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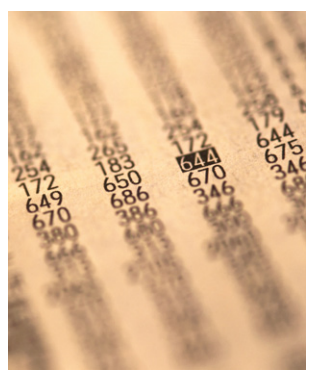

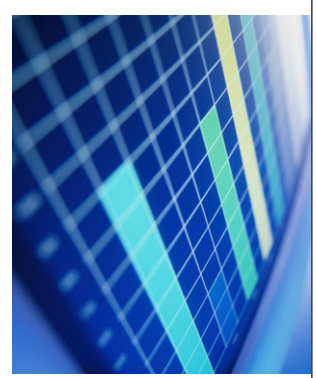

Risk modeling in a new paradigm: developing new insight and foresight on structural risk

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Risk modeling in a new paradigm: developing new insight and foresight on structural risk

Introduction

Why did sophisticated risk management tools fail to predict the 2008 crisis or at least safeguard financial institutions from its effects? Executives, shareholders, and risk experts have argued this question at length, and one important conclusion is disturbingly simple: managers relied too heavily on short-sighted models and too lightly on their own expertise and insight. As management shifts from wondering what hit them to optimizing returns in the ongoing recovery, the temptation is to allow risk management to slip down the list of priorities. Returning to business as usual, however, would be a serious mistake. If anything is to be learned from the crisis, it is that nothing substitutes for human judgment in evaluating business risks and setting the right course of action, in good times as well as bad.

Financial institution executives and managers must understand, in a systematic and comprehensive way, the risks associated with their business. The best way for managers to build this knowledge is by reaching deep into an organization for *insight* and monitoring key economic indicators that provide *foresight* on structural risk – the key risks that influence in a decisive way a financial institution's P&L statement and balance sheet.

The risk modeling methodology outlined below is one dimension of McKinsey's integrated approach to strategic risk management. McKinsey has implemented this *new risk paradigm* with leading clients as a best practice to support both medium-term positioning as well as strategic decision making in extraordinary circumstances. It is a strategic and holistic approach to risk, built around a number of elements:

- Improved transparency, understanding and modeling of risk
- A clear decision on which risks to "own" and which risks to transfer or mitigate[1]
- The creation of a more resilient organization and processes that help the firm to be proactive in risk mitigation
- The development of a true risk culture
- A new approach to regulation.

The focus of the present paper is on the first of these elements: the development of superior understanding (insight and foresight) on structural risk.

The flaws of current risk methodologies

The combination of flawed risk models and managerial complacency was a major factor leading to the financial crisis. On the one hand, risk models overemphasized historical data and failed to detect problems that should have been recognized as advance warning of the looming crisis. On the other hand, managers' overall risk mindset placed excessive confidence in the models and underestimated the importance of individual judgment and personal responsibility. This combination of short-sightedness and complacency was disastrous for the financial services industry.

First, the use of standard assumptions in mathematical analysis of historic data produces flawed risk calculations, because they assign disproportionate weight to recent information when predicting the future. Consequently, many

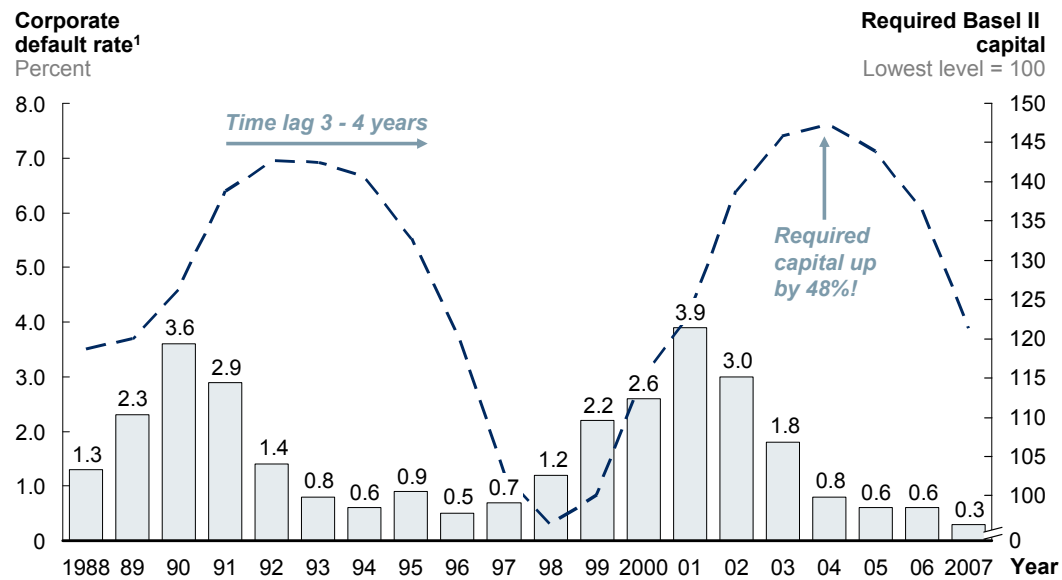
1 See McKinsey Risk Working Paper Number 23, "Getting Risk Ownership Right"

models actually encourage pro-cyclical behavior, a fact that has been widely noted in relation to the capital requirements defined by Basel II (Exhibit 1) and will likely become an issue for insurance companies under Solvency II.

Exhibit 1

The procyclicality of Basel II can have a severe negative impact on capital requirements

DISGUISED CLIENT EXAMPLE



1 F-IRB approach; assuming standard loss given default (LGD) and exposure at default (EAD)

SOURCE: R. Repullo; J. Suarez: The procyclical effects at Basel II; Moody's; annual issuer-weighted corporate default rates; McKinsey

To be fair, risk managers recognized this short-sightedness and sought to make their analyses more accurate and forward-looking by drawing on the predictive power of markets with the mark-to-market approach. They argued, in particular, that the future and forward markets reliably represented the shared insight of market participants into future developments. However, we now know that this was not the case in many markets, especially during the crisis, as forward price curves follow the cycle rather than predict it.

Second, managers placed too much confidence in mathematical models and de-emphasized the role of human judgment in risk analysis and decision making. Indeed, many equated complexity in risk models with predictive reliability and accepted analytical outputs at face value. To put it bluntly, managers often became complacent about the accuracy of their risk models, neither validating the key underlying assumptions nor questioning counter-intuitive conclusions. For example, until recently, few questioned why a mortgage CDO tranche was assigned an AAA rating, like a high-quality plain-vanilla corporate bond. Similarly, few disputed the reliability of life-insurance-embedded value models, despite the fact that these complex models rely on a small number of highly critical assumptions, and are highly sensitive to minor changes (Exhibit 2). Consequently, a false sense of security (i.e., complacency) blinded many organizations to material changes in the ecosystem, and they were unable to respond even when reality no longer behaved in the way anticipated by the models. *Models are based on specific assumptions, and to use models properly managers must understand these assumptions thoroughly.*

Exhibit 2

Profitability of various life products highly dependent on accuracy of assumptions

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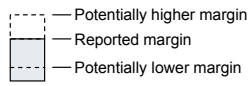
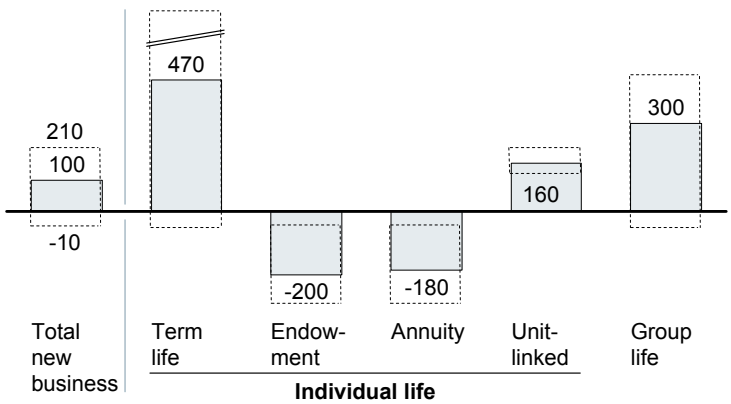
DISGUISED CLIENT EXAMPLE



Sensitivity analysis – new business margin

- Actual costs 20% higher/lower than assumed
- Persistency 1/3 higher/lower than assumed



- At most insurers, limited transparency on sensitivities of life product economics at board level
- Critical implicit assumptions made by life actuaries typically not further disclosed, or discussed and challenged – potentially resulting in misdirection of business activities, e.g., of sales priorities

SOURCE: McKinsey

Stress-testing is another area where the complacency of managers weakened companies' ability to ascertain risks promptly and accurately. Scenarios were usually limited to observed events, and there was little motivation for more robust testing, as managers rarely paid attention to them. Additionally, as we now know, stress tests underestimated the true impact of many risk-relevant factors.

An effective antidote to some of the intellectual lassitude of managers regarding risk analytics is the translation of analytical outputs into the P&L. That is, how much would we lose if x were to happen? Unfortunately, most management information systems failed to capture structural risk metrics or to quantify their potential impact on daily P&L and balance sheets – the real indicators whether an institution is doing well or going bankrupt. This situation encouraged write-offs at the beginning of the crisis, which are now likely to become self-fulfilling prophecies (Exhibit 3). In addition, risk modeling tools focused on mark to market were rarely able to simulate the accounting impact of risk.

Overreliance on the risk models and tools designed to assist managers in tactical medium-term positioning and short-term risk mitigation was clearly an exacerbating factor in the crisis. While mathematical models play an important supporting role, managers must fully acknowledge that these models provide only a limited view of reality and should not in any circumstance substitute for sound managerial judgment.

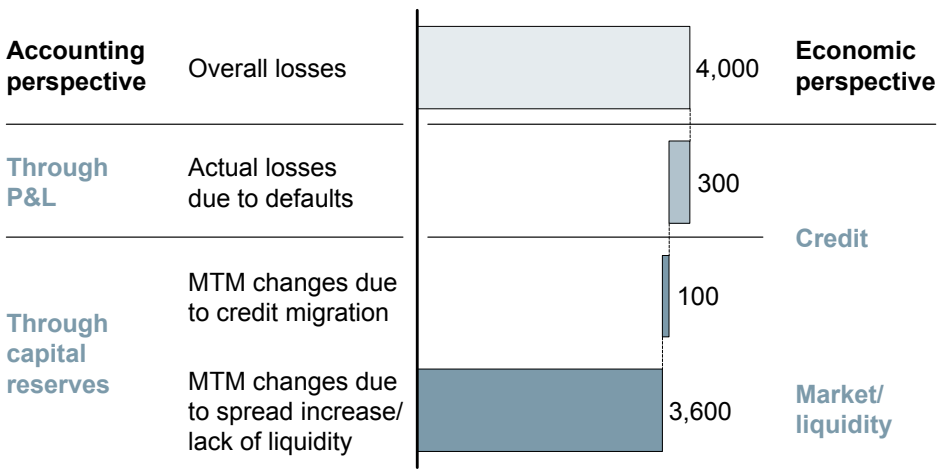
If existing tools are not the answer, what do managers need to better steer their business in the future? Are there alternatives to overloading managers with data applicable only to short-term decision making? Will new regulations for the banking and insurance industries – historically the benchmark in risk management – provide guidance on the right approach and tools for these sectors and beyond?

Exhibit 3

Risks from accounting and economic perspectives through credit risk-related losses, Q1 2008

DISGUISED CLIENT EXAMPLE

EUR millions



- **90% of losses related to mark to market**
- **10% of losses with an "immediate" accounting impact**

SOURCE: McKinsey

Do new financial regulations show the way?

Before the crisis, the Basel II regulation raised hopes that the quality of risk management would improve. Indeed, it brought significant improvements in many areas, such as risk tracking, processes, and decision making. Despite the positive effects of Basel II, however, some of the regulation's shortcomings may have contributed to the crisis:

- The strong pro-cyclicality of capital requirements exacerbated the race to increase returns on RWAs, and fueled the credit crunch when the cycle turned.
- The expectation that capital requirements would fall under Basel II provided banks an additional reason to exploit vigorously all means and regulatory opportunities, including optimizing models to allow for greater leverage.
- The treatment of assets in the trading book and excessive reliance on value-at-risk models led to a very short-sighted perspective on risk and a higher level of volatility. Many observers have discredited this aspect of the regulations.
- The focus on complying with the requirements distracted many institutions from paying sufficient attention to risk factors not there covered, such as liquidity risk, and these proved critical in the crisis.

Basel III aspires to make the banking system safer by redressing many of the flaws that became visible in the crisis. The new thresholds for capital and funding will have a substantial impact. Supposing no further changes, the capital needed to meet the Tier I requirements of Basel III is equivalent to almost 60 percent of all European and U.S. Tier 1 capital outstanding. At the same time, the new short-term liquidity ratio (LCR) and net stable funding ratio (NSFR), the details of which are still being worked out) will pose a significant challenge to banks. Basel III means higher costs and closer scrutiny, and banks will need to redefine their business models in order to restructure their balance sheets and optimize the use of capital and liquidity.

The higher capital requirements and tighter funding ratios "automatically" define the boundaries between "default" and "survival," but they do not fully address the need for resilience in the banking sector. If an institution is to gain a competitive advantage from the new requirements, it must go beyond "ready-to-use" or "off-the-shelf" risk solutions, which, as many have argued, can facilitate "herd behavior." Instead, each institution must build tools that sharpen its vision of customers, markets and the economy at large by capturing and analyzing proprietary historical data. Ideally, this operational effort should be part of a holistic strategic effort to steer the organization toward a new generation of success.

For insurers, Solvency II has yet to address weaknesses inherited from Basel II, such as the tendency toward collective "herd" behavior and the lack of mechanisms for proactive management of cycles and structural risks. Solvency II may even exacerbate some problems. For banks, Basel II.5 and Basel III have extensively revised risk methodologies but leave many things on the shoulders of banks[2]. There are many elements about risk parameters and calculations (e.g., what enters into Tier I), but these changes do not add up to a substantively new methodology. Across the financial services industry, institutions must recognize that higher requirements and closer supervision will never automatically address future technological innovations, market developments and economic crises. The winners will be institutions that move beyond mere regulatory requirements to manage risk better than their peers.

Using insight and foresight to mitigate risk through changing circumstances: a new four-step process

Bank and corporate managers are demanding a new generation of risk modeling that goes beyond transparency and enhances their ability to see competitive opportunities as well as to recognize the harbingers of economic change. New tools are available, but in order to make the organization truly resilient, managers must radically change their approach to risk decision making. They should pursue a proactive and strategic approach, using insight and foresight to identify and mitigate emerging risks.

This new approach comprises four steps: understand your risks, decide which risks to own, anticipate new risks, and know when to act. Exhibit 4 displays the actions and new risk tools that define and support each step.

1. Use your organization's insight to understand your risks

As a first step, top managers should identify the structural risk drivers of their business and then calculate the quantitative impact of each risk driver on the P&L and balance sheet, in a series of scenarios ranging from mild to severe. A market in which such relationships are already well known can illustrate how the approach works: forecasting the health of the office space market is possible based on just a few indicators (Exhibit 5)

2 See McKinsey Working Papers on Risk Number 27, "Basel II and European Banking," and Number 28, "Mastering ICAAP."

Exhibit 4

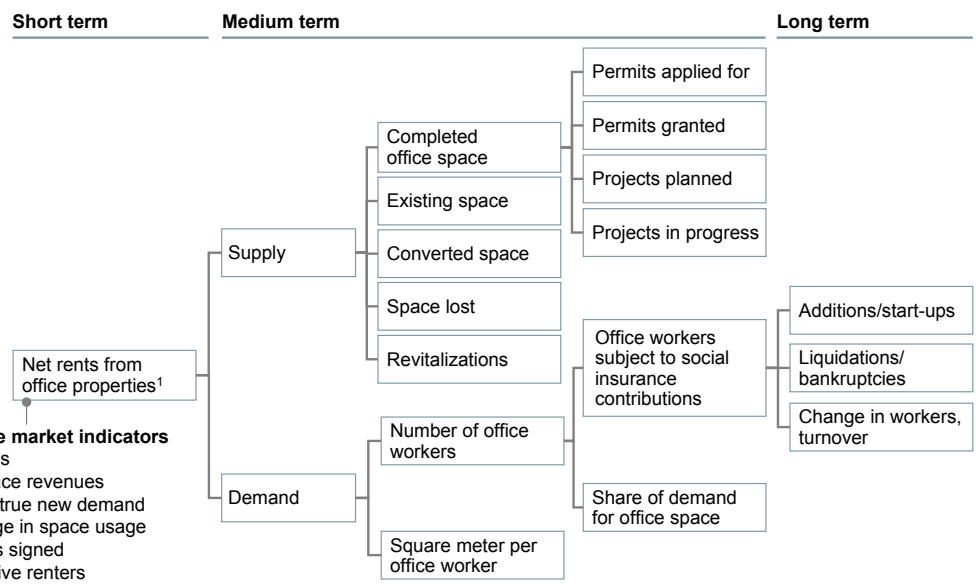
Strategic risk identification and mitigation – the concept

	Understand your risks: insight	Decide which risks to own: positioning	Anticipate new risks: foresight	Know when to act: mitigation
Key actions	▪ Identify structural risk drivers ▪ Link structural risk drivers to P&L and balance sheet components	▪ Develop different "realistic" scenarios for each risk driver ▪ Assess sensitivity/ impact on P&L if scenarios occur (P&L at risk) ▪ Develop extreme scenarios ▪ Increase robustness against undue risks	▪ Measure current level of each risk driver ▪ Develop and monitor early-warning indicators ▪ Revise probabilities of scenarios ▪ Define reference scenario to act against ▪ Transform contingency plan into action plan	▪ Execute action plan ▪ Monitor results and impact ▪ Adjust to developments as appropriate
Supporting risk modeling tools	Structural risk mapping tool	P&L at risk forecast, scenarios, and stress test	Structural risk early-warning tool	Contingency plan tracker

SOURCE: McKinsey

Exhibit 5

Interdependencies of risk factors need to be assessed by business (and constantly reviewed) EXAMPLE



1 To forecast property and office space prices, demand analysis must consider the investor perspective (e.g., rates of return from alternative investments, fund volume)

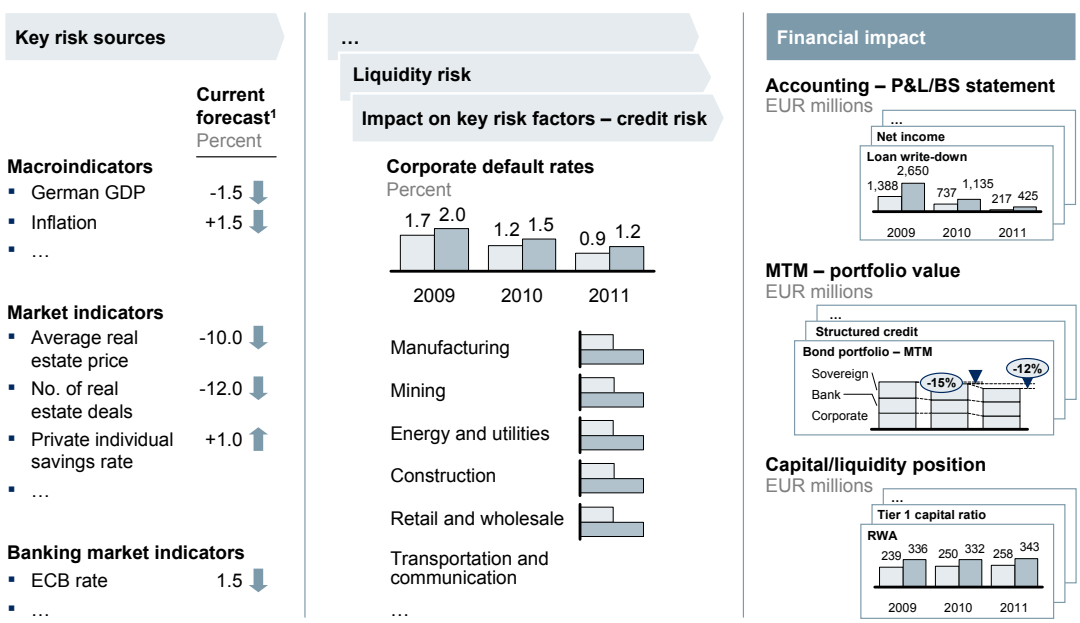
SOURCE: McKinsey

Financial institutions should identify the P&L and balance-sheet impact for each main category of risk driver. From a risk modeling standpoint, they will need to develop a comprehensive risk mapping tool (Exhibit 6 shows a simplified example). This tool should highlight the top five to ten sources of risk with the most severe impact on the business and show the exact points where each risk driver hits the P&L statement. For example, bank managers could ask: "If real estate prices drop by 10 percent, what happens to the provisions of our mortgage portfolio?" While such models may perform at a high level, putting them in place often takes intense effort.

Exhibit 6

Risk mapping tool – example of output

ILLUSTRATIVE EXAMPLE



1 Forecast for 2010 - 11 is modeled, but not shown for simplicity

SOURCE: McKinsey

By drawing on proprietary market and customer data residing in diverse areas (e.g., sales, customer service, finance, and risk management), an institution can develop the insight necessary for the clearest possible view of its risks. It is important to train the organization while at the same time building support tools for knowledge gathering and analysis. Since this approach relies on identifying risk factors that are inherently **instable and require constant review**, it is important to reach a point at which the risk unit systematically develops and continuously accesses the full insight available within the organization.

2. Decide which risks to own in order to optimize your competitive position

While the first step produces insights into potential structural risks, the goal of the second step is to determine the organization's proper risk position – which risks it really should own and which should be off-loaded. To do this, managers must translate the insight achieved previously into an understanding of how underlying risk drivers might evolve according to scenarios that express varying levels of uncertainty.

Managers should think through a limited set of consistent scenarios for the possible evolution of key "foreseeable" risk drivers (or "known unknowns"). These might include changes in the level of demand in certain segments, interest rates, default rates, oil prices, etc. In addition, managers should consider hypothetical interdependencies among diverse market risk factors and gauge the potential impact of these interdependencies on the P&L and balance sheet. These "stress tests" enable managers to assess the resilience of the business in "extreme" states of the world (i.e., unanticipated industry discontinuities or "unknown unknowns"), such as the break-up of the oil-gas correlation in some European markets, the sudden breakdown of the interbank market, or a slow-down in China's growth.

On the modeling side it is important to train the organization to express the appropriate range of uncertainty in designing scenarios, and the actual risk-takers should have a hand in identifying key risk factors and estimating the possible course of their evolution. The fundamental aim is that management understands the sensitivity of the actual P&L and balance sheet to potential developments, both adverse and positive (Exhibit 7). The essence of the approach lies in the debate through which managers reach a consensus on potential scenarios and outcomes. This will not always be a comfortable dialogue, as it is in part a rehearsal for real decision making under stressful conditions.

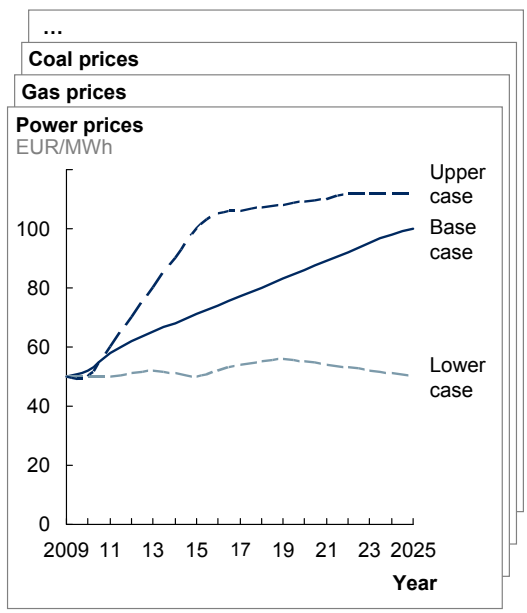
Exhibit 7

Scenarios should express the "uncertainty" while stimulating top management understanding of sensitivity of the P&L against risks

ILLUSTRATIVE

Key scenario factors

- **Fuel prices** (e.g., hard coal, gas, lignite, and oil, as well as CO_2)
- **Regulatory regime** (e.g., free CO_2 allocation or renewables feed-in requirements)
- **Generation stack** (e.g., installed capacity, technology, and heat rate)
- **Retail demand** and load
- **Macroeconomic data** (e.g., FX rates)
- **Infrastructure data** (e.g., pipelines and grids, interconnectors and storages)
- …



Criteria for definition

- **Consistent input parameters** (e.g., fuel prices and regulatory regimes need to be aligned)
- **Interdependencies between** fuel **prices** included (e.g., high CO_2 prices lead to decrease in hard coal prices, as hard coal becomes too expensive for power generation)
- **Ongoing monitoring of** price **interdependencies** as important as prices themselves

Usage/approach

- **Sensitivity analysis** of P&L, balance sheet, and capital
- Development of means to **increase "robustness of sensitivity"**

SOURCE: McKinsey

The sensitivity analysis is the cornerstone of a robust process for planning under uncertainty, and it prepares managers to maintain the optimal risk position of the company in all circumstances. By examining the possible evolution of key risk factors, managers should decide on three types of actions (Exhibit 8):

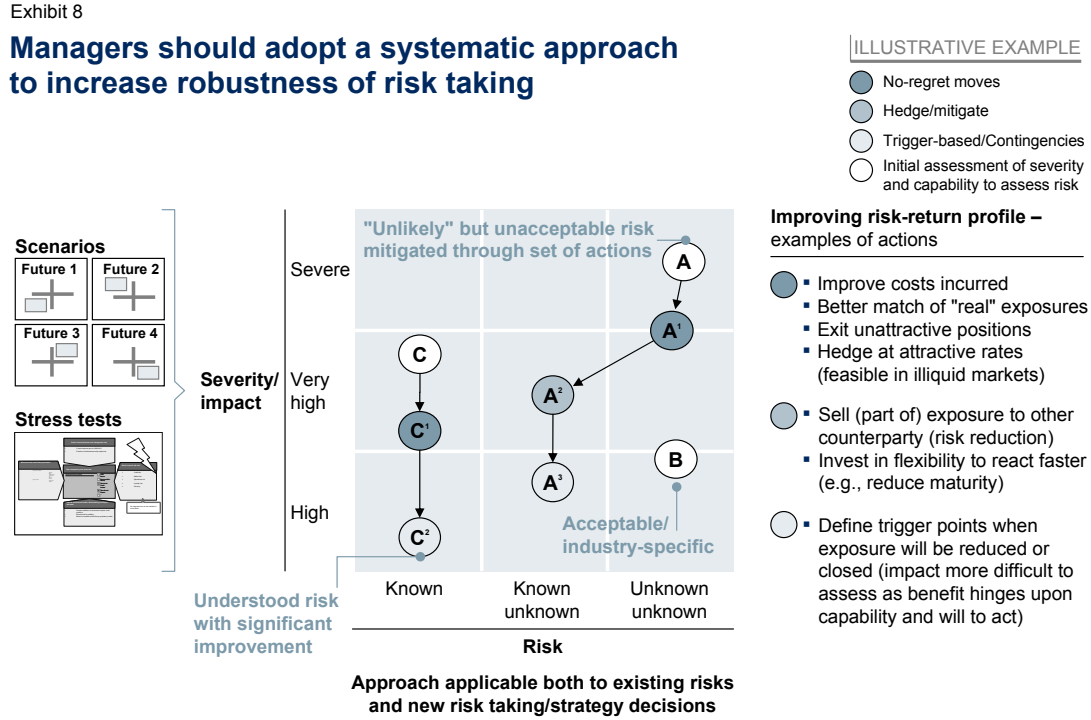
i. No-regrets moves, interventions that improve the company risk-return position anywhere in the world: for example, exit a fundamentally unattractive business line or reduce wasted liquidity and/or capital – on average we find a 10 percent or 15 percent slack, respectively, across industries due to inefficient processes and approaches.

ii. Hedge against the unacceptable, where management finds out that, in case such events occur, the company would be unacceptably exposed – especially compared with peers. These cases do not necessarily mean exiting immediately from all positions, but can also lead to investing in increased flexibility to move proactively.

iii. Trigger-based moves, which will be quickly translated into action – as the decision has been "already taken" – based on early warnings if a specific event materializes; for example, secure long-term funding even at high cost if one's own readiness to lend to other counterparties reduces due to deteriorating ratings.

Exhibit 8

Managers should adopt a systematic approach to increase robustness of risk taking



SOURCE: McKinsey

This approach supports management decision making on risk positioning by defining scenarios based on different levels of the main structural risk drivers. Such risk modeling requires both scenario planning for the analysis of "P&L-at-risk" and a stress test tool that translates structural risks into "extreme but possible" business scenarios. This method differs from traditional capital-at-risk approaches in three key ways:

- *Focus on "real economics":* The output takes the form of P&L and balance sheet numbers, not the mark-to-market figures of NPV-based approaches ("fiscal accounting").

- *Comprehensive rather than partial:* Scenarios should be consistent, and should be applied across all the relevant risk factors. The aim of the approach is thus to capture interdependencies comprehensively by, for example, moving from siloed assessments of credit, market, and liquidity risk in banking to an integrated view.

- *Used to create awareness:* The point of the exercise is not to assume that risk assessment can determine the "true" or most likely outcome. Hence, the method we propose focuses less on exhaustive granularity and emphasizes instead the use of insight to evaluate impact. In our experience, this approach helps board members better understand structural risk drivers and the interdependencies among them. As a result, managers make better decisions and are better prepared to take action if the level of perceived risk increases.

We are aware of the organizational and cultural difficulties this effort entails for many institutions, especially in terms of bridging risk management and accounting approaches. However, risk translates into real P&L losses, balance sheet developments, or liquidity issues. These are the numbers that regulators and financial analysts actually look at to determine a company's well-being, and managers must "stay in shape" for prompt and systematic action to defend the bottom line.

3. Anticipate new risks with tools that provide foresight into changing economic conditions

Fundamentally, we must recognize that some risks are not foreseeable ("unknown unknowns"). Especially in light of the recent crisis, however, much can be gained by systematically tapping the organization's knowledge of what could happen in the future ("known unknowns"). The aim is not to predict the future, but to focus on detecting early-warning signals in order to respond sooner.

Four actions can best safeguard against adverse foreseeable risks: (i) continuously measure the level of each structural risk driver; (ii) derive early-warning indicators to improve assessment of the likelihood of adverse developments; (iii) revise the probability of each scenario and define the reference scenario for action; and (iv) transform the contingency plan into a more detailed action plan if adverse scenarios are increasingly likely.

Early-warning indicators are a particularly important part of this process. For instance, it would have been possible to detect the critical situation leading to the recent real estate bubble in the United States by looking at just four main indicators: (i) home ownership costs went up by 25 percent from 2004 to 2007, while rental costs remained largely stable; (ii) real estate prices grew much faster than GDP per capita in the same period of time; (iii) debt share (i.e., mortgages) on the residential housing stock peaked to reach 52 percent; (iv) LTV mortgages increased to 33 percent in 2006 from 8 percent in 2003 (Exhibit 9).

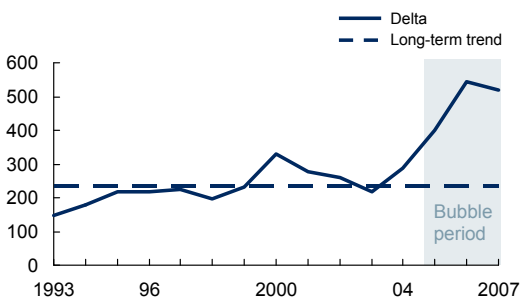
Firms should develop a structural risk early-warning tool aimed at regularly tracking emerging structural risks by fully leveraging information within the organization (e.g., structured interviews with risk takers and selected external sources to concentrate on relevant risk sources only). A limited set of KPIs carefully identified for each specific market make it possible to spot potential market anomalies and the level of threat they pose.

Exhibit 9

In hindsight all early-warning KPIs strongly suggested a "bubble" in the US real estate market

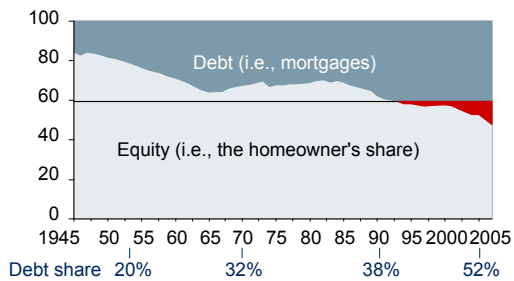
EXAMPLE

Home ownership vs. rental cost[1]

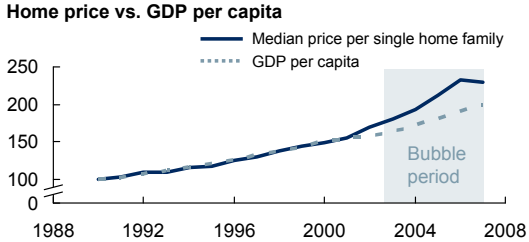


Level of leverage – debt and equity share of the US residential housing stock, 1945 - 2007

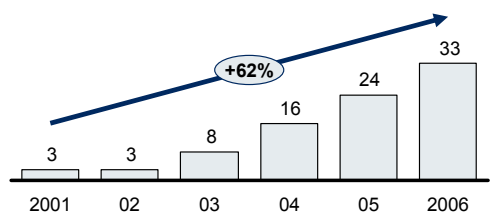
Percentage



Home price vs. GDP per capita



Percentage of new mortgages that were 100% financed



1 Monthly payment for a home mortgage including tax shields and utilities

SOURCE: Mortgage bankers associations; Census Bureau; Federal Reserve Bank; McKinsey analysis

4. Know how and when to act to mitigate emerging risks

Many key decision makers at banks were growing increasingly worried before the crisis, yet they did not get out of the game when they should have. The final hurdle financial institutions must overcome is developing detailed plans for disciplined responses to early-warning triggers. Being quick and decisive involves two steps: (i) executing the action plan defined for the contingency in question, or adapting it as the situation demands especially if an "unknown unknown" occurs, and (ii) monitoring the results and impact of this response.

Contingency plans should fulfill a set of minimum requirements. A contingency plan tracker can help firms monitor the success rate of the action plans once they are launched and, using a feedback-based approach, understand the P&L at risk after they are completed. For instance, if we look again at the mortgage origination business, an action plan for the "real estate bubble bursts" scenario would have included a set of clearly defined risk mitigation initiatives, such as the increase in underwriting no-go decisions, the introduction of more stringent LTV policies, and an initial campaign for high-DTI clients (Exhibit 10).

Exhibit 10

Risk action planning – application to credit risk for mortgages (applying foresight before the crisis)

EXAMPLE

	Risk comprehension: insight	Risk taking: positioning	Risk identification: foresight	Risk mitigation: action
Key actions	▪ Identify 5 to 10 key macroeconomic drivers of mortgage credit risk, including – Home ownership vs. rental cost – Real estate price trends – DTI evolution – LTV evolution ▪ Create a mortgage ROE tree which links mortgage portfolio profitability to 5 to 10 key risk drivers	▪ Build a set of consistent scenarios, including "extreme but possible" scenarios (e.g., RE prices drop by 25% to get back to long-term trend) ▪ Calculate the P&L and balance sheet impact if a specific scenario occurs – "P&L at risk" (e.g., reduced origination, rising NPLs, unpaid building company loans) ▪ Develop means to improve robustness (examples) – Improve monitoring and assessment of credit and collateral risk – Reduce threshold to require collateral – Cut lending to specific customer segments	▪ Continuously monitor early-warning signals against safety thresholds (e.g., home price growth vs. GDP exceeds 10 points) ▪ Revise scenario "probability" and select reference scenario (e.g., RE prices drop by 25%) ▪ Detail action plan sketched for reference scenario, e.g., – Specific revisions to underwriting policies (e.g., max. LTV, tenure, installment to income ratio) – Sell-down of parts of book (depending on liquidity of market)	▪ Execute action plan – Underwriting no-go cases up from 10 to 30% – Stricter LTV (from 90 to 60%) and max. tenure (25 years) policies – First campaign for high-DTI client – Sell 50% of book in private place-ments ▪ Monitor results and compare with expected impact

SOURCE: McKinsey

* * *

Valuable lessons have been learned about the limitations of risk models, which cannot replace managerial judgment. There is no magic oracle for generating the right risk decisions, and companies need to incorporate stronger, more strategic "human intervention" into their processes for identifying and mitigating risk. First, financial institutions should develop clear insights on the structural risk drivers influencing their performance, fully drawing on the information available within the organization. Second, they must recognize where they are not the "natural owners" of specific risks and be prepared to unload the ones which either they do not understand or which do not enhance their competitive positioning. Third, they must anticipate new potential risks with tools that provide foresight into changing economic conditions. Finally, they should develop contingency plans to be ready to respond to changing market conditions. This approach requires undertaking deep procedural and organizational changes to enable and encourage decision makers to think strategically about the constant risks of doing business.

The supporting tools discussed above form only one of several aspects of the **new risk management paradigm**. Other aspects include: strategic risk ownership; resilient organizational structure and decision making processes making it possible for the parts of the firm to be proactive in risk mitigation; and a robust risk culture. This approach will not give managers the power to predict the true future state of markets. Rather, it recognizes that the future remains unpredictable and gives managers tools with which they can prepare themselves and their organizations to (re)act flexibly and quickly.

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