

# Stress Testing Spanish Banks

## FINAL REPORT

Madrid, 21 June 2012

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## Glossary

AMC	Asset management company
APS	Asset protection scheme
BdE	Banco de España
CEBS	Committee of European banking supervisors
CNAE	Clasificación Nacional de Actividades Económicas
COR	Corporate lending
CRE	Commercial real estate
CT1	Core tier 1 capital ratio
DRC	Declaración de riesgo crediticio
EBA	European Bank Authority
EAD	Exposure at default
EL	Expected losses
GDP	Gross domestic product
HPI	House price index
ICC	Infrastructure and civil construction finance
IRB	Internal ratings based approach
LGC	Loss given cure
LGD	Loss given default
LGL	Loss given liquidation
LGR	Loss given restructuring
LLP	Loan loss provisions
LTV	Loan to value
MSI	Madrid stock exchange index
NII	Net interest income
NPL	Nonperforming loans
OOE	Other operating expenses
OOI	Other operating income
OIN	Other income
PD	Probability of default
P&L	Profit & losses
RBSC	Roland Berger Strategy Consultants
RET	Other retail lending
RMO	Retail mortgage lending
RWA	Risk-weighted assets
SC	Steering Committee
SCAP	Supervisory capital assessment program
SME	Small and medium sized enterprises
TNIE	Total non-interest expenses

## Table of figures

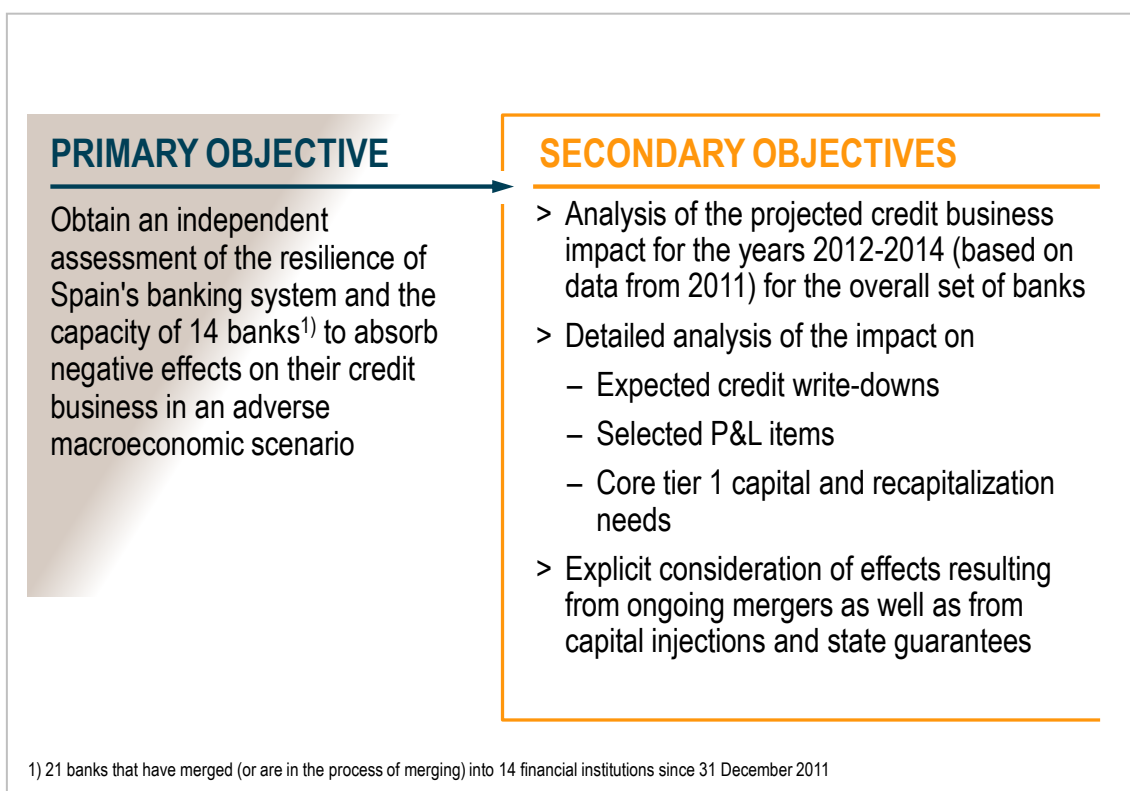
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# FINAL REPORT

## 1 Objectives and scope of project

Roland Berger Strategy Consultants (RBSC) was commissioned by Banco de España (BdE) to simulate the impact of two macroeconomic scenarios on the credit portfolio of 14 Spanish banks<sup>1</sup> for the years 2012 to 2014.

The primary objective of the exercise was to analyze the scenario-based impacts on credit write-downs and core tier 1 ratios for the overall set of banks. Explicit consideration was given to ongoing merger activities and state guarantee programs. The full set of objectives is shown in figure 1 below.



*Figure 1: Objectives*

This project stress tested only the credit exposures and foreclosed assets on the domestic banking books of the top 14 Spanish banks as shown in figure 2 below.

<sup>1</sup> BFA-Bankia, Bankinter, BBVA & Unnim, BMN, Caixabank & Civica, CatalunyaCaixa, Ibercaja & Caja3 & Liberbank, Kuxtabank, NovacaixaGalicia, Popular & Pastor, Sabadell & CAM, Santander, Unicaja & CEISS and Banco de Valencia

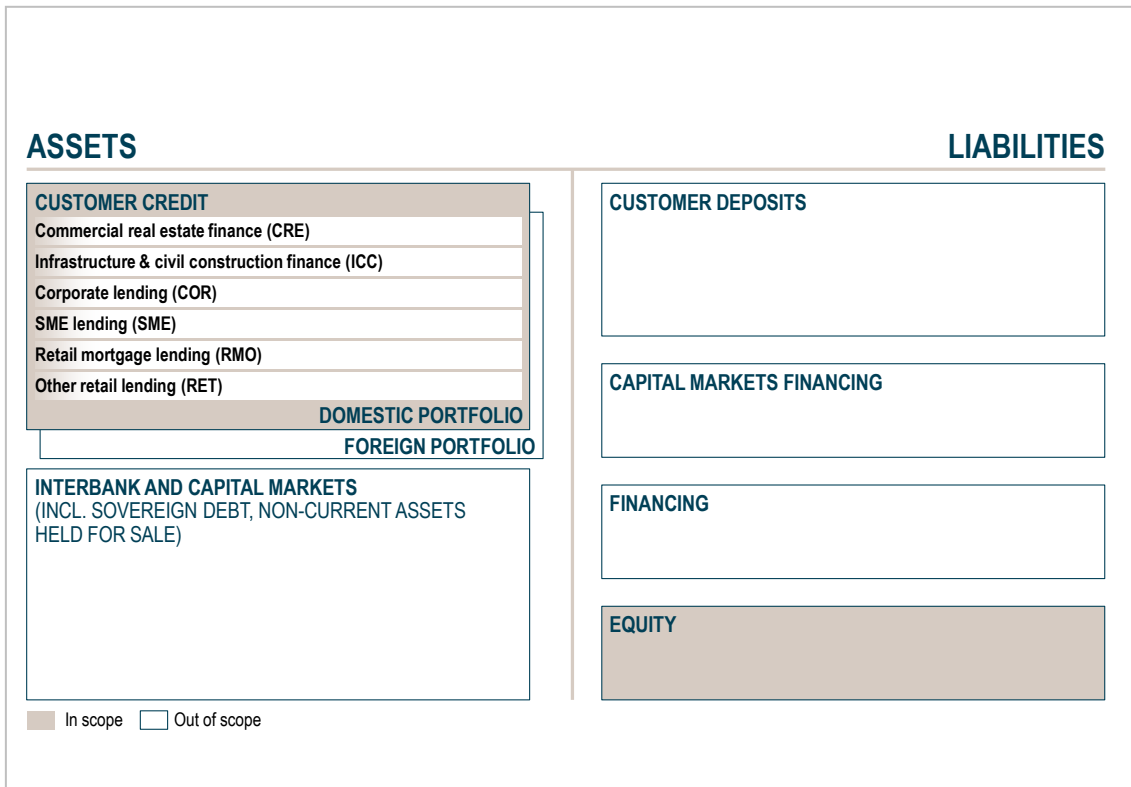


Figure 2: Balance sheet scope

For a detailed overview of aspects in/out of scope please refer to figure 3 below.

DETAILS ON PROJECT SCOPE		
DIMENSION	In scope	Out of scope
<b>BANKS</b>	> Top 14 banks (21 before mergers)	> Any other banks
<b>ASSETS</b>	> All credit positions in the banking book related to the Spanish onshore business > Foreclosed assets > Reference date 31 December 2011	> Credit exposures outside of banking books (e.g. credit type securities in liquidity reserve/ trading books) and sovereign debt > Inter-bank exposures > Liability side, e.g. widening credit spreads raising funding costs and depressing margins > Assets related to international business activities
<b>SCENARIOS</b>	> Base scenario > Adverse scenario > Three-year time horizon, 2012-2014	> Reality check of base and adverse scenario > Any other scenarios
<b>IMPACTS</b>	> Analysis of impacts on expected credit write-downs/ provisions, P&L, core tier 1 capital for 2012-2014 for each bank and overall > Impact of guarantee schemes > High level impact through announced mergers	> Overall capital impact analysis through the implementation of Basel III > Impact on liquidity > Integrated bank simulation that would consider dynamic effects (for example impact on P&L by future credit portfolio restructuring actions)

Figure 3: Project scope in four dimensions

## 2 Scenarios

As a given input to the exercise, the Steering Committee provided two scenarios, a base scenario and an adverse scenario. The scenarios were specified in detail and are described with a set of macroeconomic variables on a timeline from 2012 to 2014, as summarized in figure 4 below.

		BASELINE	BASE SCENARIO			ADVERSE SCENARIO		
		2011	2012	2013	2014	2012	2013	2014
Real GDP	Growth rate (%)	0.70	-1.70	-0.30	0.30	-4.10	-2.10	-0.30
GDP deflator	Growth rate (%)	1.40	1.00	1.00	0.90	0.00	-0.70	0.10
Nominal GDP	Growth rate (%)	2.10	-0.70	0.70	1.20	-4.10	-2.80	-0.20
Harmonized Index of Consumer Prices	Growth rate (%)	3.10	1.80	1.60	1.40	1.07	0.00	0.30
Unemployment rate	% of labor force	21.60	23.80	23.50	23.40	25.03	26.80	27.20
Exchange rate against USD	\$/€. end of period	1.39	1.34	1.33	1.30	1.34	1.33	1.30
Madrid Stock Exchange Index	Growth rate (%)	-14.60	-1.30	-0.40	0.00	-51.30	-5.00	0.00
Credit to other resident sectors:								
> Households	Growth rate (%)	-1.50	-3.80	-3.10	-2.70	-6.83	-6.80	-4.00
> Non-financial firms	Growth rate (%)	-3.60	-5.30	-4.30	-2.70	-6.40	-5.30	-4.00
Short-term interest (Euribor, 3m)	End of period (%)	1.40	0.90	0.80	0.80	1.90	1.80	1.80
Euribor, 12m	End of period (%)	2.00	1.60	1.50	1.50	2.60	2.50	2.50
Long-term interest (Spanish debt, 10y)	End of period (%)	5.60	6.40	6.70	6.70	7.40	7.70	7.70
House prices	Growth rate (%)	-5.60	-5.60	-2.80	-1.50	-19.90	-4.50	-2.00
Land prices	Growth rate (%)	-6.70	-25.00	-12.50	-5.00	-50.00	-16.00	-6.00

Figure 4: Base and adverse scenario

The base scenario comprised macroeconomic projections for the specified variables that reflect the Steering Committee's expected economic developments over the next three years. The adverse scenario assumed a pessimistic view of Spain's economic development.

RBSC considers the adverse scenario as harsh. Real GDP change is forecast at -4.1% in 2012 (figure 5). This change would represent the worst GDP decline in Spain since the introduction of democracy and free markets in the late 1970s. The decrease in GDP continues with -2.1% in 2013 and -0.3% in 2014. In contrast, current data for Q1 2012 indicate a -0.4% change in GDP<sup>2</sup>. Consensus forecasts from June moreover estimate a decline of GDP by only -1.6% in 2012 as a whole and a positive GDP change already in 2014.

<sup>2</sup> Source: Bloomberg



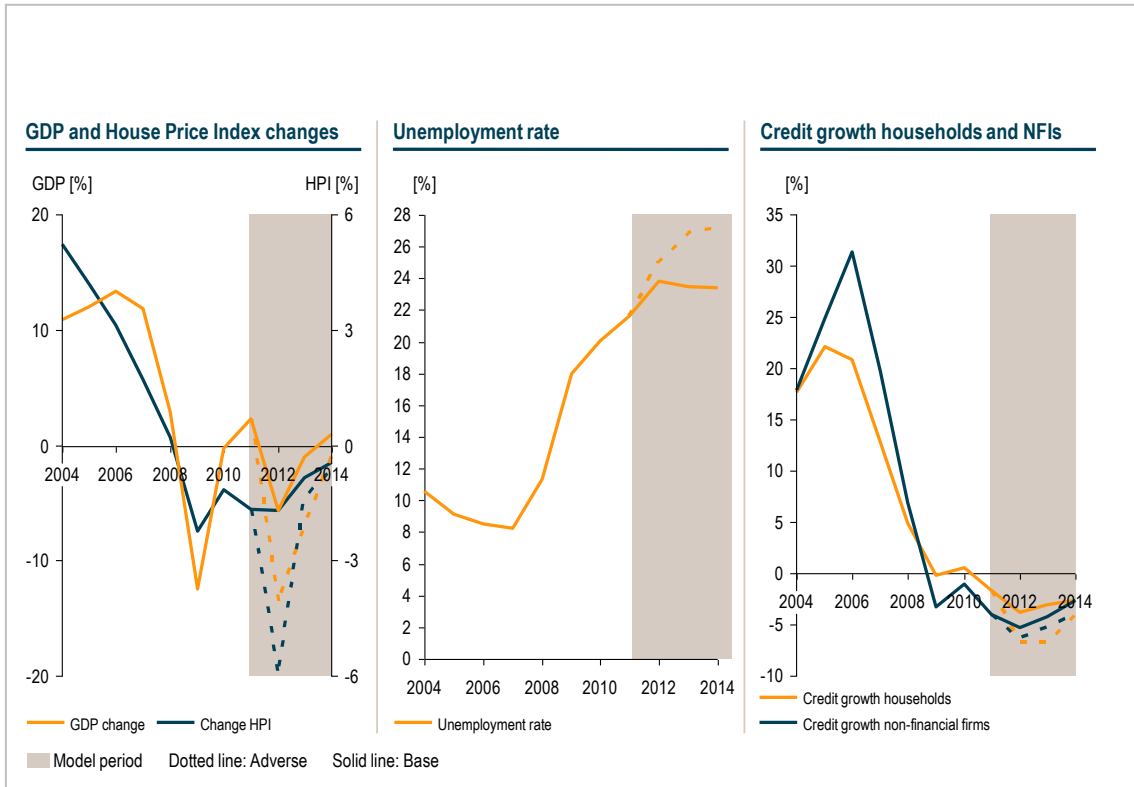


Figure 5: Comparison of key macroeconomic variables

### 3 Model approach

The RBSC model was developed in three main steps. In the first step, the relevant data input and sources were assessed and clarified, shaping the assumptions and initial model design. In the second phase, the evolution of P&L and credit write-downs' components was modeled to vary with macroeconomic factors and the given scenarios. Auxiliary analysis and regression models were used to complement the model design and support its parameterization. Finally, both streams were integrated to derive overall credit write-downs and recapitalization needs.

An overview of the model approach is provided in figure 6.

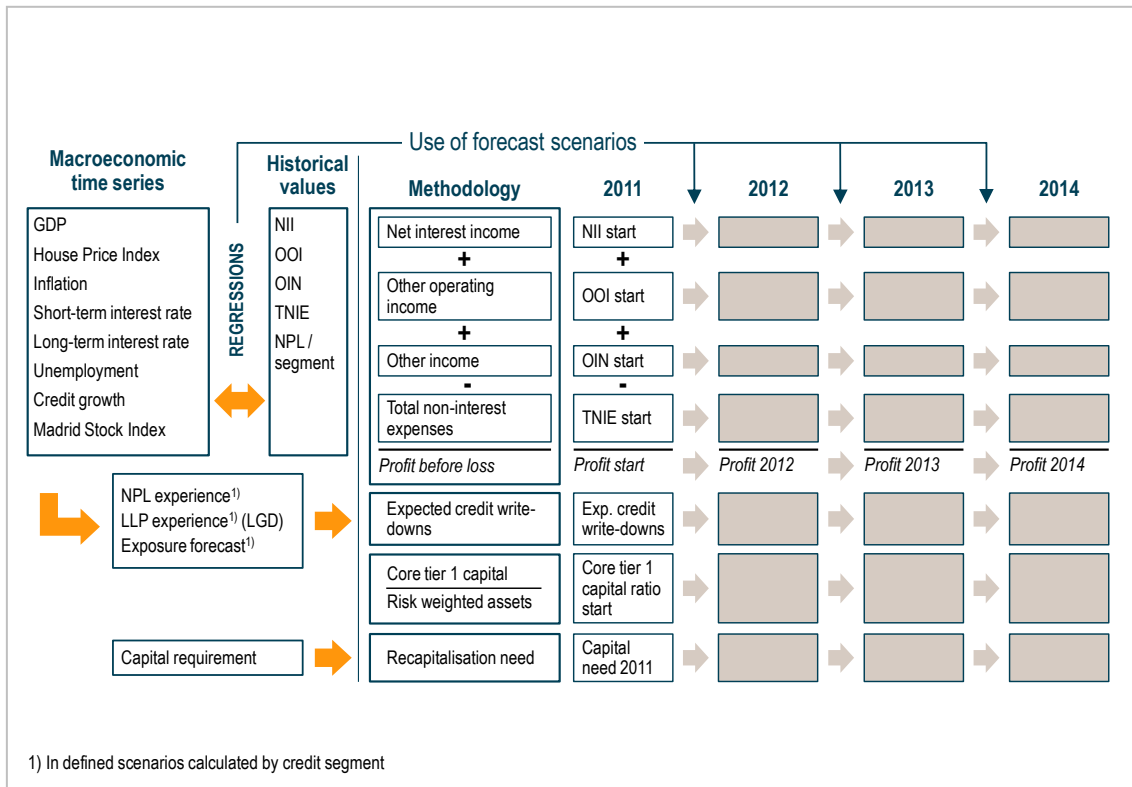


Figure 6: Overview of the model approach

All calculations were performed using data for 21 banks, whose results were aggregated into 14 banks in the wake of banks' recent merger activity. For some calculation steps, the model drilled down to segment-level calculation following the Banco de España DRC template. In such cases, the segments considered were:

- Commercial real estate (CRE)
- Infrastructure and civil construction finance (ICC)
- Corporate lending (COR)
- Small and medium-sized enterprises (SME)
- Retail mortgage lending (RMO)
- Other retail lending (RET)

In some occasions data was not available in the granularity or the time period required. To some extent, existing data gaps could be bridged by using data either from external sources, from the Roland Berger Benchmark Database or by using methodological workarounds in the model. While the missing data are not expected to have critical impacts on the final outcome, these data gaps introduce additional uncertainty and sometimes prevented analysis of results on deeper levels of granularity. Figure 7 below provides an overview of the main data inputs and sources.

## Key data items<sup>1)</sup> used for modeling

KEY DATA ITEM		SOURCE		
		BdE	Market data	RBSC Benchmark Data
Expected loan losses	PD	> PDs per bank and segment level	✓ 2011	
		> Non-performing loans (NPL)	✓ 2011	
		> NPL ratios per segment	✓ 1999-2011	
		> House Price Index, unemployment rate	✓ 1999-2014	
	LGD	> GDP, House Price Index	✓ 1999-2014	
		> LGD downturn per segment	✓ 2009-2011	✓
		> Collateral workout parameters		✓
EAD	> Credit growth per type	✓ 1999-2014		
	> EAD per segment and per bank	✓ 2011		
P&L	GDP, credit growth, MSI and Euribor 3m	✓ 2004-2014		
	Income statement data	✓ 2011	✓ BS <sup>2)</sup> : 2004-2010	
Tier 1 capital	Core tier 1 ratio	✓ 2011		
	RWAs (credit, market & operational)	✓ 2011		
	Capital injections, asset protection schemes and mergers	✓ 2011-2012		

1) Aggregated, non-exhaustive list 2) Bankscope

Figure 7: Key data items used for modeling

Credit write-downs, projection of P&L and core tier 1 capital needed to be based on a number of assumptions to counter data limitations and time restrictions. These assumptions concerned both variables' development through 2014 and their sensitivity to macroeconomic factors. Figure 8 describes the main assumptions for the calculation of these three main workstreams:

- Credit write-downs
- P&L components
- Core tier 1 capital

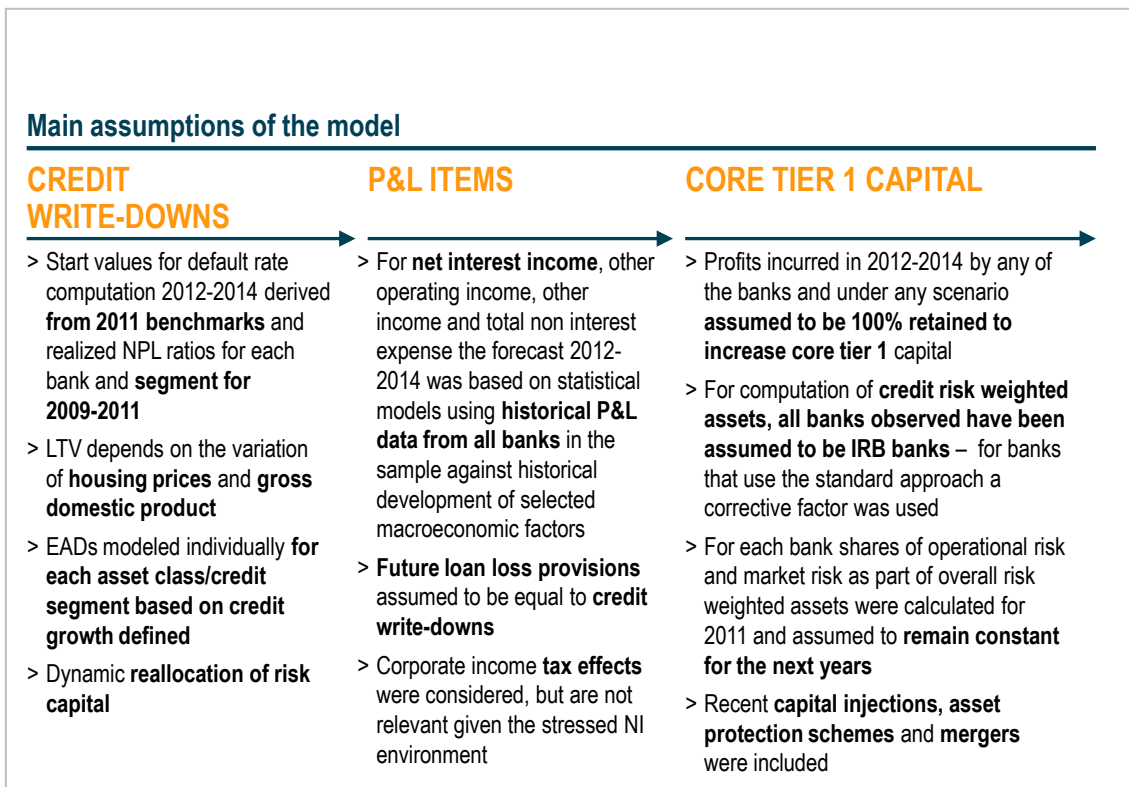


Figure 8: Key assumptions

Credit write-downs were calculated under the Basel II framework, considering segment-specific evolution of PD, LGD and EAD. Since PD expresses ex-ante probability of default (i.e. new NPL entries), the sensitivity of future PDs to macroeconomic factors can be approximated through examining historical sensitivity to NPL ratios (i.e. ex-post probability of default), which was used as proxy. Since NPL ratios data were only available by industry (CNAE/ NACE classification). A mapping table between NACE industries and the model's segments (according to BdE definitions) was constructed and assumed to be coherent across all banks. LGD and EAD were modeled as evolving in line with housing prices and credit growth, both at a segment and at a bank-level. Detail of the rationale behind the evolution of credit write-downs' components is presented in figure 9.

<b>Credit risk parameters</b>		
<b>KEY PARAMETERS</b>	<b>GENERAL DRIVERS</b>	<b>OUR CALCULATION LOGIC</b>
<b>Probability of default (PD)</b>	<ul style="list-style-type: none"> <li>&gt; General economic development (e.g. unemployment, GDP, etc.)</li> <li>&gt; Rating of counterparty</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Calculated per segment based on NPL ratios</li> <li>&gt; Calculation of bankspecific parameters for every segment by running bank specific adjustments</li> </ul>
<b>Loss given default (LGD)</b>	<ul style="list-style-type: none"> <li>&gt; Value of collateral at liquidation rates</li> <li>&gt; Present value loss in case of restructuring</li> <li>&gt; Restructuring costs</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Calculated per segment and on bank level, based on rates of liquidation, cure and restructuring</li> <li>&gt; Dependent on the loan-to-value, workout costs as well as recovery rates for the collateralized and uncollateralized part</li> </ul>
<b>Exposure at default (EAD)</b>	<ul style="list-style-type: none"> <li>&gt; Underlying commitment details</li> <li>&gt; Use of open credit lines</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Calculated on bank level based on credit growth per segment</li> <li>&gt; Redemption, kick-in of guarantees and drawing of commercial credit lines are assumed to be fully reflected in credit growth</li> <li>&gt; Partial replacement of defaulted loans is assumed</li> </ul>

Figure 9: Credit write-down calculation parameters

Regarding P&L components, historical data series on net interest income (NII), other operating income (OOI), other income (OIN), and total non-interest expenses (TNIE) were used to test these variables' sensitivity to macroeconomic factors and project their evolution for 2012 through 2014. These were estimated at a bank-level to allow for credit write-downs resulting from segment-level calculations to impact on banks' overall available capital. This impact was deduced incrementally, that is, stressed earnings and losses (net of provisions) reduce available capital at the end of each year taking the core tier 1 capital in 2011 as starting point.

Depending on the target capital ratio, capital needs could then be computed for each scenario (net of capital injections since beginning of 2012). For these calculations, the Basel II formulae for core tier 1 for IRB and non-IRB banks have been used respectively. This has taken into account "through-the-cycle-effects" of EL-measurement and respective RWA impacts for IRB banks. These results are presented in the next section.

#### 4 Final results

Required recapitalization over the period from January 2012 to December 2014 is estimated at EUR 26 billion in the base scenario (at core tier 1 target ratio of 9%). This does not include the additional funding required for the asset protection scheme (APS). The APS requires an additional EUR 6.5 billion (figure 10).

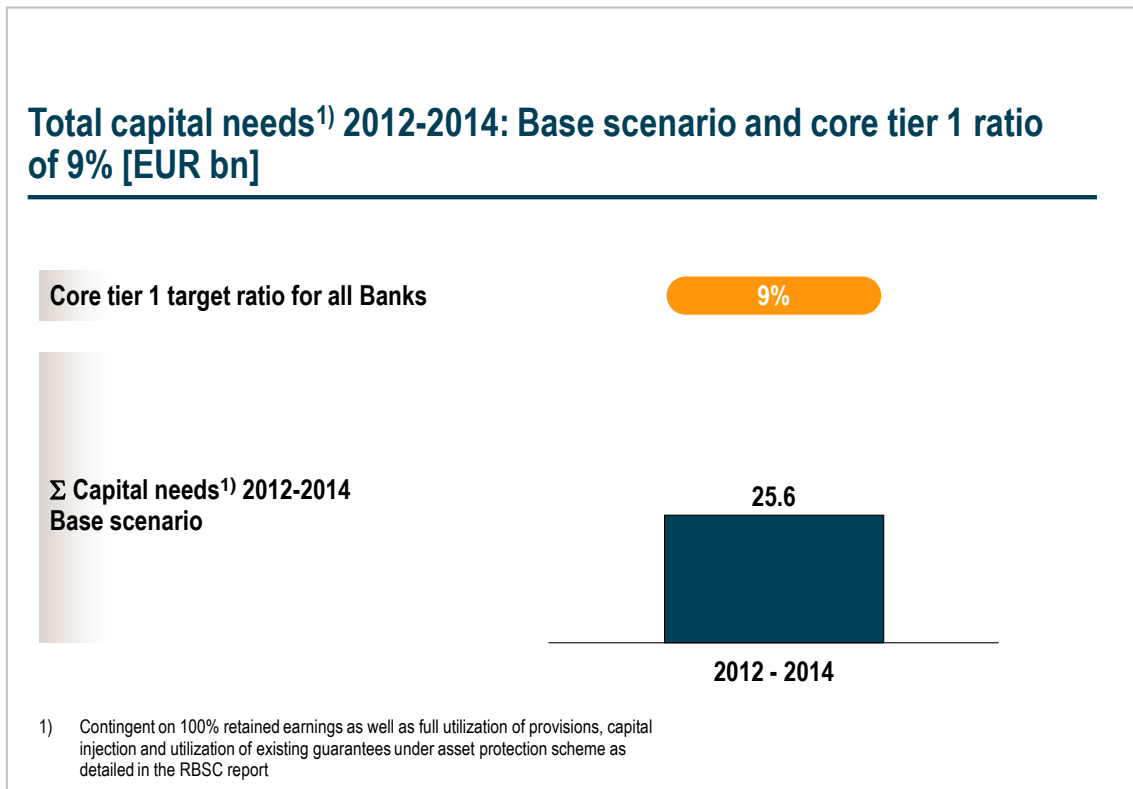
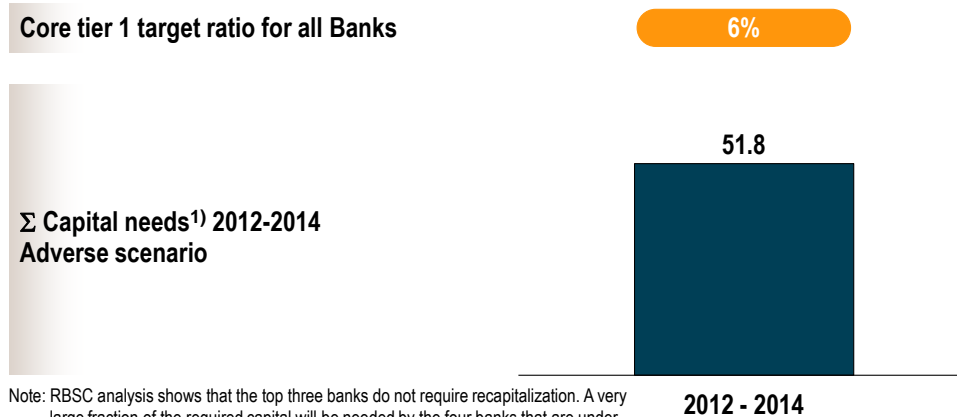


Figure 10: Required recapitalization 2012-2014, base scenario, target CT1 9%

In the adverse scenario with a core tier 1 target ratio of 6%, EUR 52 billion are required for recapitalization, once more not including the additional APS funding required, which amounts to an additional EUR 10.5 billion (figure 11).

## Total capital needs<sup>1)</sup> 2012-2014: Adverse scenario and core tier 1 ratio of 6% [EUR bn] – Top 3 banks do not require recapitalization



Note: RBSC analysis shows that the top three banks do not require recapitalization. A very large fraction of the required capital will be needed by the four banks that are under FROB surveillance

1) Contingent on 100% retained earnings as well as full utilization of provisions, capital injection and utilization of existing guarantees under asset protection scheme as detailed in the RBSC report

Figure 11: Required recapitalization 2012-2014, adverse, target CT1 6%

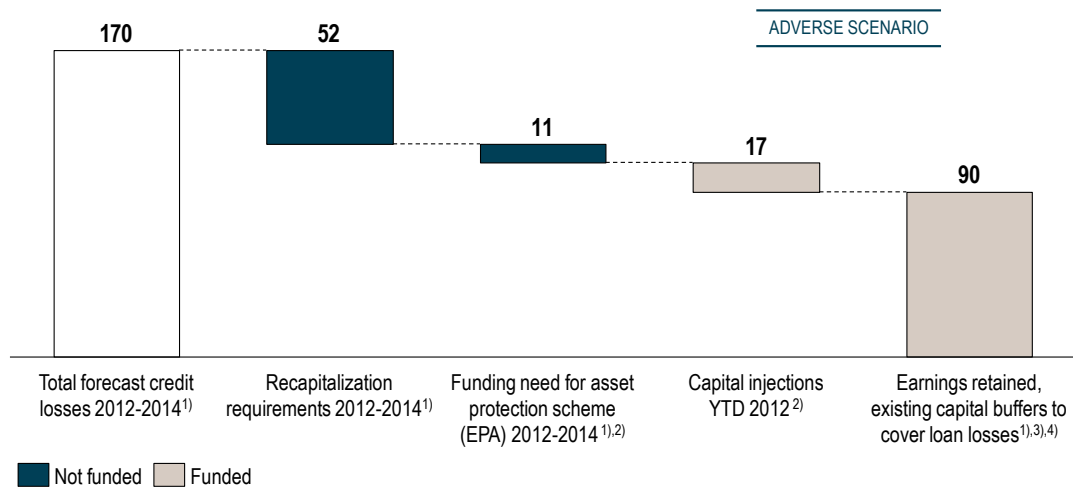
RBSC analysis shows that the top three banks do not require recapitalization in the adverse scenario. A very large fraction of the required capital will be needed by the four banks that are under FROB surveillance.

For the 14 Spanish banks, RBSC estimates expected credit write-downs for the three years to end of December 2014 to be EUR 119 billion in the base scenario and EUR 170 billion in the adverse scenario.

Figure 12 summarizes the main results by showing how the total forecast credit losses<sup>3</sup> are projected to be covered through different means in the adverse scenario with core tier 1 ratio of 6%. Retained earnings, loan loss provisions and existing capital buffers cover 54% of overall forecast credit losses, already occurred capital injections year-to-date 2012 10% (EUR 16.5 billion), the asset protection scheme covers 6% (EUR 10.5 billion) and the EUR 51.8 billion recapitalization requirement covers 31%.

<sup>3</sup> Expected future losses on credit (loan) exposures are called expected credit write-downs or forecast credit losses to avoid confusion with Basel II "expected losses"

## Means to cover total forecast credit losses 2012-2014<sup>1)</sup> [EUR bn]



- 1) Estimated by RBSC
- 2) Provided by BdE
- 3) Not including provisions for NPL 2011 and earlier, capital buffer in excess of 6% core tier 1 ratio
- 4) Earnings retained by banks in order to cover forecast credit losses

Figure 12: Means to cover total forecast credit losses



# ANNEX

## 1 Objectives and scope of project

The subset of 21 banks was reduced to 14 banks due to mergers announced between 1 January 2012 and 1 June 2012. Figures 13 and 14 show the historical merger processes that have been taken into account.

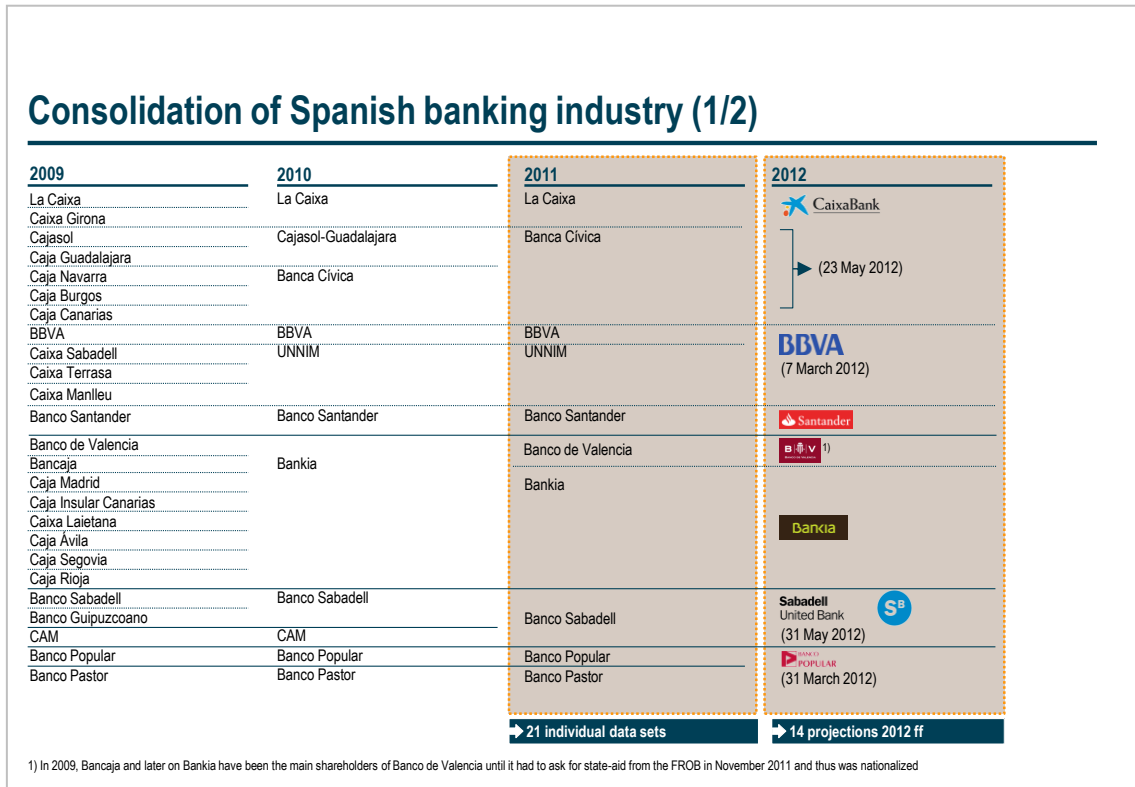










Figure 13: Merger processes (Part 1)

## Consolidation of Spanish banking industry (2/2)

2009	2010	2011	2012
Unicaja	Unicaja	Unicaja	 (16 March 2012)
Caja Jaén		Ceiss	
Caja Duero	Ceiss	Ceiss	
Caja España		Catalunya Caixa	 Catalunya Caixa
Caixa Catalunya	Catalunya Caixa	Catalunya Caixa	
Caixa Tarragona		NovaCaixaGalicia	 novagalicia
Caixa Manresa	NovaCaixaGalicia	NovaCaixaGalicia	
Caixa Galicia		Kutxa Bank	 kutxabank
Caixanova	BBK	BBK	
BBK	BBK	Banco Mare Nostrum	 BMN
Cajasur	Caja Vital	Banco Mare Nostrum	
Caja Vital	Caja Vital	Ibercaja	 iberCaja (29 May 2012)
Kutxa	Caja Vital	Caja3	
Caja Murcia	Kutxa	Caja3	
Caixa Penedès	Banco Mare Nostrum	Liberbank	 liberbank
Caja Granada		Bankinter	
Sa Nostra		Bankinter	 bankinter
Ibercaja	Ibercaja	Bankinter	
CAI	CAI		
Caja Circulo	Caja Circulo		
Caja Badajoz	Caja Badajoz		
Cajastur+CCM	Cajastur+CCM		
Caja Extremadura	Caja Extremadura		
Caja Cantabria	Caja Cantabria		
Bankinter	Bankinter		



 21 individual data sets
  14 projections 2012 ff

Figure 14: Merger processes (Part 2)

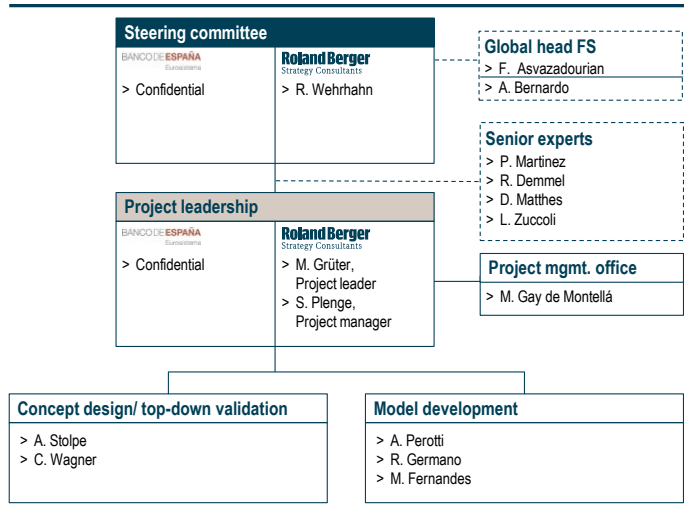
## 2 Timeframe and project organization

The project was executed over a period of four weeks from 24 May 2012 to 21 June 2012. The four-week timeframe implied a fundamental data delivery role on the part of Banco de España, which also provided two clear guiding principles for development of the model:

- Data drives solution: The stress test approach had to be tailored to the specific availability and granularity of data
- The model was to focus on those areas with the most significant impact on the overall result

The project organization reflected the objective of obtaining an independent, high-quality assessment by a steering committee comprising senior stakeholders from different central banks and international organizations, and by a project team with the right mix of capabilities (see figure 15).

# Project and team setup



## Steering committee

- > Overall responsibility for project
- > Strategic direction/ decisions
- > Potential escalation body

## Project leadership

- > Coordination/ steering of content work
- > Preparation of and participation in steering committee meetings

## Content modules

- > Analysis of relevant data
- > Derivation of implications
- > Evaluation of options/ recommendations

## Dimension of Roland Berger support

- > 1 partner, 1 principal, 4 senior experts
- > 1 project manager
- > 6 consultants

Figure 15: Project and team setup

### 3 Scenarios

As shown in figure 16, this exercise used macroeconomic variables, e.g. the rate of growth in credit to resident sectors such as households and non-financial firms, that have not been considered in previous tests.

	SCAP 2009	CEBS 2009	CEBS 2010	EBA 2011	This initiative
Real GDP	✓	✓	✓	✓	✓
GDP deflator					✓
Nominal GDP					✓
Harmonized Index of Consumer Prices				✓	✓
Unemployment rate	✓	✓	✓	✓	✓
Exchange rate against USD				✓	✓
Madrid Stock Exchange Index					✓
Credit to other resident sectors					
> Households					✓
> Non-financial firms					✓
Short-term interest rate (Euribor, 3 months)			✓	✓	✓
Euribor, 12 months			✓	✓	✓
Long-term interest rates (Spanish debt, 10 years)			✓	✓	✓
House/ land prices	✓				✓
> Commercial property		✓	✓	✓	
> Residential property		✓	✓	✓	

Figure 16: Comparing macroeconomic variables between stress tests

## 4 Model approach

### 4.1 Input data and sources

#### 4.1.1 Expected loan losses

A list of data sources used to calculate expected loan losses is shown in figure 17 below.

KEY DATA ITEM	EXPECTED LOAN LOSSES	SOURCE			
		BdE	Market data	RBSC bench- mark data	
KEY DATA ITEM	PD	> PDs per bank and segment level	✓ 2011		
		> Non-performing loans (NPL)	✓ 2011		
		> NPL ratios per industry	✓ 1999-2011		
	LGD	> LGD downturn per segment			✓
		> LGD per segment and bank	✓ 2011		
	LTV	> Madrid Stock Exchange Index	✓ 2011-2014		
		> Home Price Index	✓ 2011-2014		
	LGC	> LGC (loss given cure) per segment			✓
		> PL (probability for cure) per segment			✓
	LGR	> LGR (loss given restructuring) per segment			✓
		> PR (probability for restructuring) per segment			✓
	LGL	> Admin costs/ EAD			✓
		> Recovery rates (collateralized/ uncollateralized)			✓
		> Share of collateralization			✓
	EAD	> Credit growth households	✓ 2011-2014		
> Credit growth non-financial institutions		✓ 2011-2014			
> Credit growth others		✓ 2011-2014			
> EAD (sum of on-balance sheet and off-balance sheet exposure)		✓ 2011			

Figure 17: Data sources used to calculate expected loan losses

#### 4.1.2 P&L items (NII, OIN, OOI, TNIE)

A list of data sources used to calculate P&L items is shown in figure 18 below.

KEY DATA ITEM	P&L		SOURCE			
			BdE	Market data	RBSC benchmark data	
KEY DATA ITEM	P&L	Macroeconomic data	> GDP	✓	2004-2010	
			> Credit growth non-financial institutions	✓	2004-2010	
			> MSI	✓	2004-2010	
			> Euribor 3M	✓	2004-2010	
	P&L	Income statement data	> Net interest income	✓	2011	✓ BS: 2004-2010
			> Other operating income	✓	2011	✓ BS: 2004-2010
			> Other income	✓	2011	✓ BS: 2004-2010
			> Total non-interest expense per bank	✓	2011	✓ BS: 2004-2010

Figure 18: Data sources used to calculate P&L items

### 4.1.3 Core tier 1 capital

A list of data sources used to calculate core tier 1 capital is shown in figure 19 below.

KEY DATA ITEM	TIER 1 CAPITAL FORECAST	SOURCE		
		BdE	Market data	RBSC benchmark data
Core tier 1 ratio per bank		✓		2011
RWA (credit, market & operational RWA) per bank		✓		2011
Credit RWA per bank		✓		2011
Market risk weighted assets per bank		✓		2011
Operational risk weighted assets per bank		✓		2011
Capital injection per bank		✓		2012

Figure 19: Data sources used to calculate core tier 1 capital

## 4.2 Assumptions

### 4.2.1 Expected loan losses

A list of assumptions used to calculate expected loan losses is shown in figure 21 below.

<b>ASSUMPTION</b>	<b>COMMENT</b>
<b>Default rates</b>	> Initial values for calculation of the 2012-2014 default rate were derived from 2011 benchmarks and realized NPL ratios for each bank and segment from 2009-2011
<b>Exposure at default (EAD)</b>	<ul style="list-style-type: none"> <li>&gt; EADs were modeled individually for each asset class/ credit segment based on credit growth defined in the selected macroeconomic scenarios</li> <li>&gt; This implicitly assumes that loans that expire (mature) and loans that default will be replaced to the extent indicated by the credit growth/shrinkage rates in the scenarios – where a smaller replacement of defaulted loans in CRE and ICC segments has been assumed than in Corporate and SME for the years 2012 to 2014</li> <li>&gt; The EAD for each asset class was linked to credit growth in one particular segment (growth of the segment across the market)</li> </ul>
<b>Loan loss provisions (LLP)</b>	> Loan loss provisions were assumed to be equal to economic loan losses
<b>Additional LLPs from previous years NPLs<sup>1)</sup></b>	> Based on defined "target provisioning coverage" an LLP correction number for each bank was estimated above and beyond the modeling of the capital shortfall to reflect the possibility of the need for extra LLP due to insufficient LLPs in 2011
<b>Loan-to-value (LTV)</b>	> LTV depends on the valuation of house prices and gross domestic product

1) The accuracy of LLPs as well as each bank's and each portfolio's dependencies on the economic environment can only be assessed by a full bottom-up audit. Such an audit has been initiated by Bank of Spain. By nature, the outside-in approach taken, cannot provide this degree of accuracy.

*Figure 20: Assumptions on expected loan loss calculation*

Details on mapping industries to business segments in accordance with the BdE DRC are shown in figure 21 below.



<b>SEGMENT (DRC)</b>	<b>INDUSTRY (CNAE)</b>
<b>Commercial real estate finance (CRE)</b>	> CNAE A.11.1: "Actividades inmobiliarias y servicios empresariales"
<b>Infrastructure &amp; civil construction finance (ICC)</b>	> CNAE A.6: "Construcción"
<b>Corporate lending (COR) and SME lending (SME)</b>	> CNAE A. (other excl. A.11.1 and A.6): "Créditos aplicados a financiar actividades productivas"
<b>Retail mortgage lending (RMO)</b>	> CNAE B.1, B.2, B.6 – B.1: "Adquisición de vivienda propia" – B.2: "Rehabilitación de viviendas (obras y mejoras del hogar)" – B.6: "Adquisición de terrenos, fincas rústicas, etc."
<b>Other retail lending (RET)</b>	> CNAE B.3, B.4, B.5, B.7, C., D. – B.3: "Adquisición de bienes de consumo duraderos (automóviles, electrodomésticos y otros)" – B.4: "Adquisición de otros bienes y servicios corrientes" – B.5: "Adquisición de valores" – B.7: "Otras financiaciones a hogares" – C: "Créditos aplicados a financiar gastos de las instituciones privadas sin fin de lucro" – D: "Otros (sin clasificar)"

*Figure 21: Mapping of industries to business segments*

#### 4.2.2 P&L items (NII, OOI, OIN, TNIE)

The 2012-2014 forecasts for NII, OOI, OIN and TNIE were based on statistical models of historical P&L data from all banks in our sample against historical development of selected macroeconomic factors.

#### 4.2.3 Core tier 1 capital

A list of assumptions used to calculate core tier 1 capital is shown in figure 22 below.

ASSUMPTION	COMMENT
<b>Effective tax rate</b>	<ul style="list-style-type: none"> <li>&gt; The individual effective tax rate applicable to each bank in 2011 was used to calculate tax payments</li> <li>&gt; Effective tax rates were calculated using 2011 P&amp;L figures provided by the Bank of Spain</li> <li>&gt; Deductions due to negative results in previous years were not taken into account</li> <li>&gt; Where effective tax rates were not available or the calculated effective tax rate was negative, an effective tax rate of 0% was assumed</li> <li>&gt; For 2012-2014, effective tax rates were assumed to remain constant at the 2011 level</li> <li>&gt; Results showed that tax effects were irrelevant</li> </ul>
<b>Retention of earnings</b>	<ul style="list-style-type: none"> <li>&gt; 100% of all profits earned by any of the banks in the years 2012-2014 and in any scenario were assumed to be retained to increase the core tier 1 capital of the bank concerned</li> <li>&gt; Like all parameters in the model, though, this one too can be changed</li> </ul>
<b>Endogenous capital injection</b>	<ul style="list-style-type: none"> <li>&gt; Based on the assumed core tier 1 capital ratio, it was calculated whether the actual values for each bank fall short in 2012 and 2014</li> <li>&gt; In the event of shortfalls, the corresponding amount would be injected into core tier 1 capital</li> </ul>
<b>Credit risk-weighted assets</b>	<ul style="list-style-type: none"> <li>&gt; To calculate RWAs, the IRB formula was used for IRB banks and the non-IRB formula for non-IRB banks</li> <li>&gt; Using a scaling factor, we ensured that the 2011 CRWA values were matched exactly for every bank</li> </ul>
<b>Operational and market risk-weighted assets</b> (operational and market RWAs)	<ul style="list-style-type: none"> <li>&gt; For each bank, operational risk and market risk as shares of total credit risk-weighted assets were calculated for the year 2011</li> <li>&gt; These shares were assumed to remain constant for 2012-2014 and were used to calculate total risk-weighted assets in these years</li> <li>&gt; For most banks, risk-weighted assets for credit risk account for the lion share of total risk-weighted assets. This simplification was therefore accepted to avoid overcomplicating the analysis by treating operational and market price risks separately</li> </ul>

Figure 22: Assumptions on core tier 1 calculation

### 4.3 Statistical models

#### 4.3.1 PD estimate

The structural form used to calculate PD per asset class was the same as that used for P&L projections, i.e.:

$$PD_{i,j,t} = PD_{i,j,t-1} \cdot \text{Exp} \left( \mu_{i,j} + \sigma_{i,j} \cdot \left[ \rho_j + \varrho_j \cdot \left( \frac{X_{j,t}}{X_{j,t-1}} - 1 \right) \right] \right)$$

where:

$i$  Bank  $i$  [ $i=1, 2, \dots, 21$ ]

$j$  Segment  $j$  [ $j=\text{CRE, ICC, COR, SME, RMO, RET}$ ]

$t$  Year  $t$  [ $t=1999, 2000, \dots, 2011$ ]

$PD_{i,t}$  is the NPL ratio (PD) for each segment for bank  $i$  at time  $t$

$\mu_i$  is the sample mean of NPL ratio (PD) for each bank

$\sigma_i$  is the sample standard deviation of the NPL ratio (PD) for bank

$x_{k,t}$  is the relevant macroeconomic indicator for each segment

$\rho_j, \varrho_j$  are regression parameters

As in the previous section, log-differencing  $PD_{i,j,t}$  and normalizing the results by subtracting the sample mean and dividing by the sample standard deviation yielded a linear model in the explanatory macroeconomic variables  $x_{j,t}$ . This macroeconomic factor was varied for each asset class according to its model fit. For CRE, ICC, COR, SME and RET the explanatory variable was unemployment rate and for the RMO segment the strongest explanatory variable was the house price index.

#### 4.3.2 P&L estimate (NII, OOI, OIN, TNIE)

The overall calculation was performed as follows:

$$Profit_{i,t} = NII_{i,t} + OOI_{i,t} + OIN_{i,t} - TNIE_{i,t}$$

where:

$i$  Bank  $i$  [  $i=1, 2, \dots, 21$  ]

$t$  Year  $t$  [  $t=2004, 2005, \dots, 2010$  ]

$NII_{i,t}$  is bank  $i$ 's net interest income in year  $t$  (i.e. interest income less interest expenses)

$OOI_{i,t}$  is bank  $i$ 's other operational income in year  $t$  (i.e. net income from financial assets and equity holdings, plus all other income)

$OIN_{i,t}$  is bank  $i$ 's other income in year  $t$  (fee income less fee expenses and trading income minus trading expenses)

$TNIE_{i,t}$  is bank  $i$ 's total non-interest expenses in year  $t$  (i.e. administrative expenses and write-offs of physical goods)

The RBSC model estimated each profit component using the model:

$$y_{i,t} = y_{i,t-1} \cdot \text{Exp} \left( \mu_i + \sigma_i \cdot \left[ \rho + \varrho \cdot \left( \frac{X_t}{X_{t-1}} - 1 \right) \right] \right)$$

where:

$i$  Bank  $i$  [  $i=1, 2, \dots, 21$  ]

$t$  Year  $t$  [  $t=2004, 2005, \dots, 2011$  ]

$y_{i,t}$  is each profit component (NII, OOI, OIN, TNIE) for bank  $i$  at time  $t$

$\mu_i$  is the sample mean of  $y$  for each bank

$\sigma_i$  is the sample standard deviation of  $y$  for each bank

$x_{k,t}$  is the relevant macroeconomic indicator for each profit component

$\rho, \varrho$  are regression parameters

In other words, the dependent variable "y" (profit components) was determined in normalized log differences for the time period 2005-2010. This yielded a linear model in the explanatory macroeconomic variables  $x_{k,t}$ . The specific macroeconomic factor used to explain each profit component was chosen as a function of its model fit. Explanatory factors for each profit component were as follows:

- NII – Real GDP growth
- OOI – Madrid Stock Exchange Index
- OIN – Credit growth of non-financial assets and equity holdings
- TNIE – Short-term interest rates

The RBSC model used one model to estimate each profit component (i.e. four in total), but used the information from all banks to ensure that an adequate sample size was constructed. The resultant coefficients were used as parameters in the model to estimate the profit components' evolution from 2012 through 2014.

#### 4.4 Bank simulation model design

The following subsections provide more detailed information on the model methodology in the three main workstreams:

- Expected loan losses
- P&L items (NII, OOI, OIN, TNIE)
- Core tier 1 capital

##### 4.4.1 Expected loan losses

###### 4.4.1.1 Probability of default

The ex-ante expected annual probability of default in period  $t$  was calculated as a weighted average of the expected PD in the previous period and the realized PD in the same period, in accordance with the following rule:

$$PD_{j,t}^e = \omega_j PD_{j,t-1}^e + (1 - \omega_j) PD_{j,t}^r \quad \text{with } \omega_j \in [0,1]$$

where:

$\omega_j$  is the weighting of "expected PD inertia" (previous year's PD)

$PD_{i,j,t}^e$  is the expected PD for each segment for bank  $i$  at time  $t$

$PD_{i,j,t}^r$  is the realized PD for each segment for bank  $i$  at time  $t$

The parameter  $\omega_j$  stands for "expected PD inertia", that is, i.e. how much of last year's expectation is incorporated in this year's expectation for PD. If  $\omega_j$  equals 0, the expected PD immediately gets updated in line with the current PD realization. This implies a perfect "point-in-time" view of internal rating models. If  $\omega_j$  equals 1, the expected PD retains the value of the previous period and can be interpreted as the maximum "through-the-cycle" (TTC) value, i.e., a value that is constant over time.

The realized default rate is calculated as follows:

$$PD_{j,t}^r = PD_{j,t-1}^r e^{\mu_j + \sigma_j \left[ \rho_j + \vartheta_j \left( \frac{X_{j,t}}{X_{j,t-1}} - 1 \right) \right]}$$

where:

$\mu_j, \sigma_j,$  are parameters estimated based on historical data starting with the observations in 2011  
 $\rho_j, \vartheta_j$

$x_{j,t}$  is a segment-specific macroeconomic variable that varies for the five segments

#### 4.4.1.2 Loss given default

The following formula was used to simulate realized LGDs, based on the assumption that defaulting business has normally three possible outcomes:

- Cure with probability pC
- Restructuring with probability pR
- Liquidation with probability pL = 1 – pC – pR

where pL and pC are the frequencies of liquidation and cure that were benchmarked and considered to be constant across segments and over time. These frequencies were also used to construct the overall LGD calculation as a weighted average of its three components, as shown below:

$$LGD_{j,t}^r = p_C LGC_{j,t} + p_R LGR_{j,t} + p_L LGL_{j,t}$$

where:

$LGD_{i,j,t}^r$  is the realized "loss given default" for each segment of bank  $i$  at time  $t$

$LGC_{i,j,t}$  is the "loss given cure" for each segment of bank  $i$  at time  $t$

$LGR_{i,j,t}$  is the "loss given restructuring" for each segment of bank  $i$  at time  $t$

$LGL_{i,j,t}$  is the "loss given liquidation" for each segment of bank  $i$  at time  $t$

LGL depends on loan-to-value (LTV), recovery rates (RR) for the collateralized and uncollateralized part of loans and workout costs (WC) as percentage of EAD. The LGL is calculated separately for the collateralised and uncollateralised business of every segment and aggregated into a single expression for LGL depending on the weight of collateralisation for a given business segment. The components of LGL are computed according to the following formula:

Collateralised:

$$LGL_{j,t} = \max\left(0; 1 - \frac{RR_j^{coll}}{LTV_{j,t}}\right) (1 - RR_j^{uncoll}) + \frac{WC_{j,t}}{EAD_{j,t}}$$

Uncollateralised:

$$LGL_{j,t} = 1 - RR_j^{uncoll} + \frac{WC_{j,t}}{EAD_{j,t}}$$

The relationship between LTV and LGD is represented in figure 23.

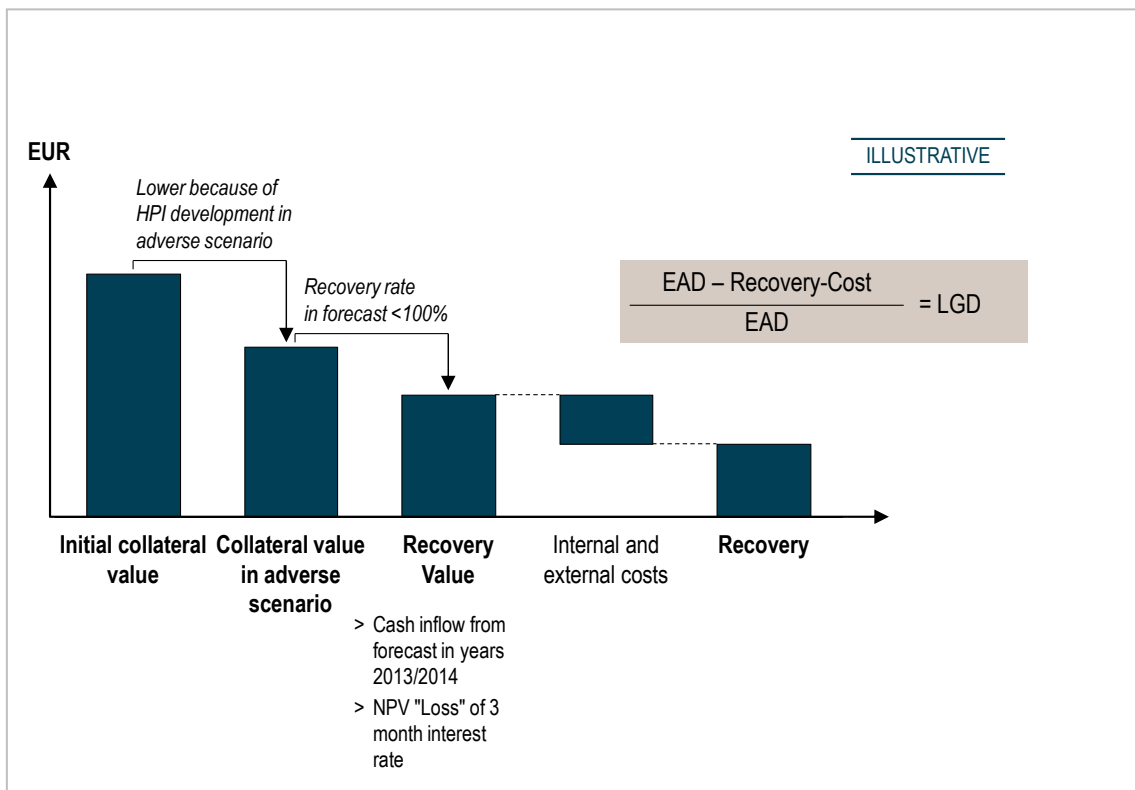


Figure 23: LGD calculation for collateralised exposures

The updating rule for the LGD is similar to the one used for the PDs:

$$LGD_{j,t}^e = \omega_j LGD_{j,t-1}^e + (1 - \omega_j) LGD_{j,t}^r \text{ with } \omega_j \in [0,1]$$

where:

$\omega_j$  is the weighting of "expected LGD<sup>e</sup> inertia" (LGD<sup>e</sup> of previous year)

$LGD_{i,j,t}^e$  is the expected LGD for each segment for bank  $i$  at time  $t$

$LGD_{i,j,t}^r$  is the realized LGD for each segment for bank  $i$  at time  $t$

#### 4.4.1.3 Exposure at default

To model exposures at default, the RBSC model formulated EAD as varying with (net) credit growth for each segment depending on the relevant macroeconomic scenario. EAD evolved from 2012 through 2014 in line with the following formula:

$$EAD_{i,j} = (1 + \text{Credit Growth}_{j,t}) EAD_{j,t-1} (1 - \delta_{j,t})$$

where  $\delta = 20\%$  for 2013 and  $25\%$  for 2014 if  $j = \text{CRE or ICC}$

This modeling implies that EAD varies with net credit growth, that is, credit growth given in scenarios net of new defaulted loan entries and replacements. Given RBSC's current market understanding, however, defaulted loans in CRE and ICC segments were not being replaced, but reallocated towards corporate segments, and were thus assumed to be decreasing by a higher rate than given in the scenarios. This parameter was set across all banks at 20% for 2013 and 25% 2014, which is reflected in a higher decrease in CRWA for ICC and CRE relative to other segments - given current market conditions this is believed to be conservative. This exposure was then reallocated to Corporate (COR) and SME business in order to fulfil the net credit growth requirements as set out in the scenarios.

Figure 24 below shows further EAD details.

<b>Segment credit growth used for estimating EAD by asset class</b>	
<b>EAD BY SEGMENT</b>	<b>CREDIT GROWTH ON</b>
Commercial real estate (CRE)	Households
Infrastructure & civil construction (ICC)	Others
Corporate lending (COR)	Non-financial institutions
SME lending (SME)	Non-financial institutions
Retail mortgage (RMO)	Households
Other retail lending (RET)	Households

Figure 24: Segment credit growth used for estimating EAD by asset class

#### 4.4.2 P&L items (NII, OOI, OIN, TNIE)

Profit and losses before provisions were calculated as follows:

$$PL_t = NII_t + OOI_t + OIN_t - TNIE_t$$

Expected losses affected (net) profit components via increases in loan loss provisions (LLP), which were derived from the historical behavior and expected provisions for each year.

$$LLP_{i,t} = (1 - z_t)NPL_{i,t-1} \times \frac{\sum_j LGD_{i,j,t}^* EAD_{i,j,t}}{EAD_{i,j,t}} + z_t \sum_j PD_{i,j,t}^* LGD_{i,j,t}^* EAD_{i,j,t}$$

It is uncertain whether the LLPs from previous years that are supposed to cover previous years' NPLs are sufficient. Since those LLPs were set aside in the economic environment of 2011 but the sale of the corresponding collateral assets can be delayed until 2014, the severity of the crisis in the environment into which the collateral is sold could impact the accuracy and coverage of 2011 NPLs by 2011 LLPs.



The accuracy of LLPs and each bank and portfolio's dependency on the economic environment can only be assessed by a full bottom-up audit. Such an audit has been initiated by the Bank of Spain. No "outside-in" estimate can provide this accuracy.

However, to reflect the possibility of the need for extra LLP, an LLP correction should be estimated above and beyond the modeling of the capital shortfall. This has been done as follows:

- Calculate the "provisioning coverage" as LLP/NPL for each bank
- Define a "target LLP/NPL ratio" – derived from the respective ratio for 2012 to 2014 for the scenarios
- Calculate the "LLP shortfall" compared to this target ratio for each bank
- In reality, the LLP/NPL ratio depends on the composition and type of the portfolio and the individual NPL. Accordingly, this "broad" approach cannot reflect idiosyncratic elements of the portfolios

#### 4.4.3 Core tier 1 capital

The impact of expected losses and P&L projections on the core tier 1 ratio (CT1R) was as follows:

$$CT1R = \frac{CT1_{pre-stress} + Earnings - Loss - 0.5 \max(Basel II EL - Provisions; 0) + APS + CapInject}{Total RWA}$$

Initial core tier 1 capital was taken as the actual 2011 value for each bank. Capital injection year to date 2012 has been additionally considered. The model derived the impact of expected losses and provisions on core tier 1 ratio for 2012 through 2014 incrementally. In other words, stress-tested earnings and losses (net of provisions) reduced available capital at the end of each year. This is illustrated in the formula below for core tier 1 capital (CT1):

$$CT1_t = CT1_{t-1} + \psi_t [Profit_t - LLP_t - \vartheta \max(0, Profit_t - LLP_t)] + APS_t + CI_t$$

where:

$\vartheta$  is the corporate tax rate

$\psi_t$  is the retained earnings rate

$APS_t$  is the asset protection scheme

$CI_t$  is the capital injection

Expected losses under Basel II were calculated as shown in section 2.2.3.1 and were integrated in the capital ratio as follows:

$$\text{Basel II Expected Losses}_t = (\text{LGD}_t^{\text{downturn}} \text{NPL}_t) \times \sum_j (PD_{j,t}^e \text{LGD}_{j,t}^e \text{EAD}_{j,t}^e)$$

$$\text{LGD}_t^{\text{downturn}} = (1 + \theta) \frac{\sum_j (\text{LGD}_{j,t}^e \text{EAD}_{j,t}^e)}{\sum_j \text{EAD}_{j,t}^e}$$

Risk-weighted assets were calculated as the sum of credit RWAs for each segment (for each bank in each year), plus market and operational RWAs (MRWA, ORWA respectively) that were calculated based on 2011 values for each bank and spread proportionally over the period (see formula for total RWA below). It should be noted that credit RWAs are calculated in line with the specific Basel II IRB formula for each segment.

$$\text{Total RWA}_t = \sum_j \text{CRWA}_{j,t} + \text{ORWA}_t + \text{MRWA}_t = (1 + \varphi) \sum_j \text{CRWA}_{j,t}$$

Once core tier 1 capital projections have been made for each year, the capital requirements can then be calculated for a given target capital ratio. The resulting capital requirements – in line with Basel II requirements – are then adjusted to capital increases already made by banks since the beginning of 2012 according to Banco de España.

#### 4.4.4 State guarantees, capital injections and merger activity

##### 4.4.4.1 State guarantees

The Spanish government has set up an asset protection scheme (APS) which affects three banks that have been acquired by other banks: CAM, UNNIM and Liberbank. For the first two banks the effect of the scheme is such that up to 80% of the credit losses that will occur from 2012 onwards will be borne by public sector institutions (e.g. FROB, Spanish deposit insurance system etc.) and only 20% have to be borne by the acquiring bank. Liberbank has been granted a capped guarantee scheme up to EUR 1bn, i.e. losses up to EUR 1bn are taken over public sector institutions, starting 2012.

These effects have been included accordingly in computing the evolution of tier 1 capital as the first formula in section “4.4.3 Core tier 1 capital” indicates.

##### 4.4.4.2 Capital measures

Capital measures YTD 2012 have been included in computing the evolution of tier 1 capital as the first formula in section “4.4.3. Core tier 1 capital” indicates.

#### *4.4.4.3 Merger activity*

The ongoing consolidation of the Spanish banking sector has been accounted for in the model approach by including the mergers between BBVA and Unnim, Popular and Pastor, Sabadell and CAM, Caixabank and Banca Cívica, Iberjaca, Caja3 and Liberbank, Unicaja and CEISS, hereby reducing the number of banks from 21 to 14.

A detailed list of banks in scope and merger activity is shown in figures 14 and 15.

Capital needs were first calculated for the 21 banks individually. In a second step the consolidation process was undertaken which reduces overall recapitalization need by around EUR 10 billion as capital needs are compensated between the merging entities.

## 5 Final results

RBSC has calculated expected credit write-downs by segment. Results are shown in figure 25 below.

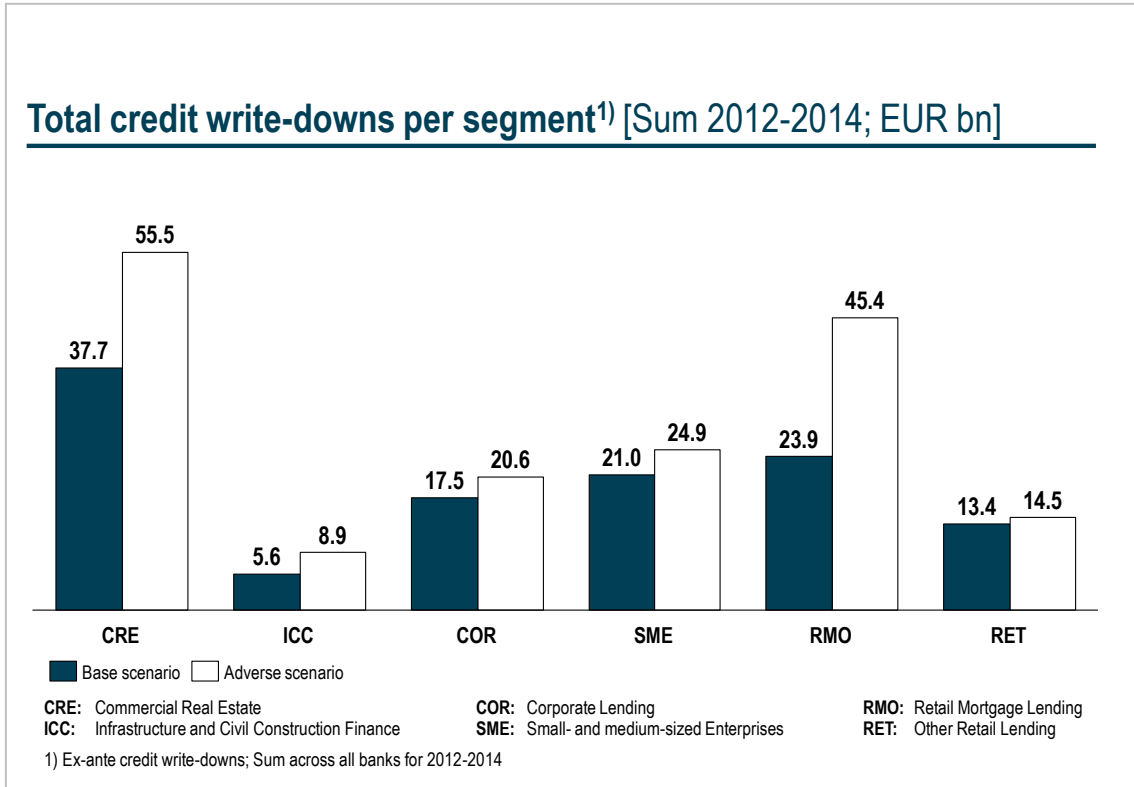


Figure 25: Credit write-downs per segment

## General Terms and Conditions

### 1. Applicability

1. All Consulting Services provided by Roland Berger Strategy Consultants shall take place solely on the basis of the following General Terms and Conditions (T&C), as amended from time to time.

2. Divergent terms and conditions proposed by Client that Roland Berger Strategy Consultants does not expressly recognize in writing shall not be binding for them, even if Roland Berger Strategy Consultants does not expressly oppose them in individual cases.

### 2. Object of the Agreement and conduct of consulting activities

1. The scope and content of the Consulting Services provided by Roland Berger Strategy Consultants shall be set out in an individual contract each time. Unless expressly agreed otherwise, Roland Berger Strategy Consultants' obligation shall be limited to performing the Services agreed upon in the contract; Roland Berger Strategy Consultants shall in no event be held responsible for the implementation of these Services, in particular of recommendations and analyses, by Client. Under no circumstances does Roland Berger Strategy Consultants guarantee the achievement of a specific business result as a result of its consulting activity.

2. Roland Berger Strategy Consultants shall carry out all tasks with the greatest possible care based on accepted rules of science and practice. In doing so, the consulting activity shall always be oriented to the individual situation and needs of the Client. In performing its Consulting Services, Roland Berger Strategy Consultants shall always act objectively, neutrally, and with independent responsibility. Accordingly, Roland Berger Strategy Consultants undertakes to accurately and completely reflect in its analyses and presentations Client's situation with respect to the tasks agreed upon in the contract, subject to Section 4 Par. 2 below.

3. At Client's request, Roland Berger Strategy Consultants shall furnish information on the status of its consulting activity at any time. The drawing up of comprehensive written reports, particularly also for presentation to third parties, shall be agreed upon on a case-by-case basis.

4. Roland Berger Strategy Consultants shall have the right to avail itself of subcontractors for the purpose of conducting its consulting activity. Roland Berger Strategy Consultants shall be responsible for the choice of employees entrusted with the conduct of the consulting activity. This includes the right to replace individual employees or an entire team during the course of a project, taking the justified concerns of the Client into consideration.

5. Client may transfer his rights from the contractual relationship only with the prior written approval of Roland Berger Strategy Consultants; the applicability of Section 354a of the German Commercial Code (§ 354a HGB) shall not be affected.

### 3. Changes of contract

1. If Client requests changes after signing the Agreement, particularly with respect to the scope and content of the consulting activity, Roland Berger Strategy Consultants shall endeavor, within reasonable limits, to take account of the relevant changes requested. If and to the extent the requested change has substantial impact on the contractual foundations, in particular expenses and/or timeframe, Roland Berger Strategy Consultants shall have the right to approve a corresponding contractual change only in exchange for an appropriate adjustment of the contractual terms and conditions, particularly an increase in compensation and an adjustment of the service deadlines. Unless and until a corresponding agreement is reached, Roland Berger Strategy Consultants shall continue its consulting activity on the basis of the signed Agreement and these Terms and Conditions.

2. Any changes or additions to the scope of the Engagement and the content of the Consulting Services shall not be valid unless they are made in writing, pursuant to Section 14 Par. 1. This shall be satisfied if Roland Berger Strategy Consultants confirms oral agreements in writing within a period of two weeks, and if Client does not immediately raise an objection.

### 4. Client's obligations to cooperate

1. Client is obligated to create the basis necessary for proper conduct of the Consulting Agreement and in particular to make available in a timely and complete fashion all relevant data and documents for the consulting activity of Roland Berger Strategy Consultants and to furnish all necessary information.

2. Client shall guarantee that the documents provided by it and the information it furnished in writing or orally are accurate and complete. Roland Berger Strategy Consultants is obligated merely to check the data supplied by Client or by third parties for plausibility.

### 5. Compensation and terms of payment

1. Compensation for the consulting activity of Roland Berger Strategy Consultants shall be determined in accordance with the provisions of the respective Individual Agreement. All price quotes shall be understood as not including Value Added Tax. Unless agreed otherwise, Client shall be invoiced separately for expenses.

2. If, in individual cases, compensation according to time spent on service provision is agreed, the current price lists, as amended from time to time, or the per diem rates of the consultant employed in each case shall apply. For Agreements that stipulate that the consulting activity of Roland Berger Strategy Consultants is to be completed within four months after signing the Agreement, an update of the price list or an increase in the hourly rates following the signing of the Agreement shall not be considered under any circumstances. However, this shall not apply if the consulting activity of Roland Berger Strategy Consultants extends beyond a period of four months for reasons for which Client is responsible.

3. All claims to compensation shall become due when they are invoiced, and shall be payable immediately without deduction.

4. Client claims can be offset against Roland Berger claims only if the former are uncontested or unappealable claims.

### 6. Confidentiality

1. Roland Berger Strategy Consultants undertakes to observe secrecy of all Client information and business and operating secrets that become known to Roland Berger Strategy Consultants during the conduct of the consulting activity and that are obviously confidential or that were expressly identified as confidential when they were communicated or handed over, even following termination of the consulting activity. Transfer to third parties not involved in conducting the consulting activity shall always require the prior written consent of the Client.

2. If and to the extent that, pursuant to Section 2 above, Roland Berger Strategy Consultants employs subcontractors in conducting the consulting activity, Roland Berger Strategy Consultants shall obligate them to secrecy to the same extent to which it itself is obligated with respect to the Client.

3. Personal data required for the conduct of the consulting activity shall be stored in compliance with the German Data Protection Law (BDSG) and treated confidentially. Roland Berger Strategy Consultants shall be authorized to collect, store, process, and use, or to allow third parties to collect, store, process, and use the data received in connection with the contractual relationship for the purpose of the consulting activity.

### 7. Mutual duty of good faith

1. The Parties undertake to be loyal to one another. Each Party shall inform the other immediately of all events that arise during the term of the Consulting Agreement and that may affect its conduct.

2. Both Parties are prohibited, individually, from hiring or otherwise employing employees or former employees who are or were active within the scope of the consulting activity of Roland Berger Strategy Consultants, prior to expiration of a blocking period of 12 months following termination of the Agreement.

3. Moreover, both Parties undertake not to actively entice away the respective other party's employees involved in the Consulting Agreement. Should Client learn that a Roland Berger Strategy Consultants employee working within the scope of the Agreement intends to terminate his employment relationship, Client shall inform Roland Berger Strategy Consultants of this immediately.

### 8. Warranty

1. Client shall report any defects in the Consulting Service immediately in writing. If and to the extent that rectification is possible and can be conducted at reasonable expense, Roland Berger Strategy Consultants has the right to rectify defects for which it is responsible.

2. In the event of refusal, impossibility, or failure of, or unreasonable delay in, rectification, Client may request his choice of rescission of the Agreement or a reduction of compensation.

3. Client's warranty claims shall become time-barred within a period of six months following completion of the Consulting Services concerned.

4. Roland Berger Strategy Consultants shall be liable for consequential damage caused by a defect only pursuant to Section 9 below. This exclusion of liability shall not apply, however, if a specific service quality was guaranteed that related to the consequential damage caused by the defect that occurred, and if the damage that arose is based on the absence of this quality.

#### 9. Liability

1. Unless stipulated otherwise in the remaining provisions, Roland Berger Strategy Consultants shall be liable for claims to damages due to a violation of contractual or non-contractual obligations resulting from wilful acts or gross negligence of its legal representatives, its executive employees, or agents.

2. In cases of slight negligence, Roland Berger Strategy Consultants shall be held liable only if this constitutes a violation of key contractual obligations.

3. Any liability existing under this provision shall, in cases of wilful acts or gross negligence by agents, as well as in all cases of slight negligence, be limited in extent to the damage typically foreseeable for the agreement. Moreover, the liability for each individual case of damage shall be limited in amount to 50% of the total net fee volume, not to exceed EUR 250,000.

4. Contractual claims for damages on the part of the Client against Roland Berger Strategy Consultants shall become time-barred within a period of two years from their occurrence.

#### 10. Rights to results of work

1. Client shall use the results of Roland Berger Strategy Consultants' Services only for the contractually agreed purposes and shall not publish them without the express prior consent of Roland Berger Strategy Consultants. The publication shall always include mention of the Roland Berger Strategy Consultants name; any change to the original documents from Roland Berger Strategy Consultants shall require express prior written consent. Transmittal of the results of the Consulting Services to third parties shall likewise require the express prior written consent of Roland Berger Strategy Consultants.

2. To the extent that the results of Roland Berger Strategy Consultants' Services are copyrightable, Roland Berger Strategy Consultants shall be entitled to the copyright. In these cases, Client shall receive, in the context of Par. 1 above, the irrevocable, exclusive, and non-transferable right to these results, unlimited with respect to time.

#### 11. Force majeure

Force majeure or other unforeseeable events for which Roland Berger Strategy Consultants is not responsible and which cause Roland Berger Strategy Consultants substantial difficulties in performing, or which make it tempo-

rarily impossible to perform, the contracted Services, including strikes, lock-outs, and regulations issued by authorities, entitle Roland Berger Strategy Consultants to postpone the fulfillment of its Services by the duration of the hindrance plus an appropriate startup period. Roland Berger Strategy Consultants shall immediately inform Client of the occurrence of such hindrances to performance. If the delays arising from an event pursuant to Sentence 1 above extend beyond a period of six weeks, both contracting parties shall be entitled to withdraw from the Agreement with regard to the scope of Services affected. Claims for damages shall be precluded in such a case.

#### 12. Term and termination

1. The term of the Agreement and the schedule for the Roland Berger Strategy Consultants Services are detailed in the respective Individual Agreements.

2. Unless agreed otherwise, Consulting Agreements can generally be terminated by giving notice within a period of 2 weeks before the end of the month. The right to terminate without notice for cause shall not be affected. Notice shall be given in writing.

3. In the event of Client's premature termination pursuant to Par. 2 above of an agreement with a specified term, resulting from circumstances for which Roland Berger Strategy Consultants is not responsible, the following compensation provision shall apply:

The full compensation agreed shall be paid for Consulting Services performed prior to contract termination. Compensation for Services that will no longer be performed as a result of the termination shall be canceled if and to the extent that Roland Berger Strategy Consultants saved expenses and/or generated or maliciously neglected to generate income by using freed-up capacities elsewhere.

#### 13. Applicable law

1. The contractual relationship between Roland Berger Strategy Consultants and Client shall be subject exclusively to the laws of the Federal Republic of Germany.

2. If Client is a businessperson, a legal entity under public law, or a special fund under public law, the place of jurisdiction for all claims arising from the Agreement shall be Munich (Munich Regional Court I). The right of Roland Berger Strategy Consultants to bring an action against Client in his general place of jurisdiction shall not be affected.

#### 14. Final provisions

1. Any changes or amendments to the Agreement, including this requirement of written form, shall be made in writing.

2. Should individual provisions of the Agreement or these Terms and Conditions be or become invalid or should the Agreement contain loopholes, the validity of the remaining provisions shall not be affected thereby. Any invalid provision shall be replaced by a valid provision that corresponds to the meaning and intent of the invalid provision. Any loophole shall be covered by a provision that corresponds to the meaning and intent of the Agreement and that would reasonably have been agreed had the issue been considered from the beginning.