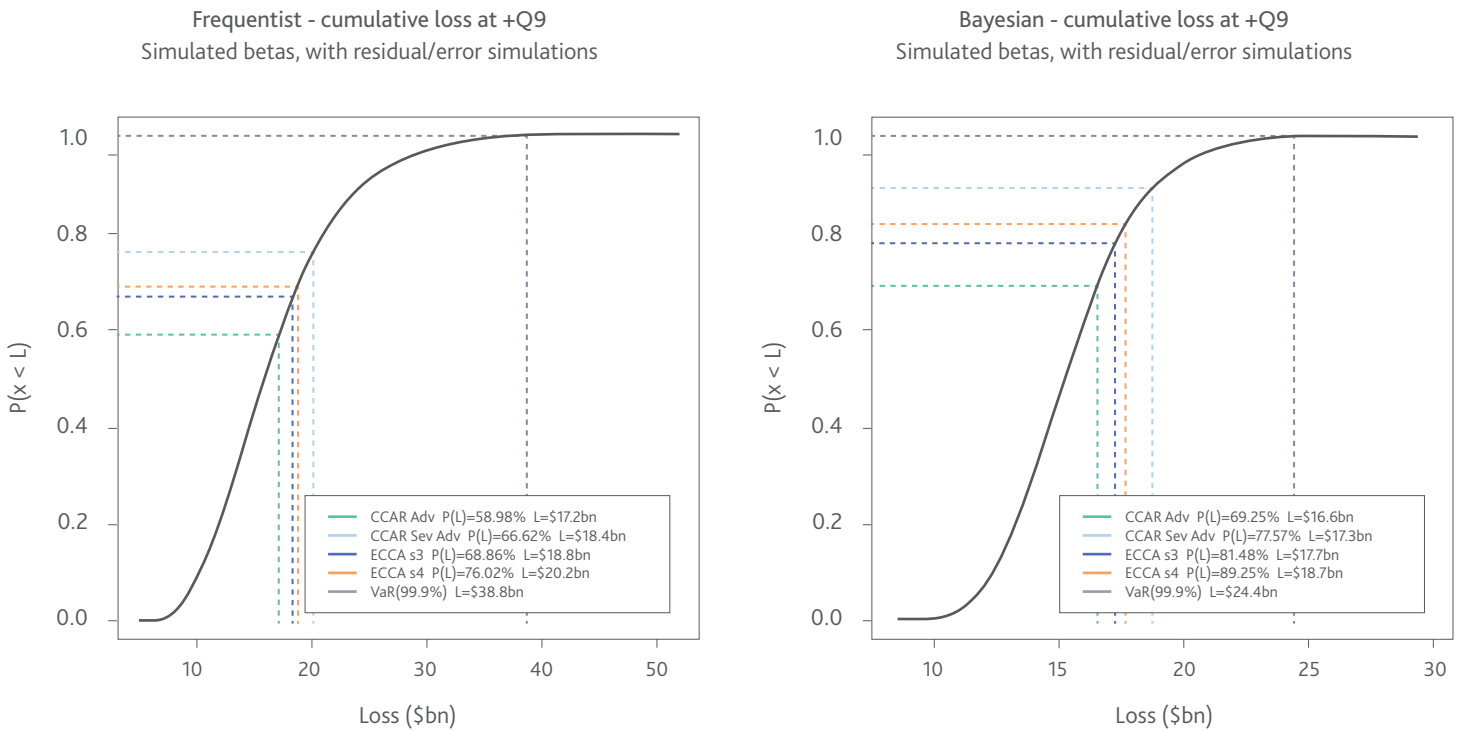
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Our annual Risk Practitioner Conference brings together industry experts and leading risk practitioners from across the globe.

For more information visit
**MoodysAnalytics.com/RPC**

# Highlights from 2015 RPC
# and a look toward next year

Q&A WITH DAVID LITTLE - Managing Director, Head of US
Enterprise Risk Solutions and Sales Teams

### How has the Moody's Analytics Risk Practitioner Conference evolved over time?

When Moody's launched an industry conference called Credit Practitioners Conference 10 years ago, it was primarily focused on single obligor and portfolio credit risk. Over time, the conference has become bigger and broader. In 2010, the event was renamed Risk Practitioners Conference (RPC), acknowledging the expanding range of interests from industry participants and the growing range of solutions from Moody's Analytics. The 2015 conference attracted 300 attendees from about 100 global institutions. Participants represented financial institutions large and small, as well as bank supervisors. Interestingly, as Finance and Risk are increasingly working together on areas like stress testing and CECL/IFRS 9, there were also prominent speakers and attendees from Finance functions.

### What were some of the main themes of the conference this year?

One theme underpinning many sessions was data and data quality as the foundation for better risk management and capital planning. Firms are thinking about how to improve foundational risk management and risk identification, and how to extract greater value from their data and infrastructure investment beyond basic regulatory compliance. Model risk management is a topic at the forefront of everyone's mind as the supervisory expectations, particularly in the US have risen sharply. In fact, firms are thinking of how to get more out of stress testing, leveraging some of the same models, systems, and regimens to improve business-as-usual processes like limits management and the Risk Appetite Framework.

### What do we expect for 2016?

The accounting regulations should continue to evolve over the next year, so there will be more concrete discussions about modeling for ALLL. There are still open questions about how to get an integrated and comprehensive view of risk at the top of house, how to integrate liquidity and capital views, and approaches to liquidity stress testing results and capital optimization. I would also expect an even more diverse group of attendees as we will be dealing with the integration of more and more BAU Risk processes with required regulatory processes like stress testing.  However, I suspect that the series of bank and regulatory round tables Moody's Analytics will host in the spring and summer will inform the choice of topics for the RPC 2016.

# PRINCIPLES AND PRACTICES

# THE EMERGENCE OF A NEW BANKING MODEL

By Cayetano Gea-Carrasco and Andy Frepp

**Cayetano Gea-Carrasco**
*Senior Director, Head of Stress Testing Services and Advisory, Enterprise Risk Solutions*

Cayetano works with financial institutions on addressing their technology and enterprise risk management needs. He has extensive experience working with financial institutions on enterprise risk management, stress testing, liquidity management and capital planning.

**Andy Frepp**
*Managing Director, Enterprise Risk Solutions*

Andy has more than 25 years of experience in the insurance, asset management, and pensions industries and helps global financial institutions address their regulatory compliance and risk management needs. Prior to his current role, Andy was the CEO of Barrie & Hibbert, which was acquired by Moody's Analytics in 2011.

Banks should prepare for a new business ecosystem driven by the financial technology (FinTech) revolution. Learn how the industry can adapt to disruptions by optimizing resources, revamping technology, analytics and data platforms, improving efficiency, rebuilding their capital base, changing the risk culture, reducing payout ratios, and searching for new business models.

The banking sector has changed dramatically since the 2007 financial crisis, which severely affected the traditional growth engines of investment and corporate banking. Stricter global regulations and financial legislation have increased the level of capital, shrinking the profitability of the investment and lending activities, lowering leverage and revenues (Figure 1).

At the same time, a long period of ultra-low (Figure 2) and, in some areas, negative interest rates have left banks struggling to accelerate their deposit base growth given the increasing competition, lower margins, and new customer behaviors. In addition, the wide-spread adoption of social media, mobile technology, and the web by many customer segments is radically changing the way they interact with banks and other financial institutions. It is also transforming how these institutions manage and interact with their customers. As a consequence, banks face increasing challenges in acquiring and retaining customers, along with low interest rates and maintaining and growing margins.

These external factors are exacerbated by outdated banking infrastructure and legacy systems that limit timely responses to new regulatory and business requirements. Manual processes in the front, middle, and back offices, lack of automation, and use of traditional analytics are dragging down efficiency and represent a huge cost for a business. Applications for loans can usually take weeks, individuals without credit history cannot access basic banking services, and a lack of credit information from small and medium enterprises make their access to financing extremely difficult and expensive.

## Preparing for the FinTech revolution

Technology is reducing information asymmetry in the financial and consumer sectors. Borrowing Daniel Goldin's quote, information is being shared and distributed "faster, better, and cheaper." As a consequence, emerging new business models are more customer focused, have a lower cost, and are more efficient than traditional banking models (e.g., peer-to-peer lending and alternative payment systems).

Banks should prepare for a new ecosystem driven by the financial technology (FinTech) revolution, as it represents one of the biggest threats to the banking industry. After all, global FinTech investment tripled to $12 billion from 2013 to 2014[1] (Figure 3). Investors around the world are starting to price innovation in banks' valuations and are considering the effect of non-bank competitors. FinTech companies are also putting additional pressure on banks' margins and revenues by providing traditional banking services and fee-based solutions (e.g.,

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1  *The Future of FinTech and Banking*, Accenture 2015.

lending, payments, wealth management, etc.) with lower costs. Therefore, financial institutions should not underestimate new incumbents in the financial space and the potential impact on future revenues. For example, Apple was not even considered a competitor by Nokia during its 2008 investors presentation.[2]

From a strategic perspective, Moody's Analytics views how banks and financial institutions respond to the following themes as key to the success or failure of these institutions in the coming years:

1. **Digital banking:** Firms must adjust to digital replacing brick-and-mortar as the primary banking channel.

2. **Operational efficiency:** How can firms best operate in a low interest rate, low margin environment?

3. **Non-traditional competitors:** For example, peer-to-peer and online marketplace lenders

4. **Payments systems:** Cryptocurrencies, smart contracts, and new settlement processes

5. **Distributed data architectures:** Technologies based on Hadoop, Apache, Spark, open APIs, etc.

6. **Cyber risk and cyber security:** How will banks address security concerns?

7. **Leveraging data and analytics:** Gain new insight, open up new business opportunities, and develop new products.

As these themes evolve, the investment in analytics development and enterprise software will increase, reshaping the banking and finance industry. This will affect how a customer views banking and the speed, cost, user experience, transparency, and openness of transactional and consumer banking in a way never they have never seen before. Non-traditional competitors will also erode banks' already low margins, requiring non-traditional responses:

» Customizing their offerings to clients' needs; analyzing sentiment scores to maximize retention rates

» Enhancing risk and underwriting analytics

» Designing new financial products using new technologies, such as the Internet of Things and data from wearable technology (i.e., based on location, business activity, environmental factors, shopping, or weather patterns)

The FinTech revolution is also transforming banks into big data factories (Figure 4), driven by customer interactions with their websites, third-party vendors, or mobile applications. Nowadays, banks generate and record terabytes of daily information – from geographical

**Figure 1** Net interest margin for US Banks, %
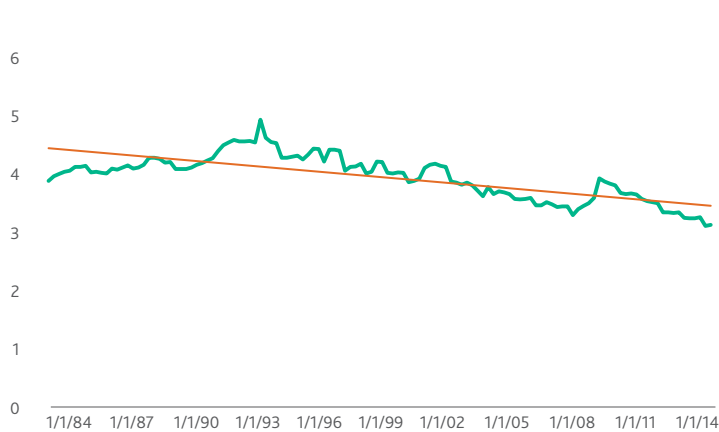


Source: Federal Financial Institutions Examination Council

**Figure 2** Effective Federal Reserve funds rate, %
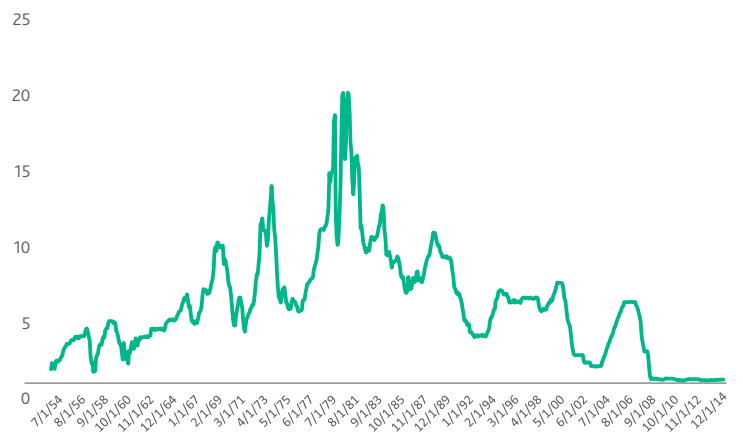


Source: Board of Governors of the Federal Reserve System

2 *Extending the leading device market position*, Lehman Brothers Wireless Conference, May 2008.

pinpointing and transactional data to life events (e.g., deposits, paychecks, mortgages, rent, shopping habits). Consumers and small and medium enterprises also express interest for financial products through search engines and social media; thus generating a wealth of information that can substantially improve the underwriting and credit scoring process of those individuals.

The ability to leverage this data across different functions, coupled with the analytic layer to exploit it, can give banks a competitive advantage over their competitors – from generating better predictive insights about customers to customizing the risk management, pricing, and underwriting process.

**Figure 3** FinTech investment, USD billion



FinTech Investment
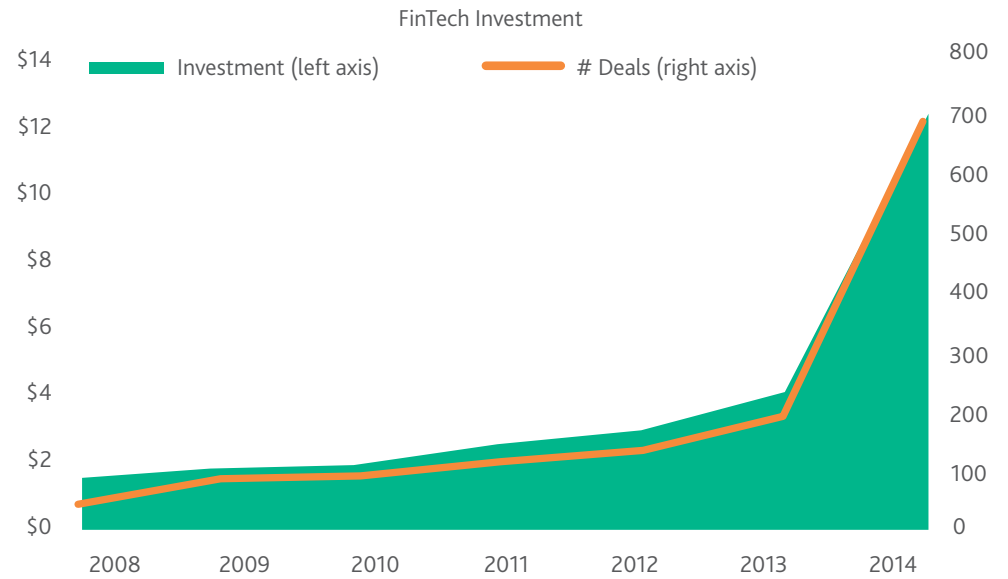
Sources: Moody's Analytics, Accenture, CB Insights

**Figure 4** Non-traditional credit and financial metrics – Creating value through data aggregation and benchmarking
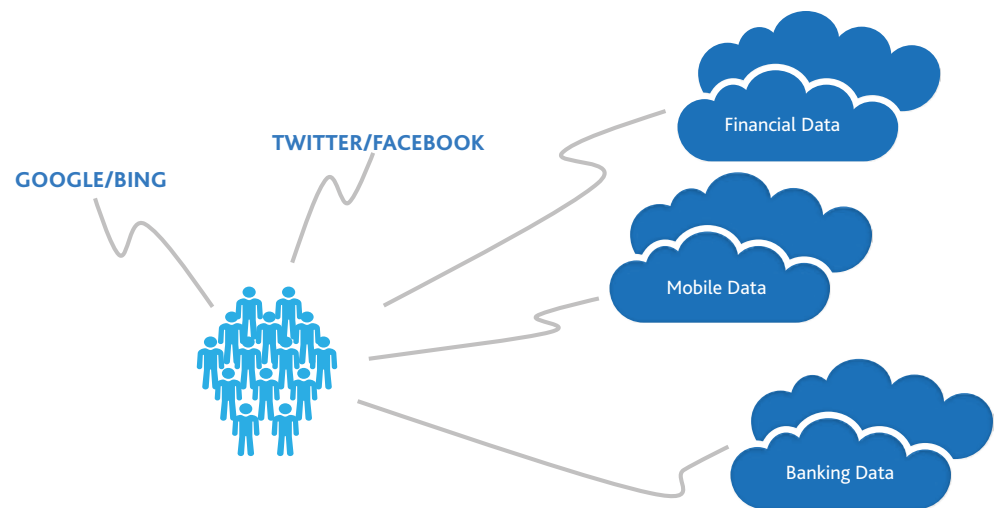


Source: Moody's Analytics

### Digital banking transformation

Digital banking is growing rapidly across customer segments and is poised to replace traditional brick-and-mortar branches as the core channel for banking. Traditional relationship management, which most banks rely on as a vehicle for maintaining a low cost of funds and a high lending margin, cannot be easily adapted to the new digital banking landscape and electronic distribution channels.

The digital banking transformation, while reducing operating costs and facilitating market penetration, is coming at a cost to banks. Tasks like account comparison shopping are becoming increasingly simple, forcing banks to erode margins to maintain a competitive advantage and retain customers. Therefore, to enhance digital relationships and provide high-value, one-to-one services to digital customers, banks will have to develop a new generation of analytics to evaluate customer behavior data

and make inferences about customer needs and risk profiles.

### The impact of technology: Industry response

The industry (Figure 5) is adapting to these disruptions by optimizing resources, revamping technology, analytics, and data platforms, improving efficiency, rebuilding their capital base, changing their risk culture, reducing payout ratios, and searching for new business models.

Regulators also view technology as the key element for improving the transparency of the financial system and facilitating the supervisory and data evaluation processes of both banking and non-banking institutions. However, there is still a lack of clarity about operational and regulatory requirements as well as lack of cross-border coordination about how regulators will approach a new generation of analytics and technology being used by banks.[3] There is also an important shift in the attitude of

**Figure 5** Adopting the FinTech revolution – Benefits for financial institutions
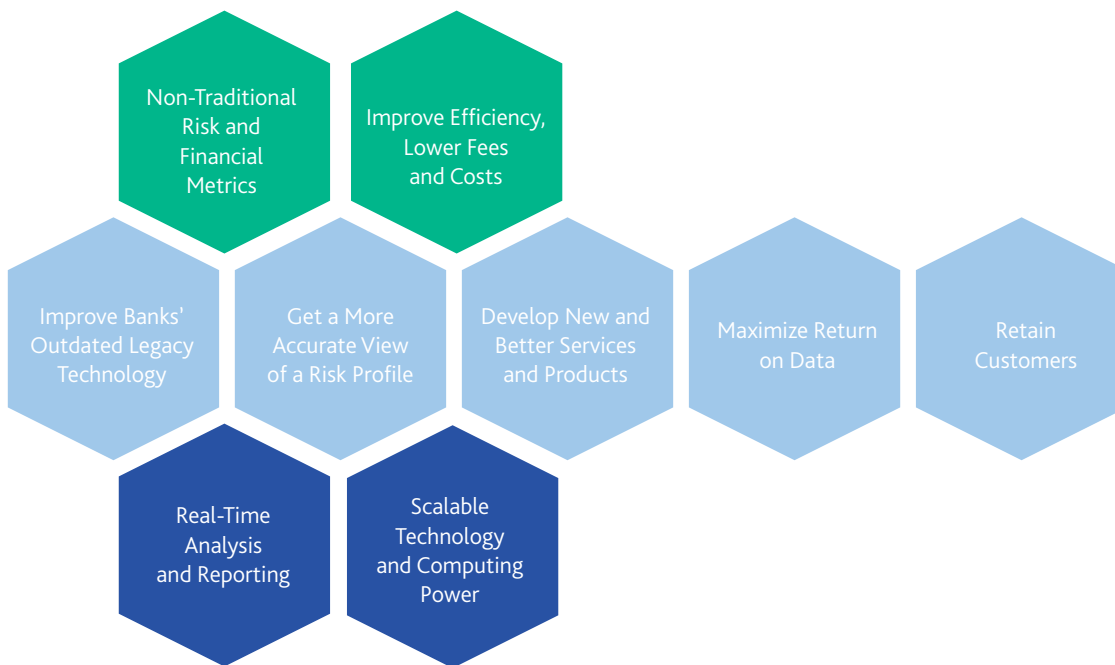


Source: Moody's Analytics

3   The Australian Prudential Regulation Authority (APRA) is one of a few that has released an information paper about its expectations when using cloud computing and sharing data: *Outsourcing involving shared computing services*, July 2015.

business leaders and senior management, who recognize the incredible value in bringing new technologies and analytics to the banking business and sharing data across the organization:

» **On the organizational front**, banks have started adopting a less siloed approach to their business. The conditions are also significantly different in terms of how technology and regulatory requirements can facilitate this change in organizational dynamics.

» **The exponential advances in technology** and the adoption of enterprise-wide risk architectures and cloud-based computing approaches present a unique opportunity for banks to advance their traditional analytics and scoring processes, which extends services to a wider segment of the population. In addition, data processing and real-time analysis capabilities are also significantly different than those available decades ago. They have provided banks with

authentication, and security. In Moody's Analytics view, the next generation of predictive risk management analytics and business intelligence platforms will use large-scale customer and enterprise behavior data, analyzed by cutting-edge machine-learning algorithms to arrive at predictive inferences. This, in turn, will facilitate the discovery of trends and quantification of risk profiles while driving business actions.

» **Banks are launching their own FinTech funds and innovation labs** to accelerate the adoption of new technologies and analytics. FinTech funds allow banks to tap into innovation outside of their own technology ecosystems to capture new trends such as data-mining-driven scoring systems, cash management, and predictive analytics focused on maximizing and monetizing client relationships across the full spectrum of banking services (e.g., small and medium enterprises, corporate clients, wealth management, and retail banking).

Banks should prepare for a new ecosystem driven by the financial technology (FinTech) revolution, as it represents one of the biggest threats to the banking industry. After all, global FinTech investment tripled to $12bn from 2013 to 2014.

the technology and infrastructure to exploit and monetize multiple sources of data in a cost effective and timely manner.

» **Security and data privacy will be key for financial innovation success**. Privacy laws and banks' concerns about security have been a major issue in the financial space. However, a new generation of remote data processing capabilities (e.g., cloud computing) and improvements in security are addressing these concerns.

» **Modern data-mining applications** represent the next frontier in banking analytics, from risk management to fraud detection, digital

Effectively implementing these technologies will enable banks to make better informed underwriting and credit decisions, automate processes and services, develop new products, minimize fraudulent behavior, improve efficiency, reduce risks, and help understand the evolving nature of the banking business, and quantification of clients' risk profiles and behaviors. This should lead to a more sound, lower-risk financial system comprised of more efficient banks with extended services and financing opportunities for a wider segment of the population.

# IMPROVING RISK GOVERNANCE FRAMEWORKS TO ADAPT TO THE NEW BANKING ENVIRONMENT

By Yuji Mizuno

The banking industry will be affected by significant structural changes and required to implement risk governance reforms to keep up with complex regulations and macroeconomic and financial conditions. This article provides an overview of the changes and best practices for how banks can thrive in this future operating environment.

**Yuji Mizuno**
*Director, Business Development Officer*

Yuji leads the product and consulting areas of the firm in Japan and has extensive knowledge of regulations and risk management practices among financial institutions. He provides clients with insight on regulatory compliance, ALM, liquidity and ERM frameworks.

## Introduction

How will risk governance at banks evolve in 10 years? To envision the future, consider the situation ten years ago. In 2005, the inception of the financial crisis was two years away and, on the surface, the fundamental economic structure had not changed that much. Looking more closely, however, the operational environment for banks had changed significantly. So, regulatory requirements, technology, and economic and industry forces may shape governance in a way we cannot yet imagine.

In Japan, there are more than 20,000 companies around today that were founded over 100 years ago. Although most are small- and medium-sized enterprises, the fact that so many firms have survived for so long is truly surprising. These long-established companies share two key characteristics – they tend to stick to their core business and accept the necessary reforms. These firms have been more flexible than their competitors who did not survive. The global banking industry has already seen drastic changes, which could continue at least for the next 10 years. So banks will need to adapt and accept reforms to not just survive, but also to better respond to upcoming environmental changes.

## Structural economic shifts lead to new risks

The global environment for banking is undergoing fundamental paradigm shifts amid slowly progressing structural changes in the world economy, with no sign of a turnaround – if anything, most of these trends are likely to continue for the next 10 years and pose serious challenges to the world's banks.

Due to the financial crisis, numerous banking regulations have been introduced over the last few years, making the process of managing banks' balance sheets more and more complicated. Maximizing revenue while managing risk and regulatory compliance has become increasingly difficult. Moreover, regulators now require that the management of all of an organization's levels be consistent throughout. As more macro-prudential regulations pressure banks to make sure they do not become a threat to global financial stability, banks are finding that raising revenue simply by conducting an already increasingly risky business is becoming more difficult.

From a macroeconomic perspective, the amount of money flowing into the global financial markets owing to quantitative

easing has ballooned to an unprecedented scale, as investors seek higher yields and new investment opportunities wherever they can be found. As a result, the world's financial markets have become more volatile, with a growing correlation among asset markets. In addition, the dramatic expansion of China's economic presence has become one of the turbulent factors affecting global growth and

These risks are not limited to the short-term markets. For example, the sudden crash of the corporate bond market could badly hurt the financing conditions of firms, risking a credit crunch because of resulting liquidity tightening. A credit crunch would first affect firms with weaker liquidity even if they currently look safe or are free of credit risk (benefiting from monetary easing).

> Banks should focus more on proactively managing, rather than merely establishing, risk appetite, and making sure that all of the activities of their individual business segments are in sync. Given how quickly market conditions can change – and therefore how quickly financial risks can emerge – banks will need to be nimble and rapidly adapt to conditions as they evolve.

the financial markets' stability. Disinflation owing to low growth globally and the slump in commodity prices have also impacted the global economy.

These structural shifts have led to the emergence of new types of risks, which could be difficult to assess accurately with conventional risk management practices. Also, as banks shift away from their core businesses to seek profits, competition will intensify and they will feel even more pressure to maintain their profitability. However, banks will not be able to maintain revenue as easily as in the past. The large global banks in particular will have to address these paradigm shifts and carry out the necessary changes to survive.

### Financial risks are also subject to structural changes
The financial markets have also experienced structural changes in line with those in the global economy. With enormous amounts of money flowing into the global markets, bubbles have started forming in several asset categories, including equities and bonds, leading to strong concerns among market participants about the risk of price corrections (which tend to overshoot, causing wild ups and downs over short periods as well as more volatility), or a collapse.

Because market risk can so easily lead to credit risk, banks should be especially alert to signs of market volatility or sudden changes in their operating environments. Huge capital inflows make emerging economies vulnerable because of the risk that investment cash flows could disappear at any moment if their economic indices go far below investors' expectations. Such "disappointment risk" could lead to a credit crunch, a further decline in asset prices, exchange rate deterioration and further deterioration of the economy – a downward spiral particularly serious for emerging countries that rely on the issuance of external debt.

The rise in asset prices resulting from quantitative easing has lowered not only interest rates globally, but also risk premiums throughout the markets, which suggests that market participants have developed a strong risk appetite and are requiring less spread for the risks they are taking. As a result, the net interest margins – and therefore the profitability – of most banks in advanced economies have weakened.

### Regulatory reforms have benefited the banks, but with side effects
The regulatory reforms following the financial crisis have achieved their main objective

of preventing crises. Capital requirements have been raised significantly, making most banks more resistant to stress. Despite the emergence of several risks that could trigger global crises, a cascade of bank failures, such as during the financial crisis, is unlikely in the near future.

However, a new phenomenon has emerged, in which market segments such as shadow-banking, non-banks, and the fixed income markets (including funds and bonds) have assumed the role of banks in providing financing to the global economy. These segments are not subject to regulations as strict as those for the banking industry and have expanded very quickly, becoming an important source of financing – which has also led to concerns about potential price corrections driven by shocks in those segments.

Unfortunately, regulatory reform has also had some undesirable side effects. Because most large banks have downsized their trading operations, liquidity in some fixed income markets has declined considerably, greatly increasing price fluctuations in the government and corporate bond markets in advanced economies.

Another important side effect of quantitative easing is the "masking" of credit risk – that is, the flow of money has made some credit risk more difficult to discern, especially for low-credit-quality corporate firms. For example, global default rates have been very low, suggesting an almost complete lack of credit risk. However, default rates are low partly because the massive quantitative-easing money has made financing conditions of corporate firms much easier and financial institutions have strengthened their risk appetite to take credit risks in those firms.

Because of the severe revenue environment, the large global banks have upped their risk appetite and aggressively loosened their lending criteria, as in the US leveraged loan market, where loan covenants have been relaxed significantly. With ample funds flowing into the market, low-credit-quality firms, which would otherwise have been pushed into distress, have instead benefited from vast amounts of available liquidity. In the event of a shock, these large amounts could quickly flow out of the market, causing serious liquidity issues for the low-credit-quality firms.

In addition to typical market or liquidity risks, credit risk could be triggered suddenly, causing extreme market volatility and transform into further risks, at least until quantitative easing ends and excess money flows out of the global market.
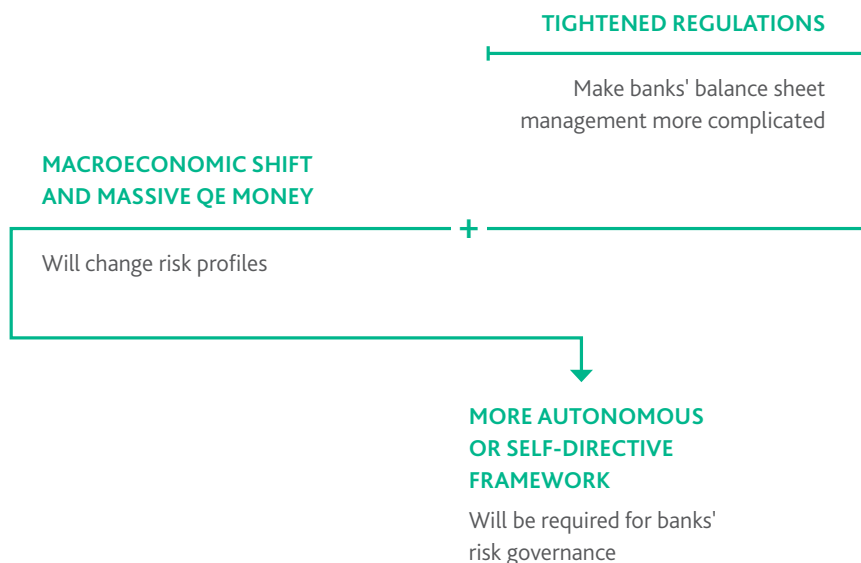
### Banking regulations will continue to tighten

The significant tightening of banking regulations has improved banks' financial strength and diminished the likelihood of similar crises. However, these banking regulations have also turned bank management into a much more complex process, with implications for the balance sheet management of the large global banks in particular.

1. **Basel III capital regulations:** require banks to hold a certain level of capital, including a variety of capital buffers.

2. **The leverage ratio regulation:** stipulates how banks manage their balance sheet size.

3. **Liquidity regulations:** mandates a certain level of liquidity, from both short- and long-term perspectives.

4. **Interest Rate Risk in Banking Book (IRRBB):** also requires that banks hold a certain level of capital.

5. **The Total Loss Absorbing Capacity (TLAC) regulation:** limits the amount of debt banks can hold on their books.

Once they are fully phased in, these regulations will constrain banks' balance sheets from a variety of directions. In most cases, the regulations will work against the banks when they try to take on more risk to raise profits – the greater the risk, the worse the regulatory results. If banks want to achieve their revenue targets in line with the regulations, they will need to strike a very fine balance

**TIGHTENED REGULATIONS**

Make banks' balance sheet
management more complicated

**MACROECONOMIC SHIFT
AND MASSIVE QE MONEY**

+

Will change risk profiles

**MORE AUTONOMOUS
OR SELF-DIRECTIVE
FRAMEWORK**

Will be required for banks'
risk governance

Source: Moody's Analytics

between aiming for higher profits and taking on more risk.

Regulations that are inconsistent or contradictory can be confusing. For example, a bank buying a government bond with a fixed interest rate would be positive for the liquidity regulations, but negative (because of the required concomitant increase in capital) for the leverage regulation. Moreover, because it is a fixed rate instrument, the IRRBB regulation would stipulate a higher capital requirement for the bank. Thus, determining if a certain business activity is good or bad from the perspective of regulatory compliance will become more complex.

Traditionally, in trying to achieve their revenue targets and minimize risk, banks have been able to comply with most regulations naturally in the course of business. However, with regulations becoming more complex, compliance is turning into a much more demanding task in itself, and banks will have to somehow reconcile three, not just two, competing factors: revenue growth, risk management, and regulatory compliance.

**Banks will have to implement revamped risk governance frameworks**

Over the next 10 years, the operating environment for banks will be quite different, especially for two reasons:

1. **Macroeconomic and financial conditions:** such as low growth, low interest rates, and excess money owing to quantitative easing; a volatile environment owing to rapid market changes; and an increase in hard-to-discern risks that can suddenly pop up.

2. **Banking regulations:** such as explicit strategies to maximize revenue, manage risk, and comply with regulation.

As a result, banks will have to make changes to their risk governance, revamping their governance frameworks by:

1. Creating an enterprise-wide framework to guide all employees and teams to achieve specific targets.

2. Developing tools to help management discern difficult-to-see risks and improve response speed.

3. Improving data management to enhance data quality.

**Figure 2** Reforming risk governance: adapting to banking challenges

| CHANGES IMPACTING GLOBAL BANKS | | | |
|---|---|---|---|
| | Regulations | Profitability | Hard-to-see risks |
| Optimize all three factors | Comply with multiple complex regulations at the same time | Maintain stable profits under strengthened regulations and hard-to-see risks | View and quickly respond to emerging risks |

| REQUIRED REFORMS OF RISK GOVERNANCE | | | |
|---|---|---|---|
| | Lead organization to the banks' targets | Improve information used by management | Manage risks to enhance business decision |
| | Risk-return based management | Establish MIS (Management Information System) | Stress test |
| | Credit limit settings that reflect credit VaR | Data collection at group level | Early warning management |
| | | | Consistent risk models applied to all the groups |
| Risk Appetite Framework to support more autonomous or self-directive activities | | | |

Source: Moody's Analytics

## Creating an enterprise-wide framework to guide employees and teams to meet specific targets

Because of tightening regulations and limited business opportunities, a bank will need to create a comprehensive business strategy that applies to all of its individual business segments. Running operations based on the revenue plans of individual business segments will not allow a bank to maximize group revenue, manage risk consistently, or thoroughly comply with regulations. This has been the main motivation for the introduction of Risk Appetite Frameworks, whereby banks set up overall business plans to accomplish these three tasks.

However, banks should focus more on proactively managing, rather than merely establishing, risk appetite, and making sure that all of the activities of their individual business segments are in sync. Given how quickly

market conditions can change – and therefore how quickly financial risks can emerge – banks will need to be nimble and rapidly adapt to conditions as they evolve. And, ideally, each business segment will run as autonomously as possible but always in the direction of the overall strategy.

Additionally, frameworks should include incentives for business segments to meet specific targets. For example, if a bank's goal is to minimize concentration risk in its credit portfolio, setting credit limits that reflect the economic capital or credit value-at-risk will be an effective tool to diminish portfolio concentration. The point is to set up a framework that all relevant employees can adhere to, to de-concentrate a portfolio. Or, if a bank is trying to achieve a better balance between risk and return, it can establish incentives to prioritize trades with a specific risk/return ratio; for example, by disseminating

risk information on required spreads for loans or internal fund transfer pricing throughout the organization. These frameworks would guide all employees, so that all business activities would be directed toward achieving the specific targets.

In the areas where building such an autonomous framework proves difficult, firms can use other tools; in this case, enhancing their stress testing capabilities will be particularly important. If a bank can conduct stress tests quickly and flexibly enough, it will help correctly guide management.

### Developing tools to help management discern hard-to-see risks and improve response speed

Changes in the operating environment will make financial risks challenging to discern, and assessing potential risk using past data or traditional risk management tools will also be more difficult than in the past. For example, when oil prices declined sharply in early 2015, few banks knew how the drop in prices would affect industries other than the energy sector. Many banks tried to conduct an impact analysis to clarify the possible ripple effects of the drop in prices. What is more, no one could foresee how the drop would affect the financial markets. The plunge in oil prices itself was an unprecedented incident and considerable effort was needed to clarify the risk.

Banks will have to establish frameworks to more systematically identify emerging risks and provide early warning signs throughout their organizations. Banks will also have to develop sophisticated risk models to capture and quantify these risks. And all of a bank's business segments should use the same risk models to ensure consistency.

### Improving data management to enhance data quality

With market conditions changing quickly and new types of risks emerging frequently, quickly obtaining accurate information throughout an organization will be critical, so having a first-rate management information system in place will be paramount. Moreover, that management information system should be the same for all of a group's entities globally. A bank's management team will need to respond rapidly to changes, and they will need the highest-quality data to make good decisions.

### Improving risk governance will be an ongoing process

The banking industry will be affected by structural changes and will need to implement reforms in risk governance to adapt, requiring additional costs and effort. However, it is also true that "change is a chance." Only banks that can perform the necessary reforms in response to the changes will win the competition. The next ten years will definitely be an important turning point for large banks.

## GLOBAL EXTENT OF QUANTITATIVE EASING IS UNPRECEDENTED

After the financial crisis, regulators and central banks in the US, Japan, and Europe started quantitative easing to cope with the economic downturn – resulting in an unprecedented amount of money flowing into the global financial markets. Although the US is currently moving to end its quantitative easing as its economy continues to recover, the massive amount of money generated in the major developed countries owing to quantitative easing has led to ultra-low interest rates and asset price increases globally, as investment money moves around the world searching for yield, prompting large-scale money shifts among different markets. As a result, the price of assets such as government bonds, stocks, real estate, and credit has risen significantly, which has also resulted in higher asset correlations.

This kind of large-scale quantitative easing policy is unprecedented. What we are observing in the current global market is an experiment conducted on an incredibly large scale. Although I believe that regulators are certain that this policy will lead their economies in a better direction, the road ahead could be very bumpy, given how much both the global economic environment and the financial risks in the global markets continue to evolve.

Meanwhile, as market participants search for yield, their focus has moved from the developed to the emerging markets, another reason for the structural shift in global risk. The institutional investor capital flowing into the emerging markets has helped meet the markets' expanding finance needs for growth, which has resulted in the rise in asset prices and the credit boom in those economies. China's presence in the global economy has grown especially rapidly in the last few years, leading to not only a significant money shift in the global markets, but also new concerns among market participants. With China's economy facing a slowdown for the first time and the country attempting a soft landing, the next five to 10 years will be somewhat bumpy, which could lead to further volatility and correlated moves in the global markets.

Also, with China and other emerging economies slowing down, the global demand for commodities such as crude oil and natural gas is declining. In addition to this relatively short-term demand-side effect, there has been a long-term structural shift in the world economy, with most economies becoming more cost-efficient and requiring less energy to produce the same output. This change has pressured global commodity prices, which manifested primarily as a sharp decline in oil prices in 2014-15, and has exacerbated the slowdown in the emerging economies this year, especially among commodity-exporting countries. This cascade effect has driven further concerns about the emerging countries' sovereign risk.

With the global economy entering an era of low growth, a rapid recovery is becoming less and less likely. As has been discussed in the US, central banks throughout the world have already purchased large amounts of bonds that they will not be able to sell in the market at once, given what a huge negative impact doing so would have; those central banks are likely to try to compress their balance sheets slowly as the bonds get redeemed. So most of the massive quantitative easing money is likely to stay in the market for at least the next five to 10 years. As a result, the current irregular financial environment will hold.

# DO BANKS NEED THIRD-PARTY MODELS?

By Dr. Douglas W. Dwyer and Dr. Tony Hughes

**Dr. Douglas W. Dwyer**
*Managing Director and Head of Single Obligor Research*

Douglas leads the Single Obligor Research Group, which produces credit risk measures of corporations and financial institutions worldwide. The group's models are used by banks, asset managers, insurance companies, accounting firms, and corporations to measure name-specific credit risk for a wide variety of purposes. The group measures credit risk using information drawn from a mixture of financial statements, regulatory filings, security prices and derivative contracts. One current focus of the group is the application of its risk models to the stress testing of bank portfolios.

**Dr. Tony Hughes**
*Managing Director of Credit Analytics, Economic and Consumer Credit Analytics*

Tony oversees the Moody's Analytics credit analysis consulting projects for global lending institutions. An expert applied econometrician, he has helped develop approaches to stress testing and loss forecasting in retail, C&I, and CRE portfolios and recently introduced a methodology for stress testing a bank's deposit book.

This article discusses the role of third-party data and analytics in the stress testing process. Beyond the simple argument that more eyes are better, we outline why some stress testing activities should definitely be conducted by third parties. We also dispel the notion that a bank can, in isolation, fully account for all of its risks. We then consider the incentives of banks, regulators, and third-party entities to engage in research and development related to stress testing.

"But in consequence of the division of labor, the whole of every man's attention comes naturally to be directed towards some one very simple object. It is naturally to be expected, therefore, that some one or other of those who are employed in each particular branch of labor should soon find out easier and readier methods of performing their own particular work …"
– Adam Smith

Sometimes, we encounter a perception among banks that regulators expect them to build all their risk management tools in-house and use only internal data. Other times, we find that banks are free to buy external data, mainly when internal supplies are low, but that models estimated using industry-wide databases are unacceptable for use in stress testing, unless they are heavily customized and calibrated to portfolio-specific data.

Such extreme views are at odds with the stated aim of the stress testing experiment. In the wake of the global financial crisis, legislators around the world instigated reforms designed to force large banks to better understand the risks associated with their books. Regulators envisaged that stress tests, when combined with enhanced regulatory scrutiny, could minimize the potential for future government bank bailouts and thus solve the problems of adverse selection of risks and moral hazard.

We describe this process as an "experiment" because, while hopes are high, no one yet knows whether stress testing will actually reduce overall banking system risk. For the experiment to be a success, a significant period of time needs to pass without a bank-failure-induced recession. For the US, a period of 50 years seems appropriate given that the Great Depression, the Savings and Loan Crisis, and the Great Recession all occurred during the past century.

Truly understanding all the risks a bank takes at a given time is a daunting challenge. If analysis of an external data set, or work by a third-party analyst, can help a bank or regulator understand risk more fully, does it matter that the arrangement involves entities and resources external to the bank? We contend that for the stress testing experiment to succeed, regulators should welcome and encourage research and development, as well as data collection and improvement, by anyone who is willing to engage in such activities. This call to arms

extends not only to banks, bank employees, and regulators but equally to academics, data collectors, consultants, students, advisors, and freelance analysts. After all, if an amateur astronomer identifies the comet on a collision course, should the analysis fail validation because he or she is not employed by NASA?

### Must banks consider other banks?

One of the main causes of the US subprime crisis was that a number of major institutions had taken long positions in this risky sector. If subprime had instead remained a niche industry with few players, the crisis may never have materialized. This type of behavior is a very common element in historical banking crises. By their very nature, credit-fueled asset price bubbles – the most dangerous phenomena for the survival of banking systems – are characterized by widespread irrational exuberance of many borrowers and many lenders. Banks see their peers making excess profits lending to a certain group of people and rush to join the party. As each new bank enters the market, the risk the initial entrants face rises even if their risk appetite and underwriting standards do not change. A safe, profitable

for the effects of distortions to their industry created by the growth of lending to borrowers at the opposite end of the credit quality spectrum.

To gain a full understanding of risks, therefore, banks must explicitly reference data collected from beyond their own walls. This statement is true for a bank with poor internal data assets, where the external information serves a further purpose of giving modelers something to model. It is also true for banks with abundant internal data at their disposal that can conceivably build any model.

Portfolio alignment across banks seems to be a necessary condition for banking sector stress. Ironically, if lending markets are healthy and thus unlikely to cause problems for large financial institutions, banks probably can safely consider the nature of their portfolios in isolation and gain a largely accurate view of baseline portfolio risk. It is only under stress, when markets are distorted by collective irrational exuberance and its aftermath, that the need for external data becomes truly critical. But it is, after all, the stress events that most interest us here.

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activity for a few banks becomes gravely dangerous when many engage in the same behavior.

The level of risk in a bank's book depends critically on how the book aligns with those of other banks. In other words, it was important for a hypothetical subprime lender circa 2006 to know and consider the implications of so many other similar lenders being active during the critical time. Furthermore, conservative mortgage lenders that were not engaged in subprime needed to know about and account

Where do banks source the needed external data to accurately gauge stress? Call reports might be one ready source. For some applications, however, these currently public sources may be insufficiently detailed. Regulators could make the data they collect from banks as part of the stress testing process public, though lawmakers or privacy activists might not favor this. In addition, many of the biggest players in the subprime saga were shadow banks and potentially invisible to banking regulators.

For financial institutions to be willing to share their data with their competitors, the data must be suitably anonymized and aggregated. Private-sector companies have historically provided a conduit through which banks can happily share information without giving up any sensitive trade secrets. Data gathering start-ups may already be collecting the data that holds the key to identifying the next crisis. They should be encouraged to continue the search and, when successful, charge an appropriate price for their products.

### Research and development

Having established the case for the use of external data, the next question concerns who should model it. The concept of stress testing a bank's book, especially against a pre-specified, exogenous macroeconomic scenario, is a relatively young discipline compared to other risk management practices. The reality is that in universities, NGOs, regulatory offices, banks, and consulting companies, dedicated professionals are busy trying to better understand stress testing methodology to make it easier for banks to implement and make it more accurate for users.

Regulators and academics will presumably continue to engage in considerable innovative effort. Academics will likely pursue stress testing because it is consequential, yields large amounts of interesting data, and is intellectually stimulating. Regulators, meanwhile, will seek to innovate out of pure necessity. These organizations must seek the best available stress testing tools to confront rogue banks and stay ahead of the next banking crisis.

Banks have a strong incentive to maintain at least a minimum standard of stress test model performance. Shareholders expect banks to pay dividends, and if a failed stress test results in a reduction or suspension of such payments, the incumbent CEO could lose the support of the shareholders. Nevertheless, among the bank holding companies that have not suffered a qualitative failure, it is unclear whether those institutions that took the stress test most

seriously were rewarded for their efforts, compared to those that merely did enough to fall over the line. Because a bank's management team represents the interests of shareholders, it is more likely to invest in activities that increase shareholder value than in those that minimize the FDIC's losses should the bank happen to fail.

Regulators, of course, have called on banks to stitch the stress test into their day-to-day operations. For this to become a reality, however, stress test models must yield insights that enable business managers to lower risk for a given return or clearly increase the profitability associated with running the portfolio. If using the model does not yield such insights, banks may pretend to take the models seriously when under the regulatory spotlight but make no actual changes in their banking behavior or operations.

In terms of downside risk management, the incentive for banks to innovate may therefore be thin. True, they must take the stress test seriously enough that the probability of a failure is sufficiently low, but there is little incentive for them to do any more. If the stress test process is improved to the point where managers can rely on the models to make money, the innovation floodgates will open and banks will be motivated to invest in research that will give them an edge over their competitors, on both the upside and downside.

Vendors, meanwhile, invest in innovation with the hope of realizing a financial return. One way that a vendor can be rewarded for innovation is by becoming the standard source for a particular analytical tool like a credit score, an asset price forecast, a probability of default, or a rating. They can then charge a premium over an upstart market entrant. Once a vendor has been established as the source and the tool is being used productively for business decisions, it will be in the vendor's best interest to ensure the quality of the analysis and carefully maintain the infrastructure used to produce the information. If the provider is motivated by something other than profits, continuity of

service may be illusive. Consequently, market participants may be reluctant to invest in adopting tools that are not produced by for-profit entities.

A recurring footnote in the Federal Reserve Supervisory's Dodd-Frank Act Stress Test (DFAST) results provides a sample of approximately 25 vendors whose analytics the Federal Reserve Supervisory used to conduct their DFAST analysis.[1] Of these, only three are not-for-profit organizations; four are financial institutions. The rest are for-profit vendor companies that rely on a combination of financing from investors and revenue from the sales of analytics to fund both their operating costs and whatever research and development they conduct.

Although many of these firms are likely to do some bespoke consulting work, we find it interesting that well-known management consulting firms (such as the Big Four) are not on the list. These firms help banks both build internal models using bank data and validate their use of vendor models. As such, they may be reluctant to sell analytics as it would conflict with their core business.

### Sharing of analytical breakthroughs among banks

If a bank develops a promising new technique that it uses to beat the market, it will likely be reluctant to sell such analytical tools to similar institutions; for competitive reasons, other financial institutions may also be reluctant to buy them. However, if a vendor does achieve a breakthrough, it will expect to be well compensated for its success, but this will be achieved through propagation of its innovation throughout the industry. While vendors will naturally seek to protect their intellectual property, the propagation of soft knowledge in the industry will likely be greater than if the technology is locked in a specific bank's intellectual vault.

While all scientific progress is welcome, information externalities are arguably greater if a vendor, as opposed to a bank, is responsible for the breakthrough.

### Economies of scale and scope in analytics

Home-grown analytics, those produced within a bank, have the advantage that bank managers and executives retain complete control. Vendor analytics, in contrast, often reflect the experiences of many market participants, offer more features and documentation, and are less expensive to implement.

Because the incremental costs of making analytics available to additional clients declines as the number of clients using the analytics grows, it is generally efficient for one party to produce them and then to share them with multiple parties. Our interpretation of what regulators have written about the use of vendor models is that they expect financial institutions to take ownership of whatever analytics and data they use, but this does not imply that they should necessarily build their own analytics with their own data in all cases.

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**WHEN DOES DATA BECOME A MODEL?**

The line between data and model is vague. For example, when bonds are sold, the invoice is based on the "dirty price," but the vendor is likely to present bond price data in a different format. The vendor may provide the "clean price," the yield, the spread over a reference curve, and finally the option adjusted spread. These transformations of raw data are increasing in complexity; an option-adjusted spread clearly involves the use of a model that makes a number of important assumptions that could be qualitatively challenged. There are many other examples: Quarterly GDP growth at the state level is estimated; dealer quotes for CDS spreads are based on the pricing models of the dealers; the exact calculation of the VIX involves fairly complex statistical manipulation; and macroeconomic variables are often seasonally adjusted with an algorithm that is, in reality, a time series econometric model.

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1  Cf. footnote 43 of the 2014 DFAST results.

In the analytics business, producing new products and supporting existing products is work, but the work product is scalable across many users. New products frequently necessitate that a firm invest in collecting data and developing analytics for several years prior to the sale of the product to the first client. There are no guarantees that the new product will be successful.

Supporting data and models requires documentation, validation, and periodic model updates. Users also require guidance from vendors on the use of the model. Much of this effort is reusable: The needs of one client will overlap heavily with the needs of other clients. Nevertheless, because every financial institution is different, there will always be a customization aspect to the provided support. Consequently, the marginal costs of providing analytics will decline as the number of users grows, but the marginal costs of providing support services always remain positive.

Having a set of firms producing data analytics for many banks is more efficient than every bank attempting to replicate all of these products on their own. Further, the more heavily used the product, the higher the quality of the product. Suppose there is an issue with a particular model. If 10 banks are using the product, the issue is likely to be discovered sooner than if the client base consists of only one institution. If one bank discovers an issue that affects nine others, beneficial externalities accrue to all banks as a result of the actions of the observant institution. Such externalities are not present in a system that relies only on internal modeling.

One issue that is often mentioned in the context of scalable analytics is that it can foster potentially dangerous concentration risks. Suppose a particular model becomes an industry standard, to the point where all banks must use the model's predictions to be viewed as competitive by financial markets. If the model has a structural flaw that causes it to under-predict losses in the industry, this could conceivably destabilize every institution using the model instead of just one.

Assume that the vendor model under consideration produces accurate insight into the riskiness of a portfolio that simply cannot be gleaned from any other source. We are not saying that the vendor model produces a complete picture of risk, just that it shades a particular color in a way that cannot otherwise be captured by risk managers. Forcing banks to exclude the use of such a vendor model will result in an incorrect rendering of the risk picture. Thus, system risk could decline if all banks adopted the use of the vendor model, as only the model's users would know that the fig leaf is, in reality, poison ivy.

Analytical concentration risk therefore depends critically on what exactly the concentration is. How the information is used by banks is also critical. If the vendor model contains unique, accurate, and pertinent information, it is not necessarily a bad thing if all banks adopt the model. If the model is flawed, a feature common to every model ever built, the onus shifts to the bank's risk managers to ensure that the information is correctly harnessed in assessing portfolio risk. We would never advocate blind acceptance of one of our models or, indeed, of any model built by any mortal. This classification certainly extends to any and all of our current and future competitors. Downside model concentration risks tend to be realized only when banks confuse a model's predictions with gospel truth and take actions based on that "truth."

The best defense for this issue is the concept of "effective challenge,"[2] which is a regulatory expectation for all models that have a material impact on business decisions. The Federal Reserve Supervisory defines an effective challenge as a "critical analysis by informed parties that can identify model limitations and assumptions and produce appropriate changes." For the challengers to be effective, they must be independent from the model builders, have the appropriate degree of

2  See OCC 2011-12.

expertise, and enough influence so that their challenges will be appropriately addressed. A well-built third-party model can certainly play this role in the validation process.

### External analytics as mitigants to agency issues

Analytics can mitigate issues that result from misaligned incentives owing to principal-agent issues, asymmetric information, and the moral hazard problem. The analytics for this purpose should be valid and unbiased, and use objective and verifiable inputs. An analytic produced by a third party is more likely to fit these purposes than one produced by a financial institution or regulator.

To give one example, after graduate school, one of the authors paid a significant commission to a real estate agent to help him lease a rent-stabilized apartment in New York City. The agent used his credit score to verify that he was a person likely to fulfill his financial obligations to potential property owners.

Though the credit score does not measure tenant soundness per se – it gives no indication of tidiness or proclivity for playing loud music – it is cheap to procure, has no horse in the race, and is sound enough to provide a useful signal to all relevant parties to the transaction. In this case, a third-party model mitigated the principal-agent problem while also helping to overcome significant informational asymmetries the parties to the transaction faced. Financial institutions use models in very similar ways. For example, credit risk buyers will often ask sellers to use a specific vendor model to indicate the likely future performance of the portfolio. In this case, the third-party model partially mitigates the issue of asymmetric information, in that sellers know more than buyers about the underwriting conditions applied in originating the loan. This situation arises with considerable frequency. In the mortgage industry, banks will often corroborate home appraisals using AVMs – auto valuation models – that are owned and operated by third

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This situation is a very common one; it is instructive to consider the motivations of the parties involved and why the analytical second opinion was sought from a third party. The lessee felt he would be a good tenant but had no way of quickly making his case. The realtor's position was more tenuous in the sense that he knew little of the potential tenant, but wanted to make the commission and move on to the next deal. The owner of the property, meanwhile, could have made time to interview the potential lessee, check references, and verify income, though this would have provided uncertain signals and would have been relatively expensive and time-consuming to procure.

parties. In auto leasing, residual prices will be set using analytical forecasting tools that are not owned by any of the parties to the transaction. Credit ratings from reputable companies will often be required before institutional investors take positions in certain risky assets. In all of these cases, there are sound reasons for why analytics simply must be undertaken by external entities.

But back to stress testing. As we mentioned, regulators want banks to stitch stress testing tools into a business' day-to-day operations. This can be achieved by either incorporating models that are already in place for day-to-

day operations into the Comprehensive Capital Analysis and Review (CCAR) stress testing or using CCAR stress testing models for day-to-day operations either in addition to or in place of existing practices. In stress testing models, a portfolio's initial risk level is a key determinant of the expected losses. Using internal models to determine initial risk levels will benefit banks with more aggressive models. Such a policy could lead to a moral hazard problem, because banks with more aggressive models would have an incentive to make more aggressive loans. An industry model that can be applied to all banks can serve as a check on the banks with more aggressive models. This type of industry model could be developed by regulators – provided that they have the required data. Still, even if the regulators' data is comparable to that of the third party, the third-party model may be more credible if the banks push back on the regulator for being too conservative.

In addition to economies of scale and scope, third-party analytics – because they are produced by third parties – can mitigate incentive issues associated with the principal-agent problem, asymmetric information, and moral hazard. In each context, the two parties that are sharing risk can agree to use the third-party analytics to make risk more transparent.

## Conclusion

We are now seven years gone since the financial crisis triggered the Great Recession. The first stress test (the 2009 Supervisory Capital Assessment Program) did help restore the market's confidence in the US banking system, and there is little doubt that the US banking system is now better capitalized than it was in August of 2008. But it is equally true that the new regulatory environment has yet to be tested by a new banking crisis or, for that matter, a recession of any flavor. Before making a proper assessment of how robust the new system actually is, we would want to see it perform under real stress.

We also would like to see banks use their stress testing infrastructures for their day-to-day business decisions. These infrastructures can be used for tactical decisions – e.g., how to manage a specific exposure – as well as strategic decisions – e.g., whether to expand/contract exposure to an industry, region, or asset class. In either case, the infrastructure would presumably enhance shareholder value.

If banks choose the analytics with the most attractive balance of costs and benefits, they will happily invest shareholder funds in stress testing models, in the knowledge that doing so will increase share prices. If the decision of which analytic to use is constrained, however, a bank is likely to use the analytic only to ensure that it meets regulatory requirements; the bank is unlikely to use the analytic to make business decisions.

For model risk management, the concept of an effective challenge plays a key role. For an effective challenge to be credible, a bank should look to all possible sources of information and knowledge. For a bank to only look internally for answers to these critical questions is simply anathema to the goals of regulatory stress tests.

# SUBJECT MATTER EXPERTS

### Philip Allen
*Associate Director, Retail Products*

Philip has more than 20 years of experience in business development and relationship management in financial services. He has developed a deep understanding of the retirement and workplace savings market and has extensive experience in both defined contribution and defined benefit pensions.

Philip has worked for both product providers and software companies and has a wide range of clients and partners, including IT/software providers, asset managers, employee benefit consultants, advisory firms, and blue chip corporate clients.

philip.allen@moodys.com

### María de la Concepción Cañamero
*Associate Director, Lead Strategist and EMEA Team Lead, Strategy and Analytics*

Maria is Lead Strategist and team leader in the EMEA Strategy & Analytics group of Moody's Analytics. She leads the team efforts to analyze and monitor key demand trends affecting our customer segments and regulatory developments in the financial services industry.

She is directly involved in the creation of expert content on topical industry trends such as stress testing (2011 EMEA Stress Testing Banking Survey) and Solvency II (2013 Solvency II Practitioner Survey).

Maria has over 10 years experience in the financial services industry. Prior to joining Moody's Analytics she worked as a senior strategy consultant for Accenture. She has a degree in Economics from the University of Salamanca in Spain and holds an MBA from ESCP Europe in France.

maria.canamero@moodys.com

### Dr. Douglas W. Dwyer
*Managing Director and Head of Single Obligor Research*

Douglas leads the Single Obligor Research Group, which produces credit risk measures of corporations and financial institutions worldwide. The group's models are used by banks, asset managers, insurance companies, accounting firms, and corporations to measure name-specific credit risk for a wide variety of purposes. The group measures credit risk using information drawn from a mixture of financial statements, regulatory filings, security prices, and derivative contracts. One current focus of the group is the application of its risk models to the stress testing of bank portfolios.

Prior to working at Moody's Analytics, Douglas was a Principal at William M. Mercer, Inc., in their Human Capital Strategy practice. He earned a PhD in Economics at Columbia University and a BA in Economics from Oberlin College.

douglas.dwyer@moodys.com

### Andy Frepp
*Managing Director, Enterprise Risk Solutions*

Andy has more than 25 years of experience in the insurance, asset management, and pensions industries and helps global financial institutions address their regulatory compliance and risk management needs.

Prior to his current role, Andy was the CEO of Barrie & Hibbert, which was acquired by Moody's Analytics in 2011. Prior to that, he had a variety of senior leadership roles in large asset management and insurance firms. A qualified actuary, Andy has a BSc in Mathematics from Imperial College London and an MBA from the University of Hull.

andy.frepp@moodys.com
MoodysAnalytics.com/AndyFrepp

### Cayetano Gea-Carrasco

*Senior Director, Head of Stress Testing Services and Advisory, Enterprise Risk Solutions*

Cayetano works with financial institutions on addressing their technology and enterprise risk management needs. He has extensive experience working with financial institutions on enterprise risk management, stress testing, liquidity management and capital planning.

Previously, Cayetano held leadership positions at various institutions and global banks. He holds a BSc and MSc in Telecommunication Engineering, a Master in Economics and Finance, and an MSc in Financial Mathematics, with distinction, from King's College London.

cayetano.gea-carrasco@moodys.com
MoodysAnalytics.com/CayetanoGea-Carrasco

### Kevin Hadlock

*Senior Director, Training*

Kevin is a Global eLearning Solution Specialist and supports all training-related activities throughout the Asia-Pacific region. He has designed numerous distance-learning and web-based training programs, developed and taught many seminars, webinars, and full, blended-training programs, and has authored a substantial body of content used globally by thousands of credit trainees.

Prior to his current role, Kevin headed up eLearning and blended-training development for the organization globally, and was the architect for the company's wholesale credit eLearning solutions. Kevin had 13 years of experience in the banking industry before joining Moody's Analytics in January 1990. Kevin holds a BA degree from the University of Utah in Business Management.

kevin.hadlock@moodys.com
MoodysAnalytics.com/KevinHadlock

### Brian Heale

*Senior Director, Business Development Officer, Global Insurance*

Brian is an insurance market and Solvency II specialist who has significant experience in the technology solutions and issues for the global insurance industry. He has an in-depth knowledge of the practical aspects of the insurance business, coupled with a comprehensive understanding of enterprise technology in relation to the development and implementation of core administration, actuarial/risk, data, and Solvency II reporting systems.

Brian has previously worked with a number of major insurers and technology and consulting companies across the world. He has run administration, product development, and sales divisions, and also has considerable experience in strategic planning.

brian.heale@moodys.com
MoodysAnalytics.com/BrianHeale

### Christian J. Henkel

*Senior Director, Enterprise Risk Solutions*

Christian leads the risk measurement advisory team throughout the Americas and is an experienced credit practitioner. Having spent most of his career in commercial banking, Christian has a unique blend of business and academic experience across the financial services industry – including expertise in commercial credit and financial analysis, portfolio management, asset quality, loan loss reserve methodologies, stress testing, credit administration, process redesign, safety and soundness examinations, and credit risk modeling.

Christian received his master's and undergraduate degree from the University of Texas and graduated as valedictorian from the Southwestern Graduate School of Banking at Southern Methodist University, where he also taught a course on credit risk management.

christian.henkel@moodys.com
MoodysAnalytics.com/ChristianHenkel

## Dr. Tony Hughes

*Managing Director of Credit Analytics,*
*Economic and Consumer Credit Analytics*

Tony oversees the Moody's Analytics credit analysis consulting projects for global lending institutions. An expert applied econometrician, he has helped develop approaches to stress testing and loss forecasting in retail, C&I, and CRE portfolios and recently introduced a methodology for stress testing a bank's deposit book.

Tony was formerly the lead Asia-Pacific economist for Moody's Analytics. Prior to that, he held academic positions at the University of Adelaide, the University of New South Wales, and Vanderbilt University. He received his PhD in Econometrics from Monash University in Melbourne, Australia.

tony.hughes@moodys.com
MoodysAnalytics.com/TonyHughes

## Anna Krayn

*Senior Director and Team Lead,*
*Capital Planning and Stress Testing*

Anna is responsible for the business development of the Capital Planning and Stress Testing Team. Her clients include a variety of financial services institutions, including those in the insurance, banking, and consumer finance sectors across the Americas.

Prior to her current role, she was with Moody's Analytics Enterprise Risk Solutions as engagement manager, leading projects with financial institutions across the Americas in loss estimation, enhancements in internal risk rating capabilities, and counterparty credit risk management.

Anna also worked as a ratings analyst in the Financial Institutions Group of Moody's Investors Service. Before joining Moody's, Anna worked at the Financial Institutions Investment Banking group at Bank of America.

Anna holds a BS degree in finance and international business and an MBA from Stern School of Business at New York University (NYU).

anna.krayn@moodys.com
MoodysAnalytics.com/AnnaKrayn

## Dr. Amnon Levy

*Managing Director, Head of Portfolio and Balance Sheet Research and Modeling Services*

Amnon heads the Portfolio Research Group that is responsible for research and model development for Moody's Analytics portfolio and balance sheet models. His current research interests include modeling credit portfolio risk, integrated models for balance sheet management, and liquidity risk.

Prior to joining Moody's Analytics, Amnon was a visiting assistant professor at the Stern School of Business, New York University, and the Haas School of Business, University of California at Berkeley. He is currently teaching a course on credit risk at the Haas School of Business MFE program. Amnon has been published in the *Journal of Financial Economics*, *Journal of Monetary Economics*, *Encyclopedia of Quantitative Finance*, *Risk*, *Journal of Banking and Finance*, and *Journal of Risk Model Validation*.

He holds a BA in Economics from the University of California at Berkeley and a PhD in Finance from the Kellogg Graduate School of Management, Northwestern University.

amnon.levy@moodys.com
MoodysAnalytics.com/AmnonLevy

### Dr. Juan M. Licari

*Senior Director, Head of Economic and Consumer Credit Analytics for EMEA*

Juan and his team are responsible for generating alternative macroeconomic forecasts for Europe and for building econometric tools to model credit risk phenomena. His team develops and implements risk solutions that explicitly connect credit data to the underlying economic cycle, allowing portfolio managers to plan for alternative macroeconomic scenarios. These solutions are leveraged into stress testing and reverse stress testing practices.

Juan communicates the team's research and methodologies to the market and often speaks at credit events and economic conferences worldwide. He holds a PhD and an MA in Economics from the University of Pennsylvania and graduated summa cum laude from the National University of Cordoba in Argentina.

juan.licari@moodys.com
MoodysAnalytics.com/JuanLicari

### Yuji Mizuno

*Director, Business Development Officer*

Yuji leads the product and consulting areas of Moody's Analytics Japan and has extensive knowledge of regulations and risk management practices among financial institutions. He provides clients with insight on regulatory compliance, ALM, liquidity, and ERM frameworks. He also functions as a main contact for Japanese regulators and financial institutions.

Before joining Moody's Analytics in 2009, he worked for ex-Sanwa Bank, Bank of America Securities, Aozora Bank, and JPMorgan securities. He holds a Bachelor of Law from Tokyo University.

yuji.mizuno@moodys.com
MoodysAnalytics.com/YujiMizuno

### Dr. Gustavo Ordonez-Sanz

*Director, Stress Testing Specialist Team*

Based in London, Gustavo advises financial organizations on the different aspects of stress testing scenario analysis at the firm-wide level. This includes: scenario generation; risk, revenue, and capital modeling and forecasting; embedding scenario analysis in the firm's decision-making processes (risk appetite, portfolio management, pricing, etc.); and governance, infrastructure, and reporting.

Gustavo also has experience in credit portfolio and counterparty credit risk modeling and management. Gustavo holds a degree in Theoretical Physics from the University Autonoma of Madrid and a PhD in Physics from Radboud University Nijmegen.

gustavo.ordonez-sanz@moodys.com

### Mehna Raissi

*Senior Director, Enterprise Risk Management Solutions*

Mehna is responsible for the management and product innovation of Moody's Analytics premier credit risk management tools – the single obligor credit risk products suite, which includes RiskCalc™, Commercial Mortgage Metrics (CMM™), and LossCalc™.

Mehna has a background in banking and has worked within the product management, business process improvement, and change management groups. Her previous experiences include wholesale, business, and consumer banking at Wells Fargo and Bank of America. Mehna completed her Bachelors in Managerial Economics from the University of California, Davis, and her MBA from the University of San Francisco.

mehna.raissi@moodys.com

## Dr. Christian Thun
*Senior Director, Strategic Business Development*

Christian is responsible for providing thought leadership on credit risk management and strategic business development in the EMEA region and functions as a main contact for regulators and senior management of financial institutions.

With almost 20 years of experience, Christian has worked with numerous financial institutions in the EMEA region on Basel II implementation, risk management, stress testing, and portfolio advisory projects, and in the process has become an internationally-known expert on credit risk management.

christian.thun@moodys.com
MoodysAnalytics.com/ChristianThun



## Chiara Ventura
*Economist, Economic and Consumer Credit Analytics*

Chiara Ventura is an Economist within the Economic and Consumer Credit Analytics team. She joined the company team after completing her summer Internship program. She has just started a part-time PhD program in Real Estate from Reading University.

Chiara holds both a MSc and a BSc in Mathematical Engineering (Statistics) from the Polytechnic of Milan. She worked with the Imperial College in London for her dissertation.

chiara.ventura@moodys.com



## Grace Wang
*Director, Enterprise Risk Management Solutions*

Grace works on the single obligor product suite and is responsible for the Credit Research Database (CRD™) data and reporting products and loss given default (LGD) models and solutions in the Risk Measurement group. She has held project and product management roles across the Risk Measurement, Structured Finance, and Stress Testing groups.

grace.wang@moodys.com



## Dr. Pierre Xu
*Associate Director, Research and Modeling Group*

Pierre is an associate director in the Research and Modeling Group of Moody's Analytics. His current research topics cover PPNR modeling, economic capital, regulatory capital, and portfolio optimization. He holds a PhD in Economics from Louisiana State University, an MFE from University of California at Berkeley, and a BA in Finance from Fudan University.

pierre.xu@moodys.com

## Ed Young

*Senior Director,*
*Capital Planning and Stress Testing*

Ed Young is a Senior Director on the Capital Planning and Stress Testing Team. In this capacity, he focuses on structuring solutions that bring together capabilities across Moody's Analytics to support robust capital planning and stress testing processes. His primary focus is on clients in the banking and insurance sectors across the Americas.

Prior to joining Moody's Analytics, Ed was AVP of the Risk Management and Analysis group at the Federal Reserve Bank of Atlanta. In this role, he led a group consisting of four teams of specialists focused on Credit Risk, Capital Adequacy and Planning, Model Risk Management, and Market and Liquidity Risk. He was also involved with many broad Federal Reserve System initiatives and prior to his departure was the Deputy Chair of the Federal Reserve System's CCAR Oversight Group.

Earlier in his career, Ed held roles in the Treasury group at two different large regional banks. He holds a BS in Business Administration and an MBA from the University of Alabama at Birmingham.

ed.young@moodys.com

## Dr. Jing Zhang

*Managing Director and Global Head of Research and Modeling, Enterprise Risk Solutions*

Jing's group is responsible for the quantitative modeling behind the EDF and LGD models for both public and private firms, commercial real estate, and portfolio and balance sheet analytics. Jing joined the research team at the former KMV in 1998, eventually becoming a Director in the Research Group. In that role, besides managing day-to-day research operations, he made major contributions to a number of KMV quantitative models.

Jing obtained his PhD from the Wharton School of the University of Pennsylvania and his MA from Tulane University. He was a lecturer for the Master of Financial Engineering program at the University of California, Berkeley from 2010 to 2012. He is also the editor of Risk book CCAR and Beyond.

jing.zhang@moodys.com
MoodysAnalytics.com/JingZhang

# MOODY'S ANALYTICS RISK MANAGEMENT SOLUTIONS

LEVERAGE POWERFUL SOLUTIONS FOR ENTERPRISE-WIDE RISK MANAGEMENT

Moody's Analytics offers deep domain expertise, advisory and implementation services, in-house economists, best-in-breed modeling capabilities, extensive data sets, and regulatory and enterprise risk management software. Our risk management solutions:

» Improve strategic business planning and facilitate meeting regulatory requirements

» Assist with defining business-specific scenarios

» Offer a comprehensive and granular credit risk, economic, and financial data set

» Help model the impact that macroeconomic cycles, regulatory directives, and/or outlier events may have on an institution's risk profile

» Deliver an integrated stress testing software solution to calculate stressed performance indicators across the risk and finance functions

» Offer a modular, flexible, and comprehensive IFRS 9 impairment solution that facilitates an institution's efforts to calculate and manage capital set aside for these provisions

For more information, contact our integrated risk management experts at RiskPerspectives@moodys.com or visit MoodysAnalytics.com.

## INFRASTRUCTURE

### GCorr™ Macro EL Calculator

Offers an innovative approach to estimating stressed expected losses (EL) for portfolios that include loans and credit securities. The tool is designed to address regulatory requirements and assists in strategic portfolio risk management.

### Scenario Analyzer™

Coordinates the stress testing process across the enterprise, centralizing a wide range of Moody's Analytics, third-party, and proprietary models.

### RiskAuthority™

Delivers comprehensive regulatory capital calculation and management for Basel I, II, and III, including the risk-weighted asset (RWA) calculations required for CCAR reporting.

### RiskConfidence™

The RiskConfidence solution offers integrated enterprise balance sheet management for interest rate risk, funds transfer pricing (FTP), and liquidity risk management. It helps manage liquidity risk, compute net interest income, define multi-factor behavior models, and measure business unit performance through FTP.

### RiskOrigins™

Comprehensive, workflow-driven solution that allows commercial lenders to streamline and standardize the commercial credit underwriting process – from spreading and rating to deal structuring and covenant management – and  monitor the loan portfolio throughout the credit lifecycle to ensure compliance with bank and regulatory standards.

### Regulatory Reporting Module

Create, validate, and deliver monthly, quarterly and annual CCAR (FR Y-14) and DFAST reporting requirements. Fully integrated with our enterprise risk platform, this module creates and delivers reports in the required formats.

### RiskIntegrity™ Suite

The RiskIntegrity™ Suite is designed to address the risk and solvency enterprise risk management (ERM) needs for insurance companies, including both regulatory and internal management requirements.  It offers a comprehensive modular solution that can help manage a wide range of finance and risk data, produce risk and solvency analytics to support risk-based decision-making, and generate regulatory and business reporting.

### Regulatory Reporting for Solvency II

Integrated with our end-to-end insurance regulatory capital solution, the easy-to-use and cost effective Regulatory Reporting module produces accurate management and regulatory reports in local supervisors' commonly used formats and languages.

### Defined Benefit ALM

Defined Benefit ALM Is a sophisticated flexible asset liability modeling solution for measurement and analysis of market and longevity risk inherent in defined benefit pension schemes. It delivers a transparent modeling framework that provides full control over model parameters, and provides users the freedom to calibrate risk drivers to reflect their own economic views.

### Pension Risk Analytics

An accessible and feature-rich asset liability modeling solution designed to help measure and manage the risks facing defined benefit pension schemes.

### Wealth Scenario Generator

The Wealth Scenario Generator is a stochastic projection engine for modeling investment products and cash flows, designed to support retail investment advice and financial planning. It is used within client applications: advice tools, suitability assessment, defined contribution (DC) pension planning portals, product comparisons, what-if tool sets, and direct-to-consumer platforms.

### Investment Governance Service

The Investment Governance Service provides a product risk and suitability framework that allows product providers, distributors, and advisors to develop investment propositions aligned with stringent new regulations, configured to their own business needs.

### Retirement Portfolio Planner

The Retirement Portfolio Planner is a risk analysis and financial engine specifically designed for practitioners in the retirement income market. Using our core stochastic modeling platform capability, it supports advisors in identifying optimized retirement income solutions, aligned with the individual retiree's income and capital needs, as well as their capacity for loss. The Retirement Portfolio Planner can be configured in line with our client's own retirement product offering and advice model.

### RiskFrontier™

Produces a comprehensive and granular measure of risk to help institutions understand portfolio risk dynamics, manage concentration risk, quantify risk appetite, and conduct scenario analysis for improved strategic decision-making.

### Structured Finance Portal

A web-based tool that provides data transparency, analysis, and reporting on structured finance portfolios. The Portal offers extensive CLO and corporate loan content with industry-first manager style reporting and time-saving data normalization and aggregation.

### Structured Finance Portal Regulatory Module

Provides banks and financial institutions key data and analytical metrics on demand to help manage regulatory risk on structured portfolios.

## SCENARIOS

### Regulatory Scenarios

Provides an expanded set of scenarios based on projections from regulating authorities, covering more than 1,500 variables for 50+ countries, including the US and all its states and metropolitan areas

### Bank Holding Company-Designed /Bespoke Scenarios

Firm specific scenarios designed by our economists tailored to your unique exposures, geographic footprint, and assumptions.

### Standard Alternative Scenarios

Moody's Analytics baseline and alternative scenarios for 50+ countries, including the US and all its states and metropolitan areas, for loss-forecasting, stress testing, and strategic planning.

### Economic Scenario Generator

Designed for insurers, the Economic Scenario Generator (ESG) is a suite of leading-edge stochastic asset modeling tools within a flexible framework that allows insurers to undertake a wide range of risk management activities.

### ESG Automation Module

The Economic Scenario Generator (ESG) Automation Module allows users to automate the various stages of their scenario production cycle. It combines state-of-the-art calibration tools, process management,

and validation capability with best-practice scenario generation, in one powerful solution.

## Scenario Service

An alternative to ESG software, our Scenario Service provides insurers with scenario sets on an annual, semi-annual, or quarterly basis. Insurers and reinsurers can decide between the control and flexibility of a software installation or the simplicity and ease-of-use offered by the scenario service.

## DATA

### RiskFoundation™

Integrates your enterprise financial and risk data to calculate regulatory capital, economic capital, ALM, liquidity, and counterparty risk, for a global view of your exposures.

### Moody's Content Licensing Services

Provides a suite of comprehensive data covering all current Moody's Investors Service issuer and issue-related ratings.

### Regulatory, Custom and Standard Alternative Scenarios

Delivered by a team of over 80 experienced economists, we provide standardized economic scenarios, expanded scenarios based on regulatory projections, and scenarios customized to your unique vulnerabilities and idiosyncratic risks.

### Global Economic, Financial and Demographic Data & Forecasts

Provides a comprehensive view of macro and regional economic conditions. Our database covers more than 280 million time series for 180+ countries. In addition, we offer specialized forecasts of US residential and commercial property prices.

### CreditForecast.com

Provides exclusive forecasts and analysis of household finances based on consumer credit bureau data from Equifax, including auto, first mortgage, bank card, home equity, student loan, and consumer finance.

### Moody's Analytics Credit Research Database (CRD)

Is the world's largest and cleanest database of private firm financial statements and defaults, built in partnership with over 45 leading financial institutions around the world.

### Exposure at Default (EAD)

Data is derived from a subset of the CRD Database and is compiled of 10+ years of usage data for estimating and calculating EAD. The EAD database contains quarterly usage and Loan Equivalency Ratio data for both defaulted and non-defaulted private firms since 2000.

### PD Time Series Information

Offers time series of observed default rates and calculated PDs, covering more than two economic cycles. This data is collected and calculated for both public and private firms.

### Credit Migration Data

Enables users to construct detailed credit migration (transition) matrices. This detailed private firm data allows users to be more granular with segmentations across industry, region, and asset size using several different PD rating calculation methodologies.

### Credit Cycle Adjustment Data

Combines financial statement ratio information of private firms with credit cycle factors in the public equity markets to derive a dynamic, through-the-cycle PD measure.

### Structured Finance (SF) Data

Offers loan, pool and bond level performance data for RMBS, CMBS, ABS and CDOs. SF Data can be used for bottom-up mortgage stress testing model creation and calibration. SSFA data and calculations are also available.

### Default and Recovery Database

Allows users to look at how default experience varies at different points in the economic cycle, and which factors made default experience in each economic cycle unique. The data includes detailed rating histories, 30-day post default pricing, and three views into ultimate recovery.

## INVESTMENT ANALYSIS/SURVEILLANCE

### Moody's CreditView

Research and data to assist risk practitioners with investment analysis, creation of internal risk scores and meeting due diligence requirements.

## MODELS

### Moody's CreditCycle™

Provides retail credit portfolio insights of existing and future vintages under normal and stressed scenarios, for benchmarking, loss forecasting and stress testing.

### CreditEdge Plus™

Bridges the equity, bond, and credit derivative markets, enabling an in-depth understanding of their impact on credit risk.

### Stressed EDFs™

Estimate PDs for public firms using a range of macroeconomic scenarios, including EBA and user-defined scenarios.

### Commercial Mortgage Metrics (CMM®)

Is the leading analytical model for assessing default and recovery risk for commercial real estate (CRE) loans. CMM's stress testing capabilities leverage Moody's Analytics standard, regulatory, and custom scenarios.

### GCorr®

Moody's Analytics Global Correlation Model (GCorr) is an industry-leading granular correlation model used to calculate each exposure's contribution to portfolio risk and return for improved portfolio performance. GCorr covers a wide range of asset classes, including public firms, private firms, small- and medium-sized enterprises, sovereigns, US commercial real estate, US retail, and emerging markets.

### GCorr™ Macro EL Calculator

Offers an innovative approach to estimating stressed expected losses (EL) for portfolios that include loans and credit securities. The tool is designed to address regulatory requirements and assists in strategic portfolio risk management.

### LossCalc™

Calculates the Loss Given Default (LGD) for loans, bonds, sovereigns, municipals and preferred stock using a range of Asset Classes and a Comprehensive Database of Defaulted Instruments.

### Portfolio Analyzer (PA)

Is a loan level capital allocation and risk management tool providing stressed PDs, LGDs, and prepayments for RMBS, auto ABS, mortgage and auto loans under the Fed's CCAR scenarios and custom scenarios.

### RiskCalc™ Plus

Offers a comprehensive approach to assessing the default and recovery of private firms. RiskCalc models enable clients to calculate forward-looking PDs, LGDs, and EL for private firms across different regions and industries and measure how borrowers would be affected by stressed scenarios versus a baseline scenario.

### RiskFrontier™

Produces a comprehensive and granular measure of risk to help institutions understand portfolio risk dynamics, manage concentration risk, quantify risk appetite, and conduct scenario analysis for improved strategic decision-making.

### WSA Platform

Is a risk and portfolio management tool used for stress testing structured finance transactions. Moody's Analytics maintains a global structured finance deal library. WSA integrates macroeconomic, credit models, pool, and loan level performance data to forecast cash flows, PDs, LGDs, and prepayments.

## SERVICES

### Enterprise Risk Solutions Services

Provide stress testing, model validation, and implementation services.

### Structured Valuation and Advisory Services

Provide stress testing, model validation, and implementation services for all structured finance assets.

### B&H Calibration Service

Is a market-leading calibration service that provides prompt quarterly updates for Moody's Analytics models, reflecting the latest market conditions and economic outlook. Also provides a range of calibration types for specific applications.

### Outsourcing Services

Our Copal Partners unit is one of the world's leading providers of outsourced high quality research and analytics services to institutional customers. Copal's workflow processes are designed to ensure the highest possible level of data integrity and auditability while delivering rigorously verified research and analysis.

## LEARNING & DEVELOPMENT

Moody's Analytics designs, develops and facilitates training programs and solutions for financial services institutions and individuals interested in banking, finance, and personal and organizational development.

### Certifications

With a Moody's Certificate, you can demonstrate to employers, clients, and regulators that you have achieved the skills and competencies of a world-class practitioner. Since 2010, we have partnered with CSI (the Canadian Securities Institute) to reinforce our resources, support market participants, and set the standard for financial services education.

### Company Learning Solutions
#### Instructor-led Training

Our subject-matter expertise and course selection can be tailored to the needs of multiple levels of an organization, from basic requirements for new hires to those of experienced professionals seeking an update on current thinking or insights into new markets.

#### eLearning and Blended Solutions

Moody's Analytics suite of training solutions for financial institutions enables companies to minimize people risk, with customized learning solutions using practical learning methodologies and Moody's Analytics expertise in credit and finance.

### Individual Learning Solutions
#### Public Seminars

Moody's Analytics offers over 300 open-enrollment courses throughout the year, in major financial centers around the world, on fundamental through advanced topics in credit, finance and risk.

#### eLearning Programs

Our eLearning programs are available online and on-demand from any web-enabled computer or mobile device, making it easy to access our self-paced courses. We provide the industry's most comprehensive eLearning curricula for corporates, and commercial and investment banks, as well as asset managers and regulators.

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## About Risk Perspectives

Each edition of *Risk Perspectives* magazine explores an industry or regulatory topic in depth, presenting a wide range of views, best practices, techniques, and approaches, all with one larger goal in mind – to deliver essential insight to the global financial markets.

# ABOUT US

Moody's Analytics offers award-winning solutions and best practices for measuring and managing risk through expertise and experience in credit analysis, economic research, and financial risk management. By providing leading-edge software, advisory services, data, and research, we deliver comprehensive investment, risk management, and workforce solutions. As the exclusive distributor of all Moody's Investors service content, we offer investment research, analytics, and tools to help debt capital markets and risk management professionals worldwide respond to an evolving marketplace with confidence.

We help organizations answer critical risk-related questions, combining best-in-class software, analytics, data and services, and models – empowering banks, insurers, asset managers, corporate entities, and governments to make informed decisions for allocating capital and maximizing opportunities. Through training, education, and certifications, we help organizations maximize the capabilities of their professional staff so they can make a positive, measurable impact on their business. More information is available at MoodysAnalytics.com.

# GLOSSARY OF TERMS

| | | | | |
|---|---|---|---|---|
| ABS | Asset-Backed Securities | HLA | Higher Loss Absorbency |
| ALLL | Allowance for Loan and Lease Losses | HQLA | High-Quality Liquid Assets |
| ALM | Asset and Liability Management | IAS 39 | International Accounting Standard 39 |
| BaFin | German Federal Financial Supervisory Authority | ICAAP | Internal Capital Adequacy Assessment Process |
| BCBS | Basel Committee on Banking Supervision | ICAS | Individual Capital Adequacy Standards |
| BHC | Bank Holding Company | IFRS 9 | International Financial Reporting Standard 9 |
| BIS | Bank for International Settlement | IRA | Individual Retirement Account |
| C&I | Commercial and Industrial | IRB | Internal Ratings-Based |
| CCAR | Comprehensive Capital Analysis and Review | IRRBB | Interest Rate Risk in Banking Book |
| CCM | Composite Capital Measure | KPI | Key Performance Indicator |
| CDS | Credit Default Swap | LCR | Liquidity Coverage Ratio |
| CECL | Current Expected Credit Loss | LGD | Loss Given Default |
| CFPB | Consumer Financial Protection Bureau | LTV | Loan-to-Value |
| CFO | Chief Financial Officer | M&A | Mergers and Acquisitions |
| CLAR | Comprehensive Liquidity Assessment Review | MiFID | Markets in Financial Instruments Directive |
| CRE | Commercial Real Estate | MIS | Management Information System |
| CRO | Chief Risk Officer | NFC | Near-Field Communication |
| D2C | Direct-to-Consumer | NPL | Non-Performing Loan |
| DCAT | Dynamic Capital Adequacy Testing | NSFR | Net Stable Funding Ratio |
| DFAST | Dodd-Frank Act Stress Test | ORSA | Own Risk Solvency Assessment |
| EAD | Exposure at Default | P2P | Peer-to-peer |
| EBA | European Banking Authority | PCA | Principal Component Analysis |
| EC | Economic Capital | PD | Probability of Default |
| ECB | European Central Bank | PPNR | Pre-Provision Net Revenue |
| EDF | Expected Default Frequency | PRA | Prudential Regulation Authority (UK) |
| EL | Expected Loss | PRIP | Packaged Retail Investment Products |
| ERISA | Employee Retirement Income Security Act | QE | Quantitative Easing |
| ERM | Enterprise Risk Management | RAF | Risk Appetite Framework |
| ETF | Exchange-Traded Funds | RDR | Retail Distribution Review |
| FASB | Financial Accounting Standards Board | RegC | Regulatory Capital |
| FCA | Financial Conduct Authority | Risk ID | Risk Identification Process |
| FDIC | Federal Deposit Insurance Corporation | RWA | Risk-Weighted Asset |
| FRS | Federal Reserve System | RWC | Risk-Weighted Capital |
| FSA | Financial Services Authority | RORAC | Return on Risk-Adjusted Capital |
| FSB | Financial Stability Board | SA-CCR | Standardized Approach to Counterparty Credit Risk |
| FTP | Funds Transfer Pricing | SCAP | Supervisory Capital Assessment Program |
| GAAP | Generally Accepted Accounting Principles | SIFI | Systemically Important Financial Institution |
| GDP | Gross Domestic Product | SPD | Summary Plan Document |
| GSE | Government-Sponsored Enterprises | SSFA | Simplified Supervisory Formula Approach |
| G-SIB | Global Systematically Important Bank | TLAC | Total Loss Absorbing Capacity |
| G-SIFI | Global Systemically Important Financial Institution | VaR | Value-at-Risk |

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## Moody's
ANALYTICS