

McKinsey Working Papers on Risk, Number 35



Strategic insight through stress-testing

How to connect the ‘engine room’ to the boardroom

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July 2012

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Strategic insight through stress-testing: How to connect the ‘engine room’ to the boardroom

Introduction

Talk to senior executives about stress testing and many will describe exercises that are cumbersome, yield limited insights, and fail to move board members or business heads to action. Typical approaches, they add, overlook the most pressing questions, such as how possible outcomes of the European sovereign-debt crisis would affect not only their bank’s capital-adequacy and liquidity position but also market dynamics and the competitive pressure in relevant markets, how the combination of regulatory trends and macroeconomic dynamics in different products or markets would affect margins and earnings, and to what extent the outlook for market developments and asset prices across regions should trigger business adjustments or even a radical portfolio review.

The trouble is that many banks react to stress tests in a piecemeal way, for instance, adapting their hedging strategies or making marginal adjustments to their lending limits. In our view, they are missing the opportunity to use insights from the stress-testing “engine room” to inspire and inform forceful boardroom decision making on risk management and strategic business issues.

This will only be achieved if stress testing serves a number of ends:

- Models the implications of scenarios for both the macroeconomy and financial markets by country and product level
- Explores higher-order follow-on effects of an immediate stress situation on midterm industry dynamics and industry structure
- Takes a comprehensive view of balance sheets and P&L, including banking and trading books, as well as off-balance-sheet items
- Forecasts capital and liquidity outcomes that extend beyond the static one-year view, coupling asset and operating performance
- Makes actionable recommendations on a bank’s core risk profile, financial and capital planning, and broader business strategy

Taking the sovereign-debt crisis in the eurozone as a pressing example, this working paper outlines a comprehensive strategic framework for scenario planning, stress testing, and management decision making that combines several traditionally isolated process elements into an integrated and flexible end-to-end approach. Critically, it highlights how the right stress-testing discipline can facilitate appropriate risk mitigation and strategic, financial, and operational responses.

The challenges facing banks

Banks are beset by multiple challenges, many of which are currently linked to the eurozone sovereign-debt crisis. (See the appendix for more detail.) However, while the stress-test guidelines provided by regulators and other authorities¹ typically focus on specific areas of concern, a comprehensive stress test should consider the full range of threats to the balance sheet, the income statement, and the business model:

- **The funding squeeze.** Economies and banks hit hard by the crisis (most notably Greece, Ireland, and Portugal) have suffered a depletion of customer funds. Even in markets that are relatively secure, banks are feeling the pressure.

¹ For example, the European Banking Authority or the Bank for International Settlements.

Moreover, concerns about insolvency have pushed credit spreads to unprecedented levels, raising funding costs and restricting access to wholesale-funding markets. The European Central Bank (ECB) has responded with two rounds of long-term refinancing operations (LTRO) that have bought some time, but in no way does this address the underlying counterparty risks that drive the funding squeeze.

- **Capital shortfalls.** According to the latest European Banking Authority stress tests, an estimated €106 billion of new capital is needed to meet the requirements of the 9 percent Tier 1 capital ratio by the end of June 2012. Given the difficult environment for raising new equity, many banks will be forced to reduce their risk-weighted assets (RWA) and undertake outright deleveraging. Where and how to shrink the balance sheet remains a key strategic challenge for most European banks.
- **Real economy stagnation.** Banks face a growing risk of further declines in revenue and profits in the form of falling interest income and rising defaults as deleveraging takes hold and austerity measures adopted by a number of European Union countries start to bite. Healthy, real top-line growth in Europe is not expected, even in the more optimistic scenarios.
- **Lack of 'risk free' assets.** More than anything, the eurozone sovereign-debt crisis has shown there is no such thing as a risk-free asset. The Private Sector Involvement (PSI) program for Greece requires banks and other institutional investors to accept losses of more than 75 percent on their holdings of Greek debt, making the previously inconceivable notion of a eurozone sovereign default practically a reality.

Banks should respond to these challenges by changing the way they think about their strategic options from a financial—that is, P&L, liquidity, funding, capital, and balance sheet—perspective, as well as from a business perspective. By conducting a comprehensive stress test of the kind we propose in this paper, banks will be better positioned not only to defend against threats but also to capture emerging opportunities.

A holistic strategic scenario-planning and stress-testing approach

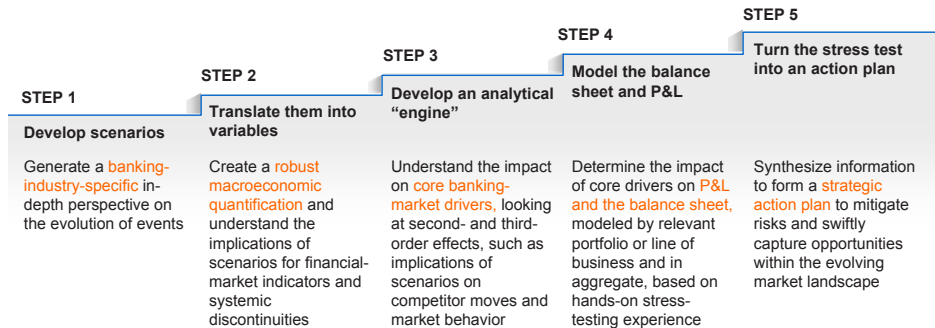
Apart from quantifying the immediate, financially relevant impact of stress, specifically on P&L, capital, funding, liquidity, and the balance sheet, and providing financial metrics such as additional capital or funding needs, banks must use scenario planning and stress testing to develop a midterm business posture. Doing so includes putting in place potentially crucial mitigating actions in the businesses and evaluating alternative financial and business strategies, as well as their impact on the viability of a bank in adverse scenarios and potential contingency plans.

In today's volatile environment, banks should take five steps, from developing scenarios to defining a plan for management actions (Exhibit 1).

Step 1: Develop scenarios for a series of events

Banks can define scenarios to describe a range of outcomes for many different events, from developments in regulation to rapid changes in interest and currency rates, as well as in oil and metal prices. The scenarios should be flexible enough to consider wider economic and political events and to accommodate the personal views of executives about how the future may unfold.

Exhibit 1 Banks can use a five-step approach for scenario planning and stress testing.



In the euro crisis, for instance, the principal way banks should think about the evolution of the eurozone is as a series of events, rather than as a single-point outcome. With this in mind, we have developed plausible scenarios on the future of the Economic and Monetary Union (EMU) that are relevant for the banking industry (Exhibit 2):

- Base case.** Events unfold without significant further EMU integration. In the short term (0–6 months), liquidity-support vehicles such as the European Financial Stability Facility, the European Stability Mechanism, and ECB’s LTRO continue, with the potential for an expanded ECB mandate. Greek debt has already been restructured without triggering major turmoil in capital markets; European banks manage to recapitalize themselves without setting off a major deleveraging wave that stalls growth. In the medium term (6 or more months), EMU’s economic governance enforces the fiscal pact agreed upon in December 2011, while International Monetary Fund–style monetary support and economic programs advance the structural reform agenda.
- The US of Europe.** Political dynamics and concern over the prospects for sustained growth and continued turbulence in capital markets create more fertile ground for fiscal integration in the eurozone. In the short and medium term (0–18 months), developments unfold as in the base-case scenario. Ultimately, however, the eurozone moves decisively toward a full fiscal union (18 or more months), with fiscal policy and governance taking place at the EMU level.

Exhibit 2 Four potential scenarios are relevant for the banking industry.

Short term (<6 months)	Medium term (6–18 months)	Long term (>18 months)	Relevant scenarios for the banking industry
Monetary bridge	Stabilization mechanisms for the EMU ¹	Stabilization mechanisms for the EMU	Base case
Monetary bridge	Stabilization mechanisms for the EMU	Full fiscal union	The US of Europe
Monetary bridge	Euro breakup		Slow decomposition
Euro breakup			Sudden death

¹ Economic and Monetary Union.

- **Slow decomposition.** While immediate solvency threats recede in the short term (0–6 months), fiscal adjustment in Southern Europe and a broader elimination of imbalances in the eurozone remain elusive. In the medium term (6–18 months), some combination of Northern European resentment and Southern European reform fatigue trigger secessionist politics and eventually a euro breakup, causing significant turmoil in financial markets.
- **Sudden death.** Insolvency becomes a reality. It could be a disorderly Greek default, Portugal requiring a second support loan, Spain's fiscal balance deteriorating beyond projections, or Italy failing to roll over debt at some point without a credible safety net in place. Macroeconomic conditions deteriorate rapidly, severely undermining adjustment programs in troubled economies. As a result, events lead to a hurried euro breakup.

Each of these scenarios will have unique implications for the macroeconomy and developments in financial markets, and thereby for the major drivers of banking performance. The base-case and US-of-Europe scenarios, for example, would produce similar results in the short to medium term; however, the US-of-Europe scenario would hasten the recovery of economies at the periphery of the eurozone.

We expect developments with regard to EMU, however benign or painful, to be the dominant influence on the fate of banks with high exposure to eurozone markets. What happens in the rest of the world represents another important dimension. Asia, for instance, could slow down if an asset bubble bursts in China; an escalation of conflict in the Middle East could have a knock-on effect on other regions; or a fiscal crisis could trigger a double-dip recession in the United States.

Step 2: Translate scenarios into macroeconomic and market variables, including potential discontinuities

Banks should quantify the impact of scenarios on the macroeconomic and financial-market outlook in different countries using regression models² and combine the results with expert insights and the historical experience of “nonlinear” events such as bank runs or currency crises. This approach allows a detailed and broad-based understanding of the links between key macroeconomic and financial-market indicators, the structure and competitive situation of specific markets, and the likelihood of some sort of systemic discontinuity.

Our analysis of the macroeconomic parameters³ (depicted for the example of GDP growth in Exhibit 3) shows the most favorable outcome under the US-of-Europe scenario: while GDP growth in this scenario is expected to average a yearly 0.6 percent in the EMU over the next three years, it would be almost –3 percent in the sudden-death scenario. Similarly, when it comes to financial-market factors,⁴ our econometric models show, for example, that under the EMU base case, the euro-to-dollar foreign-exchange rate would stay relatively flat, at 1.3; under the sudden-death scenario, it would rise to more than 1.5 for the “north euro.” For market factors that are harder to quantify under different scenarios, it might be appropriate for banks to engage internal experts from functions such as risk, strategy, macroeconomic research, and treasury to arrive at consensus forecasts after multiple iterations.⁵

² A model we developed in collaboration with Oxford Economics tracks the impact of the four scenarios for the evolution of the Economic and Monetary Union on China, 12 eurozone countries, the United Kingdom, and the United States (as well as the eurozone as a whole and the EU region). The model forecasts some 20 key macroeconomic and financial-market indicators semiannually over a period of 3 years (which can be extended to a period of up to 10 years).

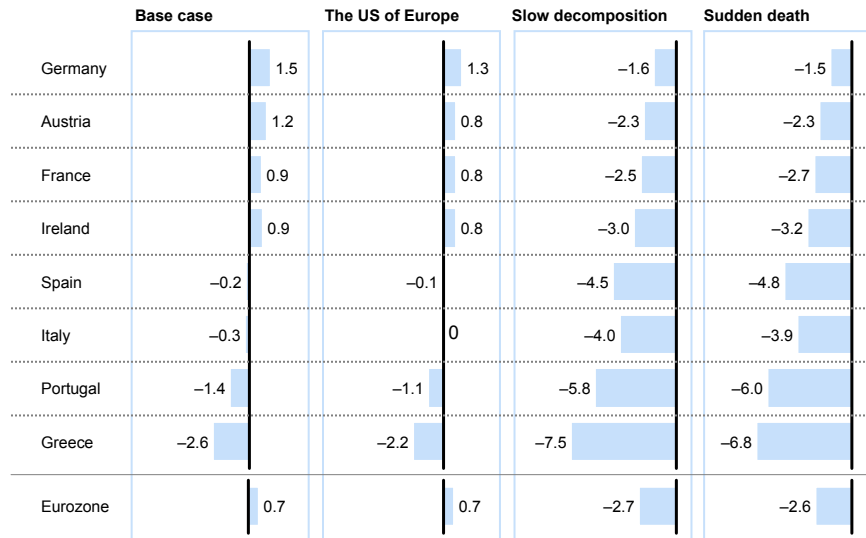
³ Including GDP growth and its subcomponents; inflation, current account, and government balance/debt; unemployment; productivity; house prices; and disposable income/income tax.

⁴ Including sovereign 10-year bond yields and credit-default-swap spreads; liquidity indicators (the European Central Bank's interbank position, bond issuances); foreign-exchange rates of major currencies (the euro, dollar, Swiss franc, pound, and yen); Euribor (3 months, 2 years, 10 years) and Libor rates; and equity markets' performance and volatility.

⁵ We have found it useful to apply the Delphi methodology for this. In each round, experts reply anonymously to specific questionnaires, providing their forecasts and the reasons behind them. After each round, a facilitator summarizes results, and experts are encouraged to revise their forecasts based on the replies of others. After multiple rounds, forecasts tend to converge around a narrower range.

Exhibit 3 GDP growth rates would vary under different scenarios.

Eurozone GDP growth, annual average growth rate, 2012–14, %



Source: Oxford Economics

On top of these macroeconomic parameters and market implications, history shows systemic discontinuities to be a particularly relevant influence on the performance of banks, especially in crisis scenarios. It is imperative for banks systematically to think through what happens in the event of a bank run, a currency shock, a technical sovereign default, or a political shock. An appropriate model can help banks reduce complexity and focus on key metrics that are relevant to business performance and financial resilience.

For instance, in any of the scenarios that result in a currency breakup, the impact of concurrent bank runs across Southern European countries should be modeled, along with the risk of substantial markdowns in the value of assets where the counterparties reside in economies expected to revert to a currency “weaker” than the euro. Even in the more benign scenarios that result in tighter EMU integration, a series of changes and reforms in the regulatory framework and market conduct should be anticipated.

Banks should be clear on the implications of different scenarios beyond the key macroeconomic and financial-market factors of conventional forecasts. In the current environment of extreme uncertainty and volatility, thinking about more extreme—yet plausible—events, such as the discontinuities described earlier, is essential in any stress-testing exercise.

If the mortgage market is severely stressed in the short term, for example, it will lead to the exit of some marginal players, often those that are most aggressive with regard to credit-quality standards and pricing. Thus, in the midterm, such a shakeout could result in more favorable market conduct and better margin perspectives for remaining players.

Step 3: Develop an analytical ‘engine’ that links the bank’s performance drivers to scenarios

For a stress-testing exercise to be truly insightful, banks must develop a strong understanding of how scenarios drive core revenues and earnings in domestic and regional banking markets. In effect, they need to build a bank performance “engine.” Doing so is not easy. Only a true and deep understanding of individual drivers and complex bottom-up mechanisms makes it possible to model the impact of a crisis and future revenue evolution.

Having a detailed view on how various markets and individual products behave under certain scenarios can be insightful because, apart from direct macroeconomic impact (for example, via interest and refinancing rates), the different degrees of maturity of a banking market, behavioral characteristics, access of local banks to capital markets, and other factors driving revenues may lead to different outcomes. A “double layer” model, which accommodates both long- and short-term horizons, is the optimal approach; it simulates long-term trends using historical analytics and regressions on macroeconomic variables and predicts the impact on short-term cycles of financial-market factors, such as stock-market performance and the risk appetite of customers.

In fact, statistical analyses of long-term trends may simply serve as one input into such a modeling exercise. Insights into business and market dynamics, as well as judgment about what might happen in the future, need to be triggered in a stress-testing exercise and to be explicitly understood in order to adjust the statistics-based modeling assumptions.

Under the base-case scenario for the European sovereign-debt crisis, for example, our preliminary findings suggest that annual growth of banking revenues in Western Europe over the next 10 years will be 4.8 percent in nominal terms—in other words, in real terms, any increase will be quite low. Under the sudden-death scenario, about five years will be “lost,” and nominal average annual banking-revenue growth is expected to amount to just 2.5 percent (Exhibit 4).

While the troubled markets on Europe’s periphery accounted for 75 percent of banking-revenue growth in Western Europe from 2000 to 2007, under our base-case scenario, they will contribute only 24 percent of growth in the next decade, or a mere 12 percent under the sudden-death scenario.

The only exception is Ireland, where banks should rebound strongly from a very low post-crisis base. We expect the UK market to be the other strong performer in the region—our projections show that, after a decade in which aggregate revenues actually dipped in euro terms, the United Kingdom is expected to account for 33 percent of any Europe-wide revenue growth under the base case, and as much as 57 percent in the sudden-death scenario (see Exhibit 3 in the appendix).

Exhibit 4 Modeling banking-revenue growth under different scenarios offers insight.

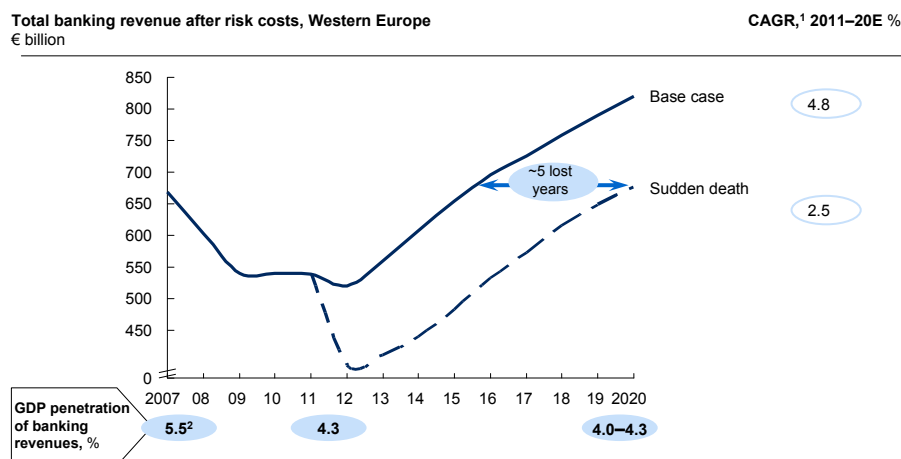
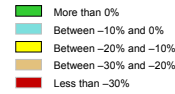


Exhibit 5 Analysis revealed some surprising differences across markets and products.

Revenue after risk cost, difference between the base-case and sudden-death scenarios, 2020
%, € billion



	Total Western European Union	Germany	France	United Kingdom	Greece	Italy	Spain	Portugal	Ireland
Total	-17%	-17%	-19%	-8%	-38%	-23%	-27%	-27%	-25%
Retail banking	-16%	-17%	-15%	-3%	-49%	-23%	-30%	-26%	-13%
Consumer finance	-23%	-22%	-19%	-6%	-51%	-39%	-54%	-34%	-30%
Mortgages	-17%	-19%	-6%	-5%	-55%	-29%	-49%	-31%	-18%
Deposits and payments	-11%	-15%	-18%	7%	-44%	-10%	-15%	-13%	7%
Investments and insurance	-18%	-18%	-12%	-19%	-52%	-27%	-27%	-37%	-31%
Capital markets ¹	-16%	-23%	-21%	-15%	-19%	-16%	-11%	-17%	-11%
Corporate banking ²	-22%	-18%	-26%	-11%	-21%	-25%	-29%	-32%	-50%
Financing and loans	-31%	-22%	-34%	-22%	-13%	-29%	-40%	-40%	-55%
Cash management (deposits and payments)	-10%	-14%	-19%	3%	-3%	-11%	6%	-7%	-19%
Asset management	-8%	0%	-14%	-11%	-44%	-25%	-17%	-30%	-25%

1 Includes investment banking, sales and trading, and securities services.
2 Includes nonbank financial institutions and those in the public sector.

Our analysis reveals some surprising results: for example, we expect deposit revenues in the United Kingdom and Ireland to grow faster than other products during the next few years and to stay relatively resilient or even improve further under the more pessimistic scenario (Exhibit 5).

Using this engine, banks can deepen their understanding of how key performance drivers (including customer-driven volume flows, yields, margins, risk costs, and cost-to-income ratios) will evolve for individual product groups within specific banking markets. See Exhibit 4 in the appendix for a detailed example from Italy.

Step 4: Model the balance sheet and P&L

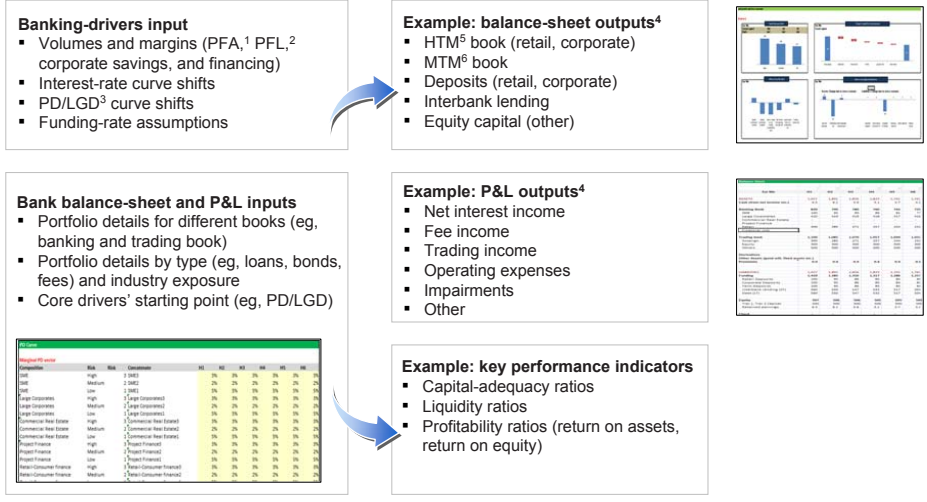
Having established how each scenario affects the bank’s core drivers, the next step is to test the resilience of the asset, liability, and capital side of the balance sheet, understand the implications for their off-balance-sheet positions, and calculate the likely impact of different scenarios on the P&L.

To illustrate our approach, let’s examine a hypothetical European universal bank with total assets of €400 billion and capital of €38 billion. The bank is subject to default risk in its banking book due to worsening macroeconomic conditions in its core market, and it also has exposure to bonds of crisis-hit economies in its trading book.

The model is set up for key P&L variables such as interest, fee, and trading income (Exhibit 6). It also includes off-balance-sheet items that affect capital requirements (via RWA) and the P&L statement.

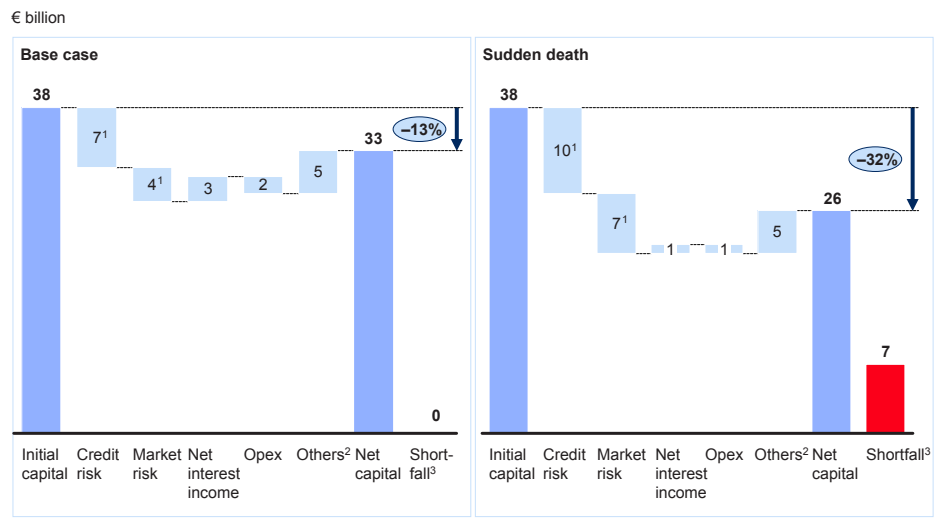
Exhibit 7 illustrates the impact of two scenarios (base case and sudden death) on various P&L components, funding, and capital ratios of the hypothetical bank. Clearly, credit risk and market risk are significant drivers of capital erosion in the sudden-death scenario. It is important for the model to allow transparency at the level of impact from individual (material)

Exhibit 6 Balance-sheet and P&L line items are forecast by a stress-testing model, based on changes of core banking drivers.

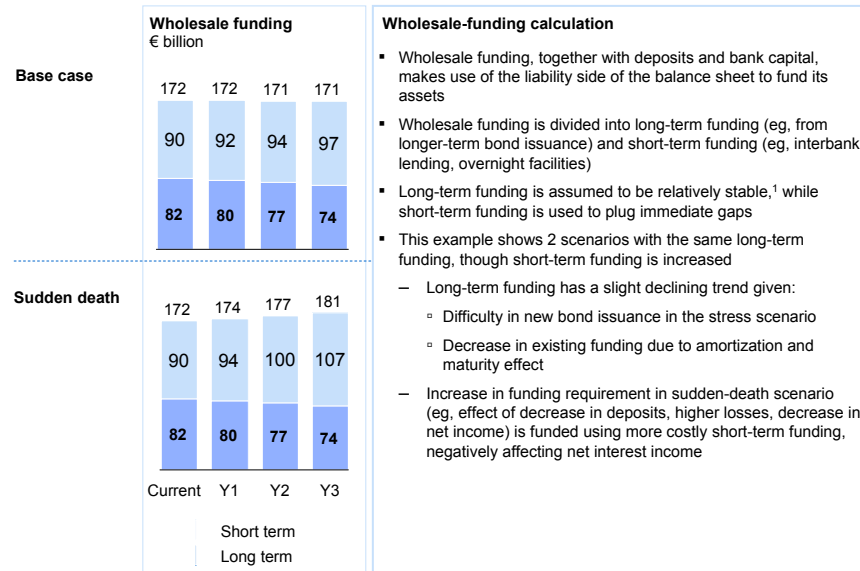


1 Personal financial assets.
 2 Personal financial liabilities.
 3 Probability of default/loss given default.
 4 For the next 3 years, with half-yearly granularity.
 5 Held to maturity.
 6 Mark to market.

Exhibit 7 Two scenarios would have different effects on capital requirements for a hypothetical European bank.



1 Model granularity allows for the identification of specific exposures that account for the majority of incremental impact between scenarios.
 2 Others = fee income – dividends – taxes.
 3 Shortfall vs a 10% core Tier 1 ratio.

Exhibit 8 Wholesale-funding implications can be modeled for a hypothetical European bank.

¹ Stability for long-term funding can be adjusted through a parameter that can also be used to increase long-term funding in case of planned bond issuance.

exposures in the banking book and trading book. Such granularity can inform truly insightful mitigation actions and business decisions (for example, with respect to winding down or exiting specific trades or businesses).

Apart from capital, funding is an integral part of the operations of any bank—and it is especially important in stress situations. Any decline in the appetite for bank debt, anticipated in the scenarios, will affect the bank's liquidity and funding position, as will further tightening of the interbank market, deposit withdrawals by customers, or tougher collateral conditions on ECB borrowing (Exhibit 8). The funding effect will be more pronounced in a bank that depends on short-term liquidity instruments for its financing needs than for a bank that has secured long-term funding at reasonable rates.

Nevertheless, these effects would lead to higher funding costs and squeezed margins, and the bank's long-term profitability will also depend to some extent on how quickly it is able to reprice its loans.

Step 5: Turn the stress test into a strategic action plan

The mix of actions appropriate for each bank will ultimately depend on the anticipated impact of the most likely scenarios on the performance and growth prospects for different business activities and on the potential threats from unexpected events or discontinuities. Banks must be ready to respond to the risks and embrace new opportunities implied by the capital, liquidity, and earnings projections. They should focus on the most relevant, high-impact actions for the short and medium term, similar to those we have seen work at leading global institutions (Exhibit 9).

Actions can be broadly divided into three areas: communication, governance, and tactical and strategic mitigation (including a review and potential adaptation of the bank's underlying business model).

How the model works

The model estimates the impact of each scenario on the bank's lending and trading portfolio. It looks at subportfolios and directly links their performance to the core banking drivers—such as probability of default (PD), loss given default (LGD), market risk shocks, and funding costs—of relevant markets. Financial statements are drawn up for several different periods to illustrate how the projected scenario could erode the bank's capital position through higher losses, squeezed margins, and lower incomes from fees over time. The projected scenario would also lead to higher risk-weighted assets. As a result, the bank would require more capital to maintain the regulatory Tier 1 capital-ratio requirement, assumed in this case to be 10 percent.

The value of the bank's balance sheet—in other words, its trading and financial assets and funding—would be undermined in the event of potentially more aggressive economic developments. In our hypothetical example, an upward shift in the default LGD curve (PD–LGD) by subportfolio (for example, consumer, small and midsize enterprises, and corporate loans) would lead to asset impairments and increased loan-loss provisions. The value of financial assets is further subject to regulatory or accounting changes, such as a requirement to recognize the impairment of sovereign bonds. The model incorporates a discounted-cash-flow approach to reflect the fair value of these held-to-maturity assets.

Movements in underlying market parameters, such as index levels and volatility, also affect the bank's trading book under scenarios such as the base-case or sudden-death scenario. This sensitivity is modeled using a Taylor expansion methodology (the “Greeks,” delta, gamma, vega, and theta), incorporated for various asset classes and geographical exposures. Counterparty credit risk for derivatives in the trading book is calculated by subjecting the bank's exposure numbers—expected positive exposure and regulatory exposure—to shifts in the PD and LGD curves.

Exhibit 9 A suite of actions could mitigate risks and allow banks to capture opportunities.

Communication with public bodies

- 1 Ally with industry bodies and peers to shape discussions on sovereign debt and banking regulation nationally and across the European Union

Governance

Take emergency action

- 2 Set up a dedicated high-level task force and process for “CEO morning meetings” to ensure swift reaction to market turbulence and alignment on communication

Pursue medium- and long-term strategic actions

- 7 Consider adapting existing committee structures and frequency of meetings to foster discussions on potential strategic repositioning

Tactical and strategic mitigation

Ensure short-term resilience

- 3 **Liquidity:** Secure short-term funding, particularly deposit strategy; review foreign-exchange funding strategy; cut credit lines
- 4 **Capital:** Adjust limits and lending activities to challenged countries, move trading to centrally cleared exchanges, rebook assets (trading vs banking), increase monitoring
- 5 **Profitability:** Review service requirements for customers, adjust the bank's hedging strategy, assure that provisioning approach yields accurate coverage levels
- 6 **Client franchise shielding:** Protect asset-management customers' wealth; focus advisory on limiting exposures and restructuring trade-finance activities

Adjust longer-term strategy

- 8 Set up resilient long-term funding and capital strategy, accounting for Basel III effects; evaluate potential of innovative hybrid instruments (eg, contingent-convertible bonds)
- 9 Revise portfolio composition and limits, business strategy (divest businesses with low return on equity), and performance logic (by return on equity); improve efficiency/cut costs
- 10 Systematically scan for M&A opportunities with banks with compressed valuations in current market environment

In today's fast-moving regulatory environment, it is vital to join forces with peers and industry bodies to try and shape thinking at national and EU levels. Current volatility requires governance frameworks to be more robust so that resources can be mobilized and decisions made quickly. In the medium term, organization and reporting structures should be aligned with any changes in overall strategy.

Banks facing pressure on their capital or liquidity should, under more adverse economic outcomes, consider contingent actions to improve their position. Ideas might include selling assets, drastically reducing operational expenses, delaying or postponing planned distributions of capital, more broadly utilizing longer-term central-bank borrowing facilities, refinancing at national central banks instead of the ECB (in order to prepare for a potential reemergence of national currencies), or preemptively issuing capital or term debt as long as domestic market dynamics allow it. The latter point underlines the significance of effective scenario planning: access to capital markets, after all, is only possible when capital markets are "open" and not pricing in distress.

Stress testing may also strengthen the case for revised capital-management practices and a review of the balance sheet. For example, banks might focus on measures such as strategically pricing deposits to counter an anticipated reduction in liquidity or launching campaigns to reduce RWA and the capital requirements attached to them.

Such a stress test enhances foresight and can provide a focal point for more forceful actions that go beyond recovery plans to create value. Several banks have already successfully translated aspects of stress-testing results into value-adding actions for their business. In other cases, though, banks are basing their key strategic and business decisions on piecemeal exercises, leading to marginal results or even destroying the value of their franchise. We have seen one bank panic and sell off its high-margin businesses prematurely; another implemented iterative rounds of cost-cutting measures that fell short of what was required. A third bank made its "bad bank" too small and therefore had to transfer in additional assets repeatedly, which led to significant uncertainty among shareholders and employees.

Concluding thoughts

Banks may be unable to hedge fully against some of the more extreme stress scenarios: a sudden death for the EMU, for instance, combined with growth shocks in Asia and the United States. That said, those institutions with strategic scenario-planning and stress-testing capabilities at the heart of their risk-management engine will be better prepared than others to address the ongoing threats, weather the storm, and capture the opportunities that will eventually emerge. We believe all banks should aim to embed stress testing deep into their culture and management processes.

In the short term, banks may need to increase their modeling capacity so as to ensure that their models are sufficiently flexible to adapt should exogenous short-term shocks occur, as well as to apply management judgment about bank and market reactions to these shocks. Banks should also be able to modify scenarios in light of unfolding events and translate stress-test results into appropriate actions. Regular stress-testing exercises should monitor the institution's capital and liquidity position, taking into account the probabilities of sovereign defaults and unexpected losses.

Banks will benefit in the medium to long term if they add more sophisticated macroeconomic analysis into their stress-testing capabilities and ensure they grasp the interdependencies between domestic and regional economies and the banking sector. Most important, banks should link the "engine room" to the boardroom by directly tying decisions on portfolio composition, funding, overall strategy, and other important topics to the results of stress-testing exercises. It is unrealistic to expect that such tests be carried out monthly, but in today's volatile environment, we believe they should take place at least twice a year.

The prize is a big one. It is more than just clarifying and quantifying the most likely impact of a series of events that may or may not happen. It is more rewarding even than devising measures to sustain the bank's capital and liquidity position and creating a robust operating model for changed times. It is, in a nutshell, laying the foundations to take advantage of the day when new opportunity beckons for those strong and confident enough to grab it.

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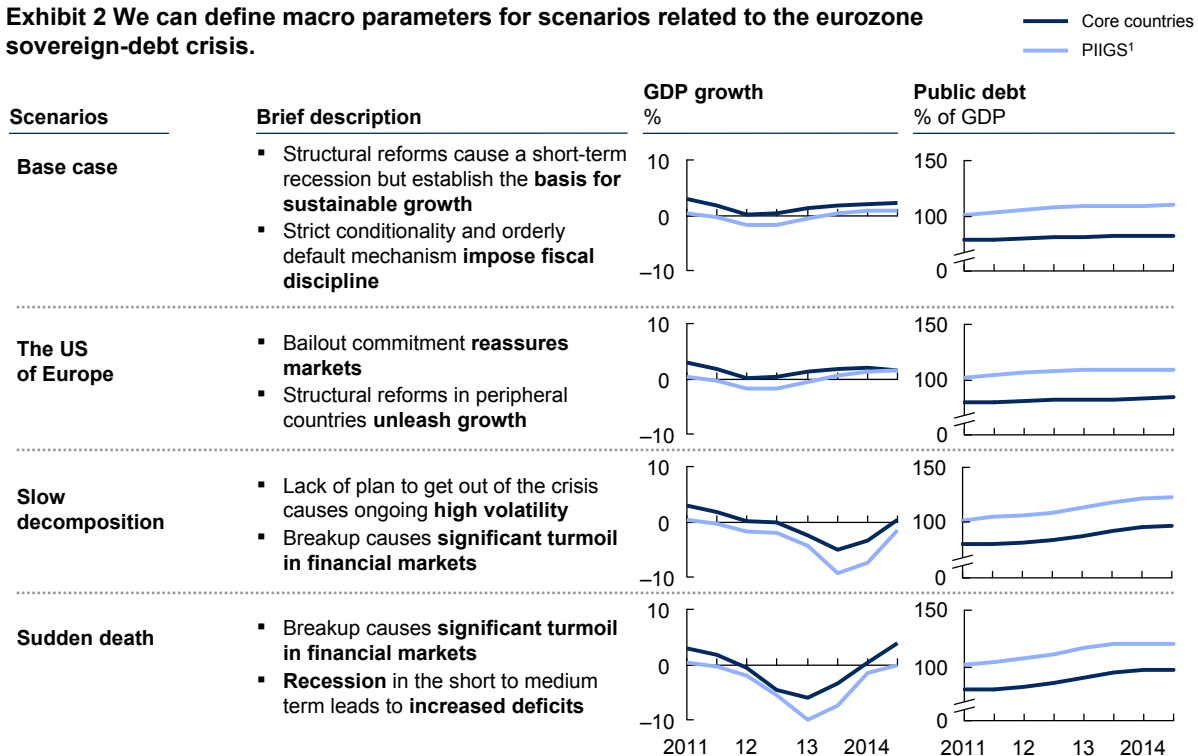
Appendix

Exhibit 1 The eurozone sovereign-debt crisis has evolved.

Phase I: Inception and underestimation	Phase II: Contagion and fragmented intervention	Phase III: Running against the clock
Late 2009 to mid-2010	Mid-2010 to early 2011	Mid-2011 to February 2012
<ul style="list-style-type: none"> The upward revision of Greece's fiscal deficit from 6% to nearly 13% in Q4 2009¹ awakened markets to the possibility of a Greek default Failure of Greek government measures to restore investors' confidence led the "troika" (European Union, European Central Bank (ECB), and International Monetary Fund) to bail out Greece Spreads on sovereign debt of peripheral eurozone economies reflected the markets' concerns of possible contagion 	<ul style="list-style-type: none"> The broadly acknowledged threat of contagion led the troika to set up bailout plans for Portugal and Ireland Bailout funds were deemed insufficient, and markets questioned the eurozone's resolve to deal with the crisis Concerns were addressed in three ways: <ul style="list-style-type: none"> Increasing availability of bailout funds Easing repayment burden on Greece, Portugal, and Ireland Establishing the European Financial Stability Facility (EFSF) Some questioned the soundness of the banks, fueled by official acknowledgement that private investors may incur losses 	<ul style="list-style-type: none"> Deleveraging and austerity measures in Europe's periphery deepened the regional recession The initial Greek sovereign-debt restructuring program, the Private Sector Involvement (PSI) program, was abandoned as insufficient A much higher Greek PSI and higher core Tier 1 capital ratio was agreed upon, leaving banks to close a €106 billion shortfall by June 2012 EFSF funds agreed to be leveraged 4–5 times to reach €1 trillion with participation of non-EU capital A "fiscal compact" for EMU² members was introduced, the European Stability Mechanism (successor to the EFSF) was launched, and ECB liquidity was injected into the market Greek PSI was finalized, with net-present-value losses on Greek debt escalating to more than 70%

¹ The figure was eventually revised to 16%.
² Economic and Monetary Union.

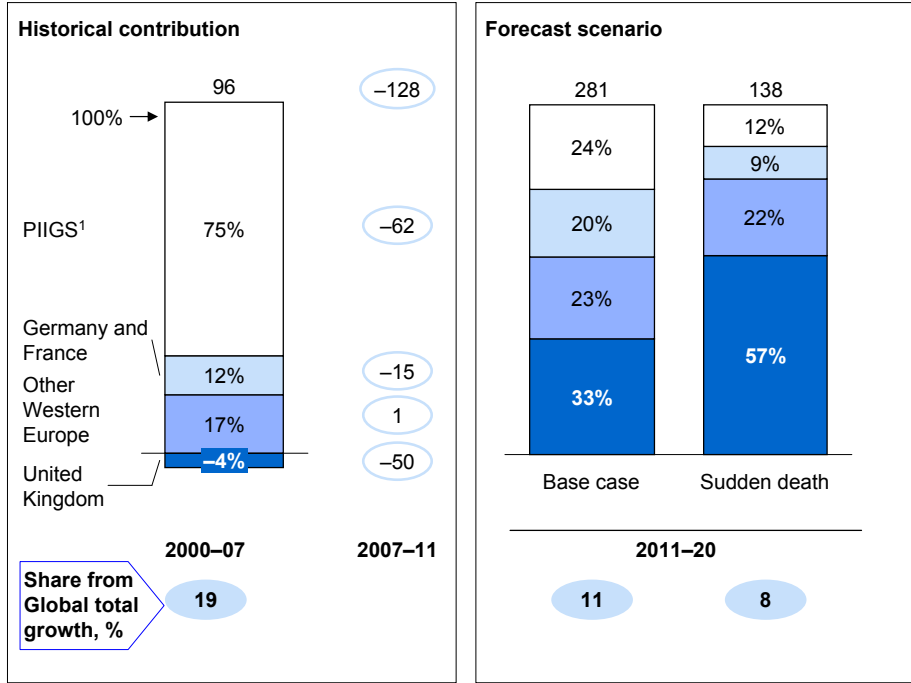
Exhibit 2 We can define macro parameters for scenarios related to the eurozone sovereign-debt crisis.



¹ Portugal, Ireland, Italy, Greece, and Spain.

Exhibit 3 Revenue growth contributions within Western Europe will shift.

Absolute revenue growth in forecast foreign exchange
%, € billion



¹ Portugal, Ireland, Italy, Greece, and Spain.

Exhibit 4 Environmental parameters can be translated into core banking-market drivers.

Example, deposit revenues, Italy

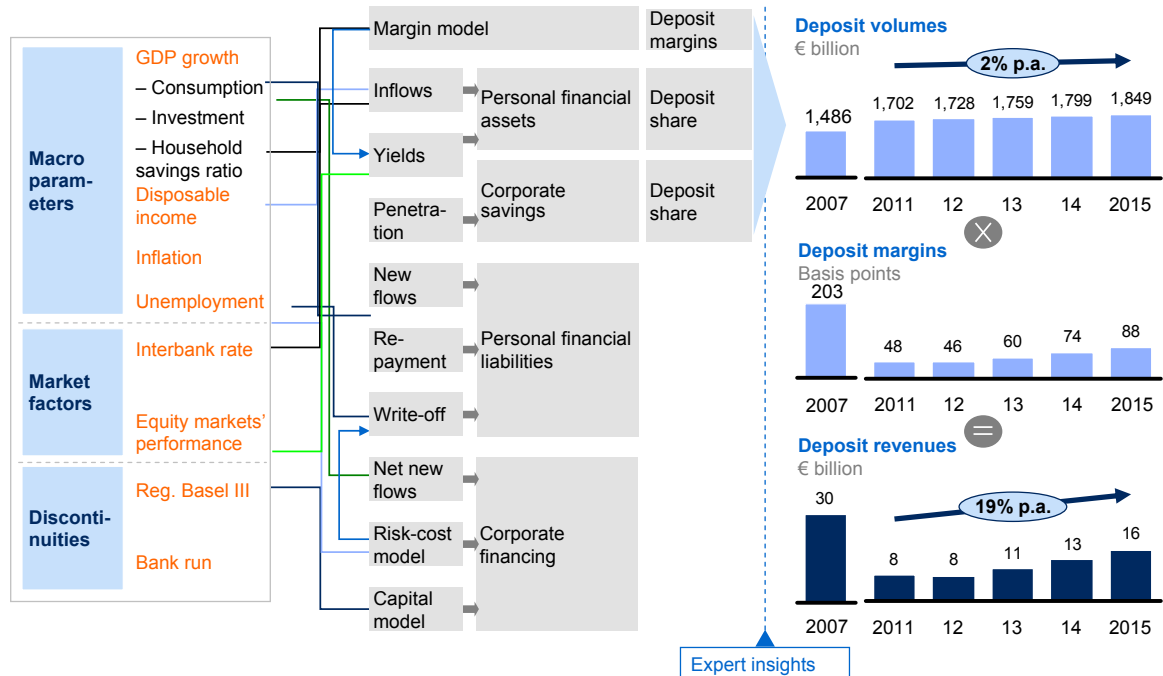
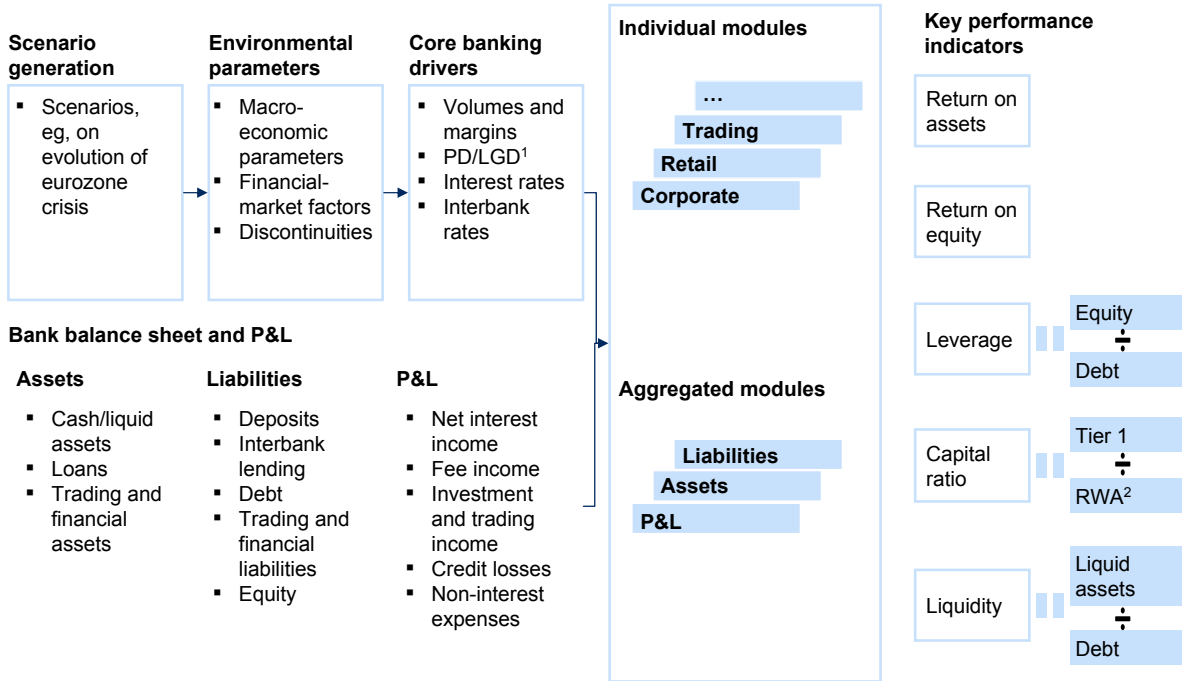


Exhibit 5 A hierarchy guides stress-testing modeling.



¹ Probability of default/loss given default.
² Risk-weighted assets.

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