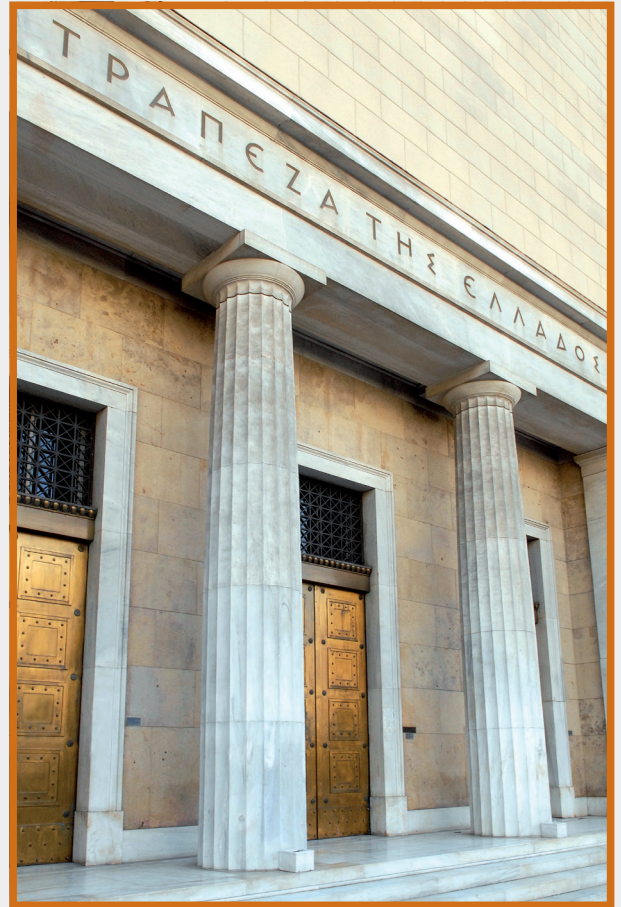


2013 STRESS TEST OF THE GREEK BANKING SECTOR



MARCH
2014



BANK OF GREECE
EUROSYSTEM

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CONTENTS

I. OVERVIEW	4	ANNEX I: CLPs ON A “DEFAULT BASIS”	28
1. Context and objectives	4	III. TREATMENT OF FOREIGN LOAN PORTFOLIOS.....	30
2. Macroeconomic assumptions ...	5	1. Context and scope	30
3. Diagnostic study on the loans portfolio	6	2. Methodology	30
4. Treatment of loan portfolios in foreign branches and subsidiaries.....	8	Overview	30
5. Capital needs assessment	8	BlackRock’s reasonability assessment	31
6. Concluding remarks.....	12	Estimation of CLPs	31
II. DIAGNOSTIC STUDY ON GREEK BANKS’ LOAN PORTFOLIO	13	3. Results	32
1. Context and scope	13	IV. CAPITAL NEEDS ASSESSMENT	34
2. Workstreams of the diagnostic study.....	14	1. Context and scope	34
3. Macroeconomic assumptions .	15	2. Guiding principles and approach	35
4. Methodology for the estimation of Credit Loss Projections	16	Guiding principles	35
Residential Mortgages Portfolio.....	17	Bottom-up approach.....	35
Consumer Portfolio	18	3. Methodology	35
Small Business and Professionals Portfolio.....	18	Overview	35
Corporate and Small & Medium Enterprises Portfolio.....	20	Component A: CLPs on banks’ loan portfolios	37
Commercial Real Estate Portfolio..	24	Component B: Bank’s internal capital generation.....	38
Shipping Portfolio	24	4. Results	41
State-related exposures.....	25	ANNEX II: ADVERSE SCENARIO RESULTS	44
5. Results	25	ANNEX III: ABBREVIATIONS AND ACRONYMS	45

I. OVERVIEW

1. CONTEXT AND OBJECTIVES

Over the past four years, the Bank of Greece, in close cooperation with the European Commission (EC), the European Central Bank (ECB) and the International Monetary Fund (IMF), set-out to create a viable, efficient and well-capitalised banking system, recognizing that it would play a fundamental role in steering the future course of the Greek economy. The banking sector ambitious reform agenda was successfully implemented.

In the course of 2012 and 2013, twelve distressed banks, including two major state-controlled banks (ATEbank and Hellenic Postbank), were resolved within an enhanced legal framework. Moreover, contagion from the Cypriot crisis in March 2013 was averted through the acquisition of the Cypriot banks' branches in Greece by Piraeus Bank.

In the second quarter of 2013, the four systemic banks, namely Alpha Bank, Eurobank, National Bank of Greece (NBG) and Piraeus Bank completed their recapitalisation on the basis of the 2012 capital needs assessment and along the recapitalisation framework prescribed in Law 3864/2010 and Cabinet Act 38/2012.¹ Private management was preserved in the three of the four systemic banks,² while Eurobank was fully recapitalised by the Hellenic Financial Stability Fund (HFSF). Furthermore, Attica bank, a non-systemic bank, also covered its capital needs through private funds.

¹ See Bank of Greece, "Report on the Recapitalisation and Restructuring of the Greek Banking Sector", December 2012.

² Private sector investors contributed €3.1 billion towards the recapitalisation of systemic banks.

During this process, systemic banks acted as consolidators,³ acquiring the good part of resolved banks as well as the subsidiaries of foreign banks that exited the market.⁴ As a result, the four systemic banks currently account for more than 90% of domestic banking sector assets and stand to benefit from synergies and the elimination of excess capacity.

Against this background, the Bank of Greece conducted "a follow-up stress test on the basis of end-June 2013 data to update banks' capital needs", as envisaged in the May 2013 Memorandum of Economic and Financial Policies.⁵ Within this process, the "Advisory Panel", an advisory body comprising representatives from the Bank of Greece, the European Banking Authority (EBA), EC, ECB and IMF, provided guidance.⁶ The Advisory Panel advised on the content and scope of the diagnostic study for the loan portfolio and the key components of the capital needs assessment. In carrying out its task, the Bank of Greece was supported by leading consulting and financial advisory firms, namely BlackRock Solutions and Rothschild.

The follow-up stress test covering all Greek commercial banks (i.e. more than 95% of the

³ Alpha Bank acquired Emporiki Bank and integrated the deposits of Dodecanese, Evia and Western Macedonia cooperative banks. Eurobank acquired New Proton Bank and New Hellenic Postbank. NBG integrated the good part of First Business Bank and Probank as well as the deposits of Achaia, Larnia and Lesbos-Lemnos cooperative banks. Piraeus Bank integrated the good part of ATEbank, the branches of Cypriot banks operating in Greece, and acquired Millennium Bank and Geniki Bank.

⁴ Foreign subsidiaries were recapitalised in accordance with the 2012 capital needs assessment prior to their sale.

⁵ In this report, by the term Memorandum we refer both to the Memorandum of Understanding on Specific Economic Policy Conditionality and the Memorandum of Economic and Financial Policies.

⁶ See July 2013 Memorandum.

Table I.1 Key macroeconomic assumptions

(in percentages)

Variable	Baseline Scenario				Adverse Scenario			
	2013	2014	2015	2016	2013	2014	2015	2016
Real GDP growth	-4.2	0.6	2.9	3.7	-4.8	-2.9	-0.3	1.0
Real disposable income growth	-6.8	-0.7	0.8	2.0	-7.4	-4.2	-2.4	-0.7
Unemployment rate	27.0	26.0	24.0	21.0	27.1	27.0	26.0	23.0
Inflation ¹	-0.8	-0.4	0.3	1.1	-1.1	-0.9	-0.4	0.4
Residential house prices	-12.5	-6.2	-2.0	0.0	-13.6	-12.1	-8.5	-4.2
Commercial real estate prices	-10.5	-6.7	-1.4	-0.7	-15.0	-11.8	-8.6	-4.8

Source: Bank of Greece.

¹ Harmonised Index of Consumer Prices (HICP).

total assets of Greek banks) comprises two main elements leading to an updated estimate of the banks' capital needs on a consolidated basis (see Chapter IV):

- a diagnostic study of the banks' loan portfolios, independently conducted by BlackRock (see Chapters II and III);
- a conservative adjustment of banks' internal capital generation on the basis of their Restructuring Plans (see Chapter IV).

2. MACROECONOMIC ASSUMPTIONS

The stress test was conducted on the basis of two scenarios⁷ regarding the evolution of key macroeconomic variables, which were provided by EC/ECB/IMF.

The Baseline Scenario reflects the projections included in the July 2013 Fourth Review under the IMF Extended Arrangement for Greece⁸ to ensure consistency with the Eco-

nomie Adjustment Programme's framework and objectives (see Table I.1).

The Adverse Scenario was developed by the Bank of Greece in consultation with the EC/ECB/IMF. By design, the Adverse Scenario, where economic recovery is delayed further and is weaker when it does finally arrive, is very conservative, reflecting the need for an adverse scenario to be severe but still plausible:

- The assumed cumulative decline in real Gross Domestic Product (GDP) of 26% for the 2008-2015 period would be among the highest for countries experiencing a crisis (the cumulative decline during the Great Depression in the United States amounted to some 29%).⁹
- The assumed decline in real GDP over the stress test horizon is so severe that the level of GDP in 2012, already five years into recession, is attained only in 2020.

⁷ For a detailed description of the Scenarios BlackRock Solution's report on "Asset Quality Review and Credit Loss Projection methodology".

⁸ International Monetary Fund, *Country Report No. 13/241 Fourth Review under the Extended Arrangement*, July 2013.

⁹ Reinhart C. and Rogoff K., "This time is different: Eight centuries of financial folly", Princeton University Press, Princeton and Oxford, 2009.

3. DIAGNOSTIC STUDY ON THE LOANS PORTFOLIO

In July 2013, the Bank of Greece commissioned the internationally reputed consulting firm BlackRock to carry out an independent diagnostic study on the loan portfolios of all Greek commercial banks. In doing so, the Bank of Greece fulfilled a requirement under the May 2013 Memorandum.

BlackRock adopted a prudent approach in the design of its methodology and the conduct of its study to ensure that its findings would be conservative.¹⁰ BlackRock had conducted a similar exercise in 2011. The 2013 exercise benefited from:

- an extended scope including additional workstreams for distressed loans and loans carrying foreign risk,
- a richer dataset taking into account five-year historical performance data coinciding with the deepest recession in Greece, and
- enhanced methodologies rendering the exercise more risk sensitive.

The diagnostic study included four main workstreams:

(i) *The Troubled Assets Review (TAR) workstream* assessing the operational readiness and effectiveness of systemic banks' established frameworks, policies, procedures and practices to deal with the large-scale resolution of troubled assets.¹¹

¹⁰ For a detailed description of the methodology see BlackRock Solution's report on "Asset Quality Review and Credit Loss Projection methodology" (March 2014).

¹¹ According to the May 2013 Memorandum the authorities commit "to step up measures to minimize the significant risks associated with the rapid deterioration of bank loan portfolios. The Bank of Greece will, in cooperation with the HFSF (and in accordance with their memorandum of understanding), and in consultation with the EC/ECB/IMF [inter alia] assess by end-September 2013, with the assistance of an independent third

For the purposes of the TAR, troubled assets were defined as (a) loans above 90 days in arrears or loans with a default rating, and (b) modified loans up to 90 days in arrears, including current modified loans.

The review focused on the following loan portfolios: Residential Mortgages, Small Business and Professional (SBP), Small and Medium Enterprises (SME), and Consumer. It comprised a portfolio data review, qualitative management due diligence, documentation review, sample-based loan-file reviews and on-site visits. The review was very granular and provided an in-depth understanding of bank practices.

(ii) *The Asset Quality Review (AQR) workstream* examining the adequacy and appropriateness of banks' lending procedures, as well as the quality of the loan portfolio. This assessment was conducted on the basis of interviews with banks' officials and loan file reviews on samples of loans across all asset classes.

The meetings with banks' officials were arranged to obtain an understanding of individual banks' business strategies, loan portfolio structures and risk-taking policies. Interviews covered the entire spectrum of lending procedures, i.e. from the early stages of loan approval to the management of non-performing loans (NPLs).

The review of the loan files within each loan sample was conducted for two purposes: (a) to assess whether loans were originated in accordance with the bank's lending policy and procedures and (b) to assess whether the loan, beyond its adherence to the bank's crite-

party, the effectiveness of established frameworks and policies to deal with troubled assets".

ria, would have been considered acceptable by a “prudent lender”. The loan samples intentionally contained a large number of high-risk loans.

Furthermore, for a sample of large corporate borrowers, representing 47% of the total large corporate borrowers’ balances, BlackRock conducted an in depth review on the basis of the physical loan files. That is, BlackRock evaluated business fundamentals, projected financial performance and analysed the indebtedness as well as the collateral value of each borrower in the sample. As a result, BlackRock estimated bespoke Credit Loss Projections (CLPs), both for the Baseline and the Adverse Scenario.

Moreover, BlackRock commissioned international real estate valuation experts to conduct sample-based valuations of properties collateralising residential and commercial loan exposures.

(iii) *The Credit Loss Projections (CLPs) workstream* estimating forward-looking CLPs on banks’ loan portfolios as of 30 June 2013 over a three-and-a-half-years’ horizon (June 2013 – December 2016) and over the lifetime of the loans for both the Baseline and the Adverse Scenario.

Following an in-depth analysis of loan portfolios and consultations with bank officials, BlackRock identified the following individual portfolios:

- Residential Mortgages;
- Consumer;
- Small Business and Professionals (SBP);
- Corporate and Small & Medium Enterprises (SME);
- Commercial Real Estate (CRE);

- Shipping;
- State-related exposures.

For each loan portfolio, BlackRock developed specific methodologies and tailor-made econometric models on the basis of loan-level exposure, borrower, collateral and ratings data. Moreover, BlackRock's methodology incorporated the impact of macroeconomic variables such as the evolution of real GDP, unemployment and residential and commercial real estate prices. The latter also impacted the value of the available collateral to cover expected losses.

To this end, BlackRock implemented a transition matrix approach utilising five-year historical data. The benefits of using a transition model include the transparency into the performance of various buckets (e.g. performing, non-performing, defaulted, prepaid) and the ability to better account for the macroeconomic and portfolio-specific variables driving such performance. The historical data used to construct the transition matrix statistical models cover a period of a severe recession and a deterioration of housing prices thus embedding conservatism into the model.

Furthermore, BlackRock incorporated the findings of the preceding TAR and AQR workstreams to inform model assumptions, such as liquidation timeline, liquidation expenses, collateral haircuts, the treatment of modified loans and collateral valuations. In addition, the AQR process ensured that the model generated CLPs were reasonable and in-line with observed practices at the individual banks and at a system-wide level.

CLPs were defined as the non-discounted loss of principal due to the (total or partial) non-repayment of loans, taking into account any amounts recovered from the sale of any relat-

ed collateral. Hence, CLPs were calculated on a “when-realised basis” (i.e. at the time of collateral liquidation) without deducting banks’ loan loss reserves. In addition, BlackRock provided on a semi-annual basis the estimated evolution of Non-Performing Loans (NPLs), defaulted exposures and CLPs calculated on a “default basis” (i.e. at the time of default).

(iv) *The Foreign Loan Book (FLB) Review workstream*, providing an independent reasonability assessment on credit risk parameters and a review of collateral valuations, risk classification, credit policies and distressed operations for the seven largest foreign subsidiaries of the Greek banks in South-East Europe (SEE) and Turkey. These subsidiaries account for 70% of the total foreign loan book. In conjunction with the domestic loan book BlackRock reviewed 94% of the Greek banks’ loan balances on a consolidated basis.

BlackRock’s assessment largely relied on quantitative and qualitative analysis of specific loan-level and portfolio-level data, along with due diligence analysis and on-site meetings with each bank’s management. Specifically, BlackRock assessed the reasonability of the one-year Probability of Default (PD) and Loss Given Default (LGD) internal bank estimates for each of the seven entities and for each asset class with June 2013 as a reference date. As a result, BlackRock graded the aforementioned credit risk parameters in six categories and provided adjustment ranges for each of these categories.¹²

¹² Conservative, Reasonable, Optimistic, Very Optimistic, Extremely Optimistic, Not Reliable.

4. TREATMENT OF LOAN PORTFOLIOS IN FOREIGN BRANCHES AND SUBSIDIARIES

The Bank of Greece aimed at ensuring that the CLPs estimation would encompass the entire loan book of Greek banking groups (i.e. both in Greece and abroad).

To this end, BlackRock collected loan-level data for all foreign branches and subsidiaries of Greek banks and classified them into two categories:

- Loans carrying Greek risk defined as loans (i) issued to a Greek borrower; or (ii) primarily secured by collateral located in Greece;
- Loans carrying foreign risk defined as all other loans.

Loans carrying Greek risk in foreign branches and subsidiaries were included in the perimeter of BlackRock’s diagnostic study. Hence, Greek risk in foreign branches and subsidiaries was treated by BlackRock per portfolio in a similar way as exposures within Greece.

For foreign loan portfolios, CLPs were estimated by the Bank of Greece using a top-down methodology in accordance with the Expected Loss (EL) methodology developed by the EBA in the context of the June 2011 EU-wide stress test. The approach was based on bank-submitted starting levels of credit risk parameters, appropriately challenged by BlackRock (in the context of the FLB review as described above) and the Bank of Greece. The methodology was complemented by loss rate increments provided by the ECB for the time-horizon of the exercise.

5. CAPITAL NEEDS ASSESSMENT

The capital needs assessment was conducted in the second half of 2013 by the Bank of

Greece, with the technical support of Rothschild. The objective of this exercise was to conservatively estimate the capital needs of all Greek commercial banks on a consolidated basis in order to ensure minimum Core Tier 1 capital levels¹³ over the June 2013 – December 2016 period (see Chapter IV), namely:

- Core Tier 1 target ratio of 8% for the Baseline Scenario;
- Core Tier 1 target ratio of 5.5% for the Adverse Scenario.

These capital thresholds have been aligned with those of the upcoming Comprehensive Assessment and of the 2014 EU-wide stress test to be conducted by the ECB and EBA respectively. In general, the Bank of Greece methodology was aligned to the extent possible to the envisaged approach of these exercises on the basis of publicly available information as of February 2014. In relation to deferred tax assets (DTA), the approach has been more conservative and in-line with the 2011 exercise (i.e. cap of existing DTA at 20% of total CT1 and no new DTA recognised during the stress test period).

The Baseline Scenario was used to determine the capital needs of each bank in alignment with the EBA 2014 EU-wide stress test. The Adverse Scenario will be taken into account in future plans regarding the appropriate capital buffers.

The Bank of Greece developed a proprietary bottom-up approach to estimate capital needs. This approach was based on the Restructuring Plans submitted by the banks for the June

2013 – December 2016 period, which incorporated the banks' commitments to Directorate General Competition (DG Comp). In this context, the Restructuring Plans have been developed under the assumption of a dynamic balance sheet (i.e. allowing the evolution of the composition and size of the balance sheet).¹⁴

As a starting point, the reference Core Tier 1 capital as at June 2013, as defined for the purposes of the exercise,¹⁵ was used. Then, the Bank of Greece adjusted conservatively the information obtained from the banks' Restructuring Plans to form the two key components of the capital needs assessment (as presented in Chart IV.1):

- Component A: Credit Loss Projections (CLPs) on banks' loan portfolios over the June 2013 – December 2016 period, carrying (i) Greek risk, and (ii) foreign-risk, net of existing loan loss reserves; and
- Component B: banks' internal capital generation over the June 2013 – December 2016 period on the basis of conservative adjustments.

Regarding Component A, the Bank of Greece aggregated CLPs at group level both in the Baseline and the Adverse Scenario taking into account:

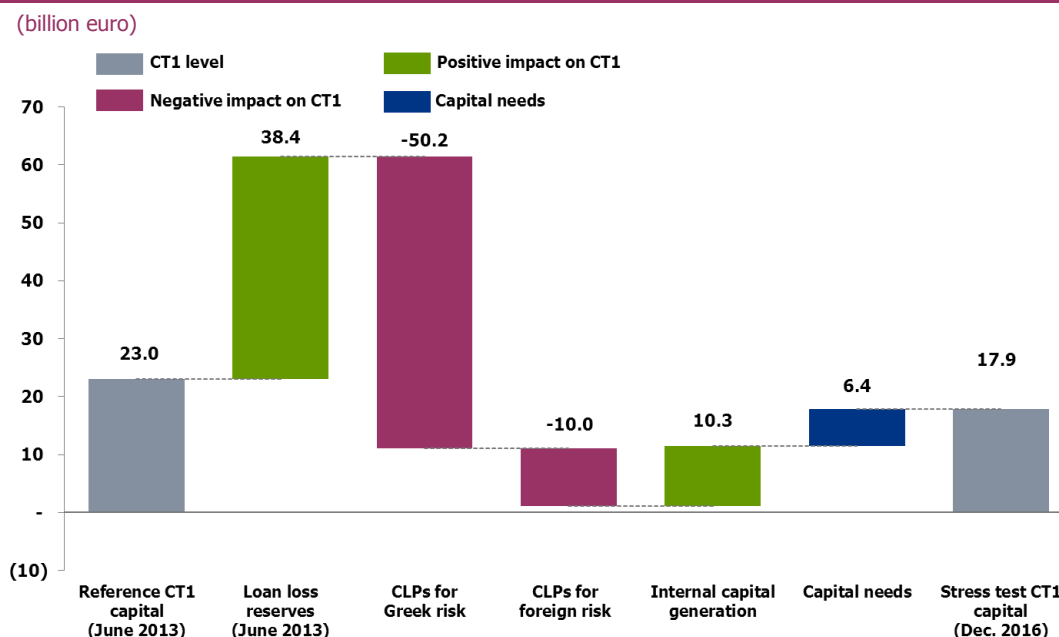
- the CLPs from loans carrying Greek risk, as estimated by BlackRock on a “when realised basis” for the three-and-a-half-year period June 2013–December 2016 (see Chapter II);

¹³ There are no substantial differences between the Core Tier 1 and the Common Equity Tier 1 Capital for the Greek banks. These differences are more than compensated by the amount of existing DTA not recognized in the reference Core Tier 1 (in excess of €2.5bn).

¹⁴ This approach is consistent with the treatment of the restructuring plans in the context of the EBA 2014 EU-wide stress test.

¹⁵ Reference Core Tier 1 is calculated after imposing a cap on net Deferred Tax Assets (DTA) at 20% of total Core Tier 1.

**Chart I.1 Process for calculating capital needs in the Baseline Scenario
(June 2013 – December 2016; consolidated basis)**



- the three-and-a-half-year CLPs from loans carrying foreign risk, as estimated by the Bank of Greece (as presented in Chapter III)¹⁶ taking into account mitigating actions (disposal commitments to DG Comp);
- the Expected Loss from new loan production in Greece over the June 2013 – December 2016 period.

Then the Bank of Greece compared the aforementioned CLPs with the amount of provisions forecasted by the banks in respect of:

- the existing loans carrying Greek risk as at 30 June 2013;
- the loans carrying foreign risk; and
- the new loans production.

Any deficit vs. the required CLPs created a capital need on a one for one basis. If the

banks had forecasted provisions in excess of the required CLPs, no adjustments to their provisions were performed.

Moreover, adopting a conservative stance, the Bank of Greece required banks to have sufficient provisions as at the end of 2016 to cover:

- at least 95% of lifetime losses as estimated by BlackRock under the Baseline scenario and 85% in the Adverse scenario; and
- at least 52%¹⁷ of the NPLs as estimated by BlackRock as at the end of 2016 in the Baseline Scenario only.

The Bank of Greece methodology to incorporate the three-and-a-half-year CLPs on a “when realised basis”, in combination with the aforementioned requirements, results in a conservative approach since lifetime ex-

¹⁶ The impact of foreign risk CLPs was calculated after foreign tax.

¹⁷ This corresponds to the 75th percentile among European banks according to the EBA Risk Dashboard Q4 2013 (<http://www.eba.europa.eu/risk-analysis-and-data/risk-dashboard>).

**Table I.2 Summary of capital needs calculation in the Baseline Scenario
(June 2013 – December 2016; consolidated basis)**

(million euro)

Banks ¹	Reference Core Tier 1 capital (June 2013) (A)	Loan loss reserves (June 2013) (B)	CLPs for Greek risk ² (C)	CLPs for foreign risk (D)	Internal capital generation ³ (E)	Stress Test Core Tier 1 capital (Dec. 2016) (F)	Capital needs (G) = (F) - (A) - (B) - (C) - (D) - (E)
Alpha	7,380	10,416	-14,720	-2,936	4,047	4,450	262
Eurobank ⁴	2,228	7,000	-9,519	-1,628	2,106	3,133	2,945
NBG ⁵	4,821	8,134	-8,745	-3,100	1,451	4,743	2,183
Piraeus	8,294	12,362	-16,132	-2,342	2,658	5,265	425
Attica	225	403	-888	0	106	243	397
Panellinia	61	66	-237	0	-26	31	169
Total	23,009	38,380	-50,241	-10,005	10,341	17,866	6,382

Source: Bank of Greece.

¹ The exercise concluded that for ABB, Credicom and IBG no additional capital was needed.

² CLPs for Greek risk are calculated on the basis of the methodology described in page 10.

³ Internal capital generation based on banks' Restructuring Plans for June 2013 – December 2016, as conservatively stressed according to the Bank of Greece methodology (see Chapter IV).

⁴ Eurobank Loan loss reserves as of June 2013 pro-forma of the provisions of New Hellenic Postbank and New Proton Bank (c. €1.7bn) that were acquired in August 2013.

⁵ NBG Loan loss reserves as of June 2013 pro-forma of the provisions of FBB and Probank.

pected loan losses are frontloaded: the effective coverage of lifetime CLPs at the end of the stress test period (December 2016) stands in excess of 100% in the Baseline Scenario and at 91% in the Adverse Scenario for the Greek risk.

Moreover, the banks' credit and provisioning policies have benefited from the 2011 diagnostic study. In the course of the last couple of years banks have improved materially their credit monitoring practices and have increased significantly their loan loss provisions and reserves. This is reflected in the improvement of the coverage ratio (i.e. the ratio of accumulated provisions for credit risk over non-performing loans)¹⁸ and in the fact that the loan loss reserves of Greek banks on a solo basis as of June 2013 already cover 67% of lifetime losses in the Baseline Scenario.

¹⁸ The coverage ratio stood at 48.3% in June 2013 compared with 46.2% in June 2011.

Regarding Component B, the key drivers of pre-provision profitability that have been conservatively adjusted are the following:

- Loan and deposit growth and pricing, which were aligned with macroeconomic assumptions and market conditions.
- Interest income from non-performing loans (NPLs), which was reduced to zero and replaced by income on the proportion of NPLs that the bank would recover over time deriving the relevant information from BlackRock's analysis. Moreover, the level of NPLs was also adjusted upwards according to BlackRock forecasts.
- Fee and commission income by imposing a cap on its cumulative growth.
- Cost of funding by assuming material increase in the cost of Eurosystem and Emergency Liquidity Assistance (ELA)

funding in the Baseline Scenario only,¹⁹ as well as potential adjustment of the funding mix depending on collateral availability.

- Revenues from international subsidiaries taking into account findings related to the FLB review, prudential and market information, as well as an assessment of the impact of mitigating actions.

In addition, the Bank of Greece, abiding by the principle of conservatism, assessed and appropriately adjusted the starting level of Risk Weighted Assets (RWA) and imposed certain floors on their evolution to ensure that banks Restructuring Plans do not underestimate their risk exposure. Moreover, the net accounting Deferred Tax Assets (DTA) was capped at 20% of Core Tier 1 capital. Lastly, the Bank of Greece took into account potential capital needs stemming from a recent stress test of banks' insurance subsidiaries.

The Bank of Greece also took into account the full year 2013 financial results of Greek banks.

On the basis of the above, the Bank of Greece estimated the target amount of Core Tier 1 capital for each bank at the end of each calendar year until 2016 based on the target Core Tier 1 ratio set for each scenario and the respective adjusted Risk Weighted Assets (RWAs).

The Baseline Scenario was used to determine the capital needs of each bank in alignment with the EBA 2014 EU-wide stress test. The

Adverse Scenario will be taken into account in future plans regarding the appropriate capital buffers.

The resulting capital needs for all Greek commercial banks were estimated under the Baseline Scenario at € 6.4 billion (see Chart I.1 and Table I.2).

The methodology and the results of the capital needs assessment were communicated to banks in individual meetings conducted from December 2013 onwards.

The Bank of Greece officially requested banks to submit their capital plans by mid-April 2014 to cover the identified capital needs in the Baseline Scenario.

6. CONCLUDING REMARKS

The Bank of Greece considers that, under reasonable levels of economic uncertainty, these capital needs should be covered for the stress-test horizon (June 2013 – December 2016) by existing built-in buffers and mitigating actions (e.g. private sector participation in future capital increases, Deferred Tax Assets allowance, potential asset sales, additional burden sharing initiatives etc.), as well as the untapped part of the HFSF's backstop facility

¹⁹ The cost of funding is among the risk areas to be subjected to stress in the context of the EBA 2014 EU-wide stress test. These stress factors should not be interpreted as a forecast for the evolution of benchmark interest rates. Sovereign risk, another area to be covered by the EBA 2014 EU-wide stress test, has not been stressed in the context of the capital needs assessment.

II. DIAGNOSTIC STUDY ON GREEK BANKS' LOAN PORTFOLIO

The Bank of Greece commissioned BlackRock Solutions to assess the quality of Greek commercial banks' recession-hit lending portfolios. Specifically, BlackRock independently estimated Credit Loss Projections (CLPs) for loan portfolios carrying Greek risk and conducted a reasonability assessment of the credit risk parameters of portfolios carrying foreign risk.

BlackRock's methodology for Greek risk was based on proprietary econometric models tailored for Greece and applied on loan-level data. Qualitative analysis complemented the assessment. In order to ensure that its findings would be sufficiently conservative, BlackRock adopted a granular and prudent approach in designing its methodology and estimating the key inputs for the calculation of capital needs of the Greek banking sector.

The methodology of BlackRock is described in detail in its report "Asset Quality Review and Credit Loss Projection methodology", while this chapter provides an overview.

BlackRock estimated CLPs over a three-and-a-half-year and a loan-lifetime horizon based on two macroeconomic scenarios, a Baseline and an Adverse Scenario, which were provided by the Advisory Panel.

1. CONTEXT AND SCOPE

In July 2013, the Bank of Greece, in consultation with EC/ECB/IMF, commissioned the internationally reputed consulting firm BlackRock to carry out a diagnostic study on the loan portfolios of Greek banks, on the basis of data as of 30 June 2013. In doing so, the Bank of Greece fulfilled a requirement under

the May 2013 Memorandum. BlackRock had also conducted a similar exercise in 2011.²⁰

BlackRock was called upon to make an independent assessment of CLPs on banks' loan portfolios both over a three-and-a-half-year and a loan-lifetime horizon on the basis of two Scenarios: a Baseline and an Adverse one. BlackRock conducted one-to-one meetings with bank officials, analysed raw data from banks and developed its own econometric models in order to estimate CLPs. In carrying out its task, BlackRock was supported by international audit firms, asset valuation experts and other firms. The Bank of Greece did not interfere in the conduct of the exercise and its participation was confined to the formulation of macroeconomic assumptions and the close monitoring of the exercise. BlackRock adopted a prudent approach in the design of its methodology and the conduct of its study to ensure that its findings would be sufficiently conservative.

The diagnostic study covered the loan portfolios of all commercial banks established in Greece. These banks were divided into two groups based on their size. Group A included the four systemic banks (Alpha Bank, Eurobank, National Bank of Greece (NBG) and Piraeus Bank).²¹ Group B included the remaining four commercial banks (Aegean Baltic Bank, Attica Bank, Credicom Consumer Finance, and Panellinia Bank).

²⁰ See Bank of Greece, "Report on the Recapitalisation and Restructuring of the Greek Banking Sector", December 2012.

²¹ Domestic banking subsidiaries of Group A Banks have been examined in conjunction with parent banks. New Proton Bank, New Hellenic Postbank and Probank, which were acquired by Group A Banks after June 2013, were treated as Group B Banks.

The diagnostic study covered all loans carrying Greek risk, as the quality of such portfolios was closely related to developments in domestic macroeconomic aggregates. Greek risk was defined as loans (i) issued to a Greek borrower; or (ii) primarily secured by collateral located in Greece. To this end, the diagnostic study covered loan exposures as of June 2013 across all Group A and Group B Banks that were held in the (i) Solo accounts, which include loans in Greek domestic branches as well as foreign branches; (ii) Greek domestic subsidiaries including leasing, factoring and financial companies; and (iii) foreign subsidiaries. By design, all shipping loans remained within the scope of the exercise.

In this context, BlackRock collected loan-level information on all loans and other credit exposures of banks. Subsequently, BlackRock isolated loans with Greek risk in foreign branches and subsidiaries in order to exclude

exposures outside the scope of the diagnostic study. The total amount of exposures included in the diagnostic study was €215.5 billion, of which approximately 97.8% was accounted for by Group A Banks (see Table II.1).

2. WORKSTREAMS OF THE DIAGNOSTIC STUDY

The diagnostic study included four main workstreams:

(i) *The Troubled Assets Review (TAR) workstream* assessing the operational preparedness and effectiveness of the four Group A Banks' established frameworks, policies, procedures and practices to deal with the large-scale resolution of troubled assets.

For the purposes of the TAR, troubled assets were defined as (i) loans above 90 days in arrears or loans with a default rating depending on the asset class, and (ii) modified loans up to 90 days in arrears, including current modified loans.

The review focused on the following asset classes: Residential Mortgages, Small Business and Professional (SBP), Small and Medium Enterprises (SME), and Consumer. It comprised a portfolio data review, qualitative management due diligence, documentation review, sample-based loan-file reviews and on-site visits. The assessment covered the following sections for each asset class per bank: (i) Organisation, Resource Capacity and Staffing, (ii) Credit Policies and Guidelines, (iii) Resolution Strategies and Execution Ability, and (iv) Reporting and Quality Assurance.

In the context of TAR, BlackRock conducted 72 due diligence meetings and on-site visits. BlackRock also reviewed 520 loan file and 550 bank internal documents.

Table II.1 Categories of exposures included in the diagnostic study

Outstanding amounts (million euro; June 2013)

Balance sheet exposures on a solo basis	212,447
Domestic branches	206,012
Foreign branches	6,435
Greek risk	1,168
Non-Greek risk	5,267
Leasing, factoring and credit finance subsidiaries	6,998
Foreign subsidiaries	49,443
Greek risk	1,338
Non-Greek risk	48,105
Excluded exposures¹	-53,372
Non-Greek risk in foreign branches	-5,267
Non-Greek risk in foreign subsidiaries	-48,105
Total exposures in scope	215,516
Total exposures analysed²	216,158

Source: BlackRock Solutions.

1. Excluded exposures were included in the treatment of foreign loan portfolios.

2. BlackRock incorporated in the analysis the residual exposures that could not be allocated to the preceding loan categories.

(ii) *The Asset Quality Review workstream* examining the adequacy and appropriateness of banks' lending procedures and the quality of the loan portfolio. This assessment was based on interviews with bank officials, as well as on loan file reviews on a sample of loans across all asset classes.

The meetings with bank officials were arranged to obtain an understanding of individual banks' business strategies, loan portfolio structures and risk-taking policies. Interviews covered the entire spectrum of lending procedures, i.e. from the early stages of loan approval to the management of non-performing loans (NPLs).

The review of the loan files within each loan sample was conducted for two purposes: a) to assess whether loans were originated in accordance with the bank's lending policy and procedures and b) to assess whether the loan, beyond its adherence to the bank's criteria, would have been considered acceptable by a "prudent lender". The loan samples were not designed to be representative of the respective loan portfolio, but they intentionally contained a large number of high-risk loans.

Furthermore, for a sample of large corporate borrowers, representing 47% of the total large corporate borrowers' balances, BlackRock conducted a full re-underwriting of the loans on the basis of the physical loan files. That is, BlackRock evaluated business fundamentals, projected financial performance and analysed the indebtedness as well as the collateral value of each borrower in the sample. As a result, it assigned a credit rating to each of these borrowers on the basis of their creditworthiness and estimated a bespoke CLP, both for the Baseline and the Adverse Scenario.

Moreover, BlackRock commissioned international real estate valuation experts to conduct sample-based valuations of properties collateralising residential and commercial loan exposures.

(iii) *The CLPs workstream* estimating forward-looking CLPs on banks' loan portfolios over a three-and-a-half-year horizon (June 2013 – December 2016) and over the lifetime of the loans both for the Baseline and the Adverse Scenario. BlackRock developed tailor-made econometric models for each loan portfolio based on loan-level exposure, borrower, collateral and ratings data, including five-year historical performance data. In this process, the findings of the two preceding workstreams were also taken into account.

(iv) *The Foreign Loan Book (FLB) Review workstream*, providing an independent reasonability assessment on credit risk parameters and a review of collateral valuations, risk classification, credit policies and distressed operations for the seven largest foreign subsidiaries of the Greek banks in South-East Europe (SEE) and Turkey. The FLB and the treatment of foreign risk portfolios is further analysed in Chapter III.

3. MACROECONOMIC ASSUMPTIONS

The stress test was conducted on the basis of two scenarios regarding the evolution of key macroeconomic variables, which were provided by the EC/ECB/IMF in October 2013.

The Baseline Scenario reflects for the near future the projections included in the July 2013 Fourth Review under the IMF Extended Arrangement for Greece²² to ensure con-

²² International Monetary Fund, *Country Report No. 13/241 Fourth Review under the Extended Arrangement*, July 2013.

Table II.2 Key macroeconomic assumptions

(in percentages)

Variable	Baseline Scenario				Adverse Scenario			
	2013	2014	2015	2016	2013	2014	2015	2016
Real GDP growth	-4.2	0.6	2.9	3.7	-4.8	-2.9	-0.3	1.0
Real disposable income growth	-6.8	-0.7	0.8	2.0	-7.4	-4.2	-2.4	-0.7
Unemployment rate	27.0	26.0	24.0	21.0	27.1	27.0	26.0	23.0
Inflation ¹	-0.8	-0.4	0.3	1.1	-1.1	-0.9	-0.4	0.4
Residential house prices	-12.5	-6.2	-2.0	0.0	-13.6	-12.1	-8.5	-4.2
Commercial real estate prices	-10.5	-6.7	-1.4	-0.7	-15.0	-11.8	-8.6	-4.8

Source: Bank of Greece.

¹ Harmonised Index of Consumer Prices (HICP).

sistency with the Economic Adjustment Programme's framework and objectives (see Table II.2). For the remaining years (extending until 2050) a plausible real GDP path was assumed, with the path for the remaining macroeconomic variables reflecting the evolution of real GDP.

The Adverse Scenario was developed by the Bank of Greece in consultation with the EC/ECB/IMF. By design, the Adverse Scenario, where economic recovery is delayed further and is weaker when it does finally arrive, is very conservative, reflecting the need for an adverse scenario to be severe but still plausible:

- The assumed cumulative decline in real Gross Domestic Product (GDP) of 26% for the 2008-2015 period would be among the highest for countries experiencing a crisis (the cumulative decline during the Great Depression in the United States amounted to some 29%).²³
- The assumed decline in real GDP over the stress test horizon is so severe that the

level of GDP in 2012, already five years into recession, is attained only in 2020.

4. METHODOLOGY FOR THE ESTIMATION OF CREDIT LOSS PROJECTIONS

BlackRock estimated CLPs for the loan portfolios on the basis of amounts outstanding on 30 June 2013. CLPs were defined as the non-discounted loss of principal due to the (total or partial) non-repayment of loans, taking into account any amounts recovered from the sale of any relevant collateral. CLPs were calculated for a three-and-a-half-year (June 2013 - December 2016) and a lifetime horizon, under both the Baseline and the Adverse Scenario. CLPs were calculated on a "when-realised basis" (i.e. at the time of collateral liquidation) and do not take into account banks' loan loss reserves.

Following an in-depth analysis of loan portfolios and consultations with bank officials, BlackRock identified the following individual portfolios:

- Residential Mortgages;
- Consumer;
- Small Business and Professionals (SBP);

²³ Reinhart C. and Rogoff K., "This time is different: Eight centuries of financial folly", Princeton University Press, Princeton and Oxford, 2009.

- Corporate and Small & Medium Enterprises (SME);
- Commercial Real Estate (CRE);
- Shipping;
- State-related exposures.

For each loan portfolio, BlackRock developed specific methodologies, described in detail below, and tailor-made econometric models on the basis of loan-level exposure, borrower, collateral and ratings data.

BlackRock incorporated the findings of the TAR and AQR workstreams to inform model assumptions, such as liquidation timeline, liquidation expenses, collateral haircuts, the treatment of modified loans and collateral valuations. In addition, the AQR process ensured that the model generated CLPs were reasonable and in-line with observed practices at the individual banks and at a system-wide level.

BlackRock received granular loan-level information both from Group A and Group B banks. Nonetheless, BlackRock developed its econometric models per portfolio on the basis of Group A bank data and five-year historical performance and then applied the resulting models to estimate CLPs also for Group B banks. Moreover, Greek risk in foreign branches and subsidiaries was treated per portfolio in a similar way as exposures within Greece.

Residential Mortgages Portfolio

The Residential Mortgages Portfolio stood at €69.9 billion, of which €1.6 billion were government-guaranteed and therefore state-related.

BlackRock's methodology was based on econometric models incorporating the behav-

ioural features of borrowers (including five-year historical performance data) and the impact of macroeconomic variables (such as the evolution of GDP, unemployment and residential real estate prices). The models were designed to project future cash flows and expected loss of principal through the modelling of transition matrices. The pace of loan repayment, projected NPL flows and the value of collateral were taken into account. Modified loans (i.e. loans rescheduled or restructured) were explicitly modelled on the basis of their five year historical performance. The most important explanatory factors of the econometric model were the Loan-To-Value ratio (LTV ratio²⁴) and the loan interest rate.

In order to ensure that property valuation was sufficiently conservative, BlackRock used input from experts, who appraised the current market value of a sample of residential properties after conducting on-site visits (so-called “drive-bys”). BlackRock then compared this appraised value with the value of the property reported by banks adjusted for residential price developments in the first half of 2013. The comparison resulted in a 13-14% downward adjustment of the real estate collateral value available to cover losses from defaulted loans.

To determine losses on NPLs, the following approach was adopted:

- the value of the real estate used as collateral at the time of liquidation was calculated using the assumptions regarding the evolution of the Property Price Index;
- a substantial discount of 35% (gradually decreasing over a five year period to

²⁴ A higher LTV ratio leads to a higher level of NPLs. The LTV is defined as the ratio of the value of the loan divided by the value of the mortgage collateral.

20%) was applied to the value of the property under both scenarios, taking into account the unfavourable conditions prevailing upon collateral liquidation, i.e. forced sale;

- the costs related to the process of collateral sale (e.g. legal costs, maintenance costs, transaction costs) were assessed and set at 11% of the property value;
- an average period of four years would elapse from the termination of a loan contract until the full liquidation of its collateral (i.e. auctioning of the property), based on historical experience and collection practices of Greek banks.

BlackRock assumed a ramp-up process for the pace of liquidations under the working assumption that the Auctions Moratorium would be lifted as of 1 January 2014.

Following the submissions of the BlackRock report, the Greek Parliament approved a partial extension of the moratorium. In order to assess the potential impact, the Bank of Greece asked BlackRock to perform a sensitivity analysis for projected lifetime losses.²⁵

Consumer Portfolio

The Consumer Portfolio amounted to €25.6 billion and was divided into three sub-portfolios: Other Consumer Loans (€15.4 billion), Revolving Loans (€8.9 billion) and Auto Loans (€1.3 billion).

BlackRock based its methodology on transition matrix models (for the sub-portfolios) in

order to forecast future cash flows and the expected loss of principal. The models incorporated borrower characteristics, loan characteristics, current and five-year historical performance (e.g. delinquency data and payment history) as well as collateral information.

Regarding the probability of default, the most important explanatory factor turned out to be the loan interest rate, followed by the loan age, the change in the unemployment rate and the availability of mortgage collateral (i.e. mortgage-backed consumer loans).

Modified Other Consumer Loans were separately modelled. The most important explanatory factors for them were the loan age and the loan interest rate.

Regarding the loss given default, BlackRock informed its assumptions by the AQR and TAR due diligence process, as well as historical recovery data submitted by Greek banks. In the Baseline Scenario recovery rates were assumed at 20% for Revolving and unsecured Other Consumer Loans, 25% for mortgage-backed consumer loans and 45% for Auto Loans. In the Adverse Scenario recovery rates were reduced by 10 percentage points for all sub-portfolios.

Moreover, BlackRock assumed a two-and-a-half-year liquidation period for Revolving Loans and Auto Loans, and a three-and-a-half-year period for Other Consumer Loans.

Small Business and Professionals Portfolio

The Small Business and Professionals (SBP) Portfolio amounted to €20.5 billion. For the purpose of the diagnostic study, this Portfolio was defined to include enterprises with an annual turnover of less than €2 million.

BlackRock based the statistical estimation of CLPs at loan level on the following formula:

²⁵ Indeed, BlackRock performed a sensitivity analysis for projected lifetime losses under the Baseline and Adverse Scenario for the Residential Mortgage asset class. The sensitivity analysis varied certain model inputs such as cure rates, forced sale discounts and liquidation expenses and also incorporated a scenario where the foreclosure moratorium was assumed to be extended until 31 December 2014.

$$\text{Expected Loss (EL)} = \text{EAD} \times \text{PD} \times \text{LGD}$$

Exposure at Default (EAD) was calculated as the sum of the on-balance sheet exposure at the time of default and a percentage of the off-balance sheet exposures (e.g. Letters of Guarantee, undrawn credit limits). EAD calculations were based either on the contractual amortisation profile of the loan or on BlackRock assumptions for revolving facilities.

The Probability of Default (PD) was the likelihood that a given loan exposure would roll into a state of default. The estimation of PD was based on transition matrix models. The models incorporated borrower characteristics, loan characteristics, current and five-year historical performance (e.g. delinquency data and payment history) as well as collateral information. BlackRock adopted a quarterly transition matrix model approach, where loan status was classified into five performance buckets: current, prepaid, delinquent, defaulted and liquidated. The PD model projected the likelihood of moving between these states and was based on a cross-sectional regression analysis that derived model coefficients for those macroeconomic, borrower-specific and loan-specific attributes with the greatest predictive power. The most important explanatory factor turned out to be the payment type (i.e. interest only or amortising), followed by the loan age, the change in the unemployment rate and, lastly, whether the borrower was a natural or legal person.

Modified loans were separately modelled. For modified loans the most important explanatory factors were the loan age and the existence of a guarantor, both exhibiting a positive correlation.

The Loss Given Default (LGD) was calculated as the difference between the EAD and the recovery proceeds at the projected time of recovery through either a borrower settlement or collateral liquidation. For unsecured loans, the recovery rate was set at 10% (gradually increasing to 15% over a five-year period) under the Baseline Scenario and at 5% (gradually reaching 10%) under the Adverse Scenario.

For secured loans, BlackRock adjusted the value of the collateral and applied liquidation haircuts according to the collateral type. Specifically, for residential real estate collateral BlackRock applied the same approach as for the Residential Mortgages portfolio. For the commercial real estate collateral, BlackRock commissioned real estate valuation experts to conduct desktop valuations on a sample of properties (406 in total out of which 80 related to SBP loans) and compare them with bank-provided valuations. Based on this analysis, BlackRock:

- Updated commercial real estate properties valuations using a SBP-tailored historical commercial real estate property index.
- Applied an additional downward adjustment of 7% and 10% (in the Baseline and Adverse Scenario respectively) based on comparisons between desktop valuations and indexed-implied valuations.
- Applied a 32% liquidation haircut in first lien commercial real estate.

A more conservative approach was adopted for second lien residential and commercial real estate collateral through the application of a 90% (95%) liquidation haircut in the Baseline (and Adverse) Scenarios respectively.

Liquidation haircuts were also applied in other collateral types (Adverse Scenario in parenthesis):

- 2% (5%) for cash and deposits;
- 10% (20%) for cheques and securities;
- 15% (25%) for accounts receivables and inventory;
- 32% for land, and
- 35% (40%) for other collateral.

As a result of these adjustments the collateral coverage ratio (i.e. the ratio between the sum of the rebased value of all tangible collateral and the total loan balances) was decreased from 63% to 45%. Moreover, collateral values have been capped at the borrower level (i.e. including only, for each borrower, an amount of collateral up to the bank's exposure to that borrower).

Corporate and Small & Medium Enterprises Portfolio

The Corporate and Small & Medium Enterprises (SME) Portfolio stood at €82.6 billion and was divided into four sub-portfolios: Corporate (€34.5 billion), SMEs (€40.7 billion), Leasing (€5.6 billion) and Factoring (€1.8 billion).

For the purposes of the diagnostic study, "Corporate" refers to enterprises with an annual turnover of more than €25 million, while "SMEs" are enterprises with a turnover between €2 and €25 million. Moreover, a further distinction was made. The term "large corporate borrowers" was used for companies or groups of companies with a total exposure of over €25 million. Leasing and factoring are typically managed within the commercial banking division (even if booked in separate subsidiaries) and, therefore, BlackRock applied the same modelling approach.

The estimation of CLPs was based on:

- a comprehensive re-underwriting for a sample of large corporate borrowers conducted as part of the AQR workstream;
- econometric modelling for all other Corporate and SME borrowers, using a common methodology.

In particular, BlackRock conducted a comprehensive re-underwriting for a sample of 128 large corporate borrowers as part of the AQR workstream. This sample represented 37% of the total large corporate borrowers' balances covering a number of industry sectors.

Table II.3 Key conservative assumptions in calculating the Credit Loss Projections

Business loans	
Probability of Default (PD)	<ul style="list-style-type: none"> BlackRock developed its master rating scale based on the realised default rates of the past five years (June 2008 – June 2013), which reflect a deep recession.
Modified loans	<ul style="list-style-type: none"> BlackRock assigned a rating floor of 13 for rescheduled loans and of 15 for re-structured loans (in a 16 rating scale), implying significantly higher PD.
Loss Given Default (LGD) for unsecured loans	<ul style="list-style-type: none"> The LGD assumptions for unsecured loans (ranging 75%-90%) were more conservative than the ones used under the Foundation Internal Ratings-Based Approach of Basel II (45%).
Collateral valuation	<ul style="list-style-type: none"> A haircut of 38% was imposed on CRE collateral (30% forced sale haircut and 8% downward adjustment based on desktop valuations). A haircut of 90% was imposed on second-lien residential and CRE collateral. Steep haircuts on securities, account receivables and inventory (30-60%).
Corporate and personal guarantees	<ul style="list-style-type: none"> Corporate and personal guarantees were only implicitly taken into account for the Corporate Portfolio by providing an increase of the recovery ratio by 5% and 3% in the Baseline and Adverse Scenario respectively.
Household loans	
Historical performance data	<ul style="list-style-type: none"> BlackRock developed its transition matrix econometric models based on five-year historical performance data (June 2008 – June 2013), which reflect a deep recession, embedding a conservatism in the estimation of CLPs.
Residential property valuation	<ul style="list-style-type: none"> Downward adjustment of residential mortgage collateral value by 13%-14% following sample on-site visits.
Forced sale discount & liquidation cost	<ul style="list-style-type: none"> A discount of 35% (gradually reduced to 20%) was imposed on the mortgage collateral value upon liquidation.
Liquidation cost	<ul style="list-style-type: none"> An additional 11% haircut on mortgage collateral was assumed for legal and maintenance costs.
Source: Bank of Greece.	

BlackRock's re-underwriting process included a comprehensive review of the physical (and in some instances, electronic) files made available by the Group A Banks. Loan files typically included the bank's credit reviews, borrower financial information, loan facility and security documents, and relevant third-party collateral valuation reports. In addition, BlackRock underwriters had the opportunity to engage with the respective relationship manager at the bank to obtain clarification or further information on selected credits. To further support the underwriting analysis, BlackRock also reviewed publicly available borrower-specific information as well as industry and market research to supplement the information provided by the banks.

Then, utilising the borrower-specific information collected, BlackRock:

- evaluated business fundamentals, including current and historical operating performance;
- projected financial performance (e.g. revenue growth, EBITDA margin, etc.) and free cash flow for the underlying business, informed by macroeconomic assumptions such as GDP, inflation and disposable income;
- analysed the value of collateral for defaulted exposures.

Based on the above analysis, BlackRock estimated for each of the re-underwritten expo-

sures bespoke CLPs both under the Baseline and Adverse Scenarios.

Moreover, BlackRock was able to extend the universe of exposures for which CLPs were based on fundamental credit file review by an additional 56 borrowers representing 10% of total large corporate borrowers' balances. This was achieved by identifying the same or similar credit exposure within facilities held across the Group A Banks to which results could be mapped (for example, a pari-passu syndicated facility or an unsecured facility with exactly the same recourse to the borrower). As a result, BlackRock overall calculated bespoke CLPs for 47% of the total large corporate borrowers' balances.

For all the rest Corporate and SME borrowers econometric modelling was used to estimate CLPs. The statistical estimation of CLPs at loan level in the Corporate and SME Portfolio was based on the following formula:

$$\text{Expected Loss (EL)} = \text{EAD} \times \text{PD} \times \text{LGD}$$

Exposure at Default (EAD) was calculated as the sum of the on-balance sheet exposure and a percentage of the off-balance sheet exposures (e.g. Letters of Guarantee, undrawn credit limits). In order to determine this percentage, BlackRock relied on the analysis of historical data provided by banks, interviews with bank officials and findings from the sample of large corporate borrowers analysed as part of the Asset Quality Review workflow.

The estimation of Probability of Default (PD) comprised the following key steps:

- Analysis of five-year (June 2008 – June 2013) internal historical ratings migration data of Group A Banks.
- Due diligence of banks' rating processes.

- Mapping of individual bank rating scales to a consistent 16 rating master scale (with grade 1 representing the lowest risk and grade 16 defaulted exposures).
- Development of a logistic regression-based PD model to forecast future transitions to default over different time horizons given the starting obligor rating and the year-over-year change in the unemployment rate. Bank dummy variables were also included in order to account for idiosyncratic risks across banks. Moreover, separate PD models were estimated for the Corporate and SME universe.

For modified loans, BlackRock applied overlays to derive PD forecasts informed by due diligence sessions, loan file review findings and by an analysis of historical modification data provided by the banks. Specifically, for rescheduled loans (i.e. loans modified before a default event) BlackRock assigned a rating floor of 13. For restructured loans (i.e. loans modified after the occurrence of a default event) BlackRock assigned a rating floor of 15.

BlackRock's Loss Given Default (LGD), approach consisted of a fundamental collateral value analysis based on the collateral data tapes submitted by the Banks, complemented by unsecured recovery rate assumptions.

For unsecured loans the recovery rates were informed by the AQR process, the large loan re-underwriting and the SME loan file reviews, which provided insight into recoverability from a debt capacity assessment against the total outstanding loan amount (and resulting principal modification in an assumed debt restructuring). Benchmarks for recoveries from other jurisdictions were also taken into consideration, keeping in mind the specific

characteristics of the Greek market. In particular, the recovery rate was set at 25% for the Corporate Portfolio (including CRE and Shipping exposures) and 20% for the SME Portfolio in the Baseline Scenario. A 10% lower recovery ratio was assumed in the Adverse Scenario for both Portfolios.

Regarding secured loans, the fundamental collateral analysis consisted of the following key steps:

- Linking collateral data to loan-level exposures to avoid double counting and ensure the correct allocation of tangible collateral.
- Rebasing values of real estate collateral to end-June 2013. For residential collateral the approach was the same as in the Residential Mortgages Portfolio. For CRE external vendors provided historical property type curves.
- Applying forward-value adjustments for real estate collateral to the assumed time of loss realisation (respectively for the Baseline and Adverse Scenario).
- Applying liquidation haircuts by collateral type (detailed further below).
- Assigning realisable value to borrower exposures; capped at the obligor level (to avoid sharing overcollateralization amounts across different borrowers in a portfolio).

Specifically, BlackRock assumed the following liquidation haircuts (Adverse Scenario in parenthesis):

- 5% (10%) for cash and deposits;
- 10% (20%) for cheques;
- 30% (40%) for securities and other collateral;

- 35% for land;
- 38% for CRE, and
- 50% (60%) for accounts receivables and inventory.

The liquidation haircut assumptions were informed by the large loan re-underwriting, the SME loan file reviews and banks' historical recovery data per collateral type. In particular, for CRE the liquidation haircut reflected an 8% downward adjustment to account for the estimated bank overvaluation compared to desktop valuations of a sample of commercial properties and a further 30% haircut to account for additional liquidation expenses associated with enforcing claims against the borrower and retiring preferential claims and prior encumbrances.

Personal and corporate guarantees were only implicitly considered through a BlackRock recovery overlay on LGD assumptions. Specifically, BlackRock assumed that personal and corporate guarantees would provide an additional recovery of 5% of the loan balance in the Baseline and 3% in the Adverse Scenario above the recovery obtained from the adjusted collateral position.

Lastly, BlackRock applied a recovery floor for secured loans. If the resulting recovery amount from the aforementioned collateral valuation steps was lower than the floor, recovery was increased to equal the floor. The recovery floor was set at 40% for the Corporate Portfolio (including CRE and Shipping exposures) and 25% for the SME Portfolio in the Baseline Scenario. A 10% lower recovery floor was assumed in the Adverse Scenario for both Portfolios.

Commercial Real Estate Portfolio

The Commercial Real Estate (CRE) Portfolio amounted to €3.3 billion. BlackRock CRE specialists reviewed the loan files of a sample of 23 large loans totalling €1.3 billion in funded exposures with the objective of assessing sustainable debt capacity for each borrower and estimating potential credit losses. For these loans both the timing and the absolute level of the losses were directly incorporated into the CLPs. For the remaining CRE exposures, BlackRock employed the same ratings-based PD/LGD approach applied to the Corporate and SMEs Portfolio for estimating CLPs.

Shipping Portfolio

The Shipping Portfolio amounted to €8.8 billion. BlackRock used two approaches to model it based on the nature of the exposure:

- Deterministic model for the merchant shipping portfolio.
- Corporate PD/LGD model for passenger ships and loans to ship owners not backed by shipping collateral.

The merchant shipping portfolio (e.g. tanker, dry bulker, containership, liquefied natural gas and liquefied petroleum gas carrier) comprised 82% of the total Shipping Portfolio. The model utilised a deterministic cash flow based methodology to forecast defaults and losses (if any) at the loan level for the portfolio of merchant shipping loans. The model produced loan-level quarterly cash flow projections using a combination of charter status, charter rates, charter expiry dates and operating expenses for each vessel. The analysis was further supplemented by current and forward-looking valuations for each vessel depending on ship type, size and age. To this

end, BlackRock engaged third-party shipping market agents and incorporated real GDP growth projections for China, North America and OECD-Europe. The derived cash flows were then compared with the contractual interest and debt service requirements for each corresponding loan. A combination of interest coverage ratios, debt service coverage ratios and loan-to-value ratios was used to determine future loan performance behaviour (i.e. performing/default status) at different points of time during the term of the loan.

Upon default, BlackRock assumed a 24-month workout period. To estimate liquidation proceeds, forward projected values for the vessel at the time of liquidation were used upon which a haircut of 10% in the Baseline and 15% in the Adverse Scenario was applied. This haircut level reflects BlackRock's estimates of reasonable transactional, liquidation or other accommodative costs in order to dispose the collateral based on discussions with experts and practitioners in the global shipping market.

Moreover, BlackRock shipping specialists reviewed the loan files of a sample of 24 large loan shipping exposures totalling €1.6 billion to provide confirmatory due diligence and substantiate its modelling assumptions, such as the liquidation haircut. Unlike the Corporate and CRE large loans that were underwritten by BlackRock, bespoke credit losses were not projected during the shipping loan file review process, since the shipping model was a cash-flow based deterministic model.

The remaining 18% of the Shipping Portfolio consisted of loans backed by passenger ships, cruise ships, yachts and vehicle carriers, as well as loans issued to ship owners without being backed by shipping collateral. This portion of the portfolio was analysed using the

Corporate Loans PD/LGD approach. Bespoke losses were only estimated for three Greek ferry exposures, which were classified as general industries in the Corporate large loan sample.

State-related exposures

State-related loans portfolio amounted to €12.1 billion as of June 2013 and comprised state-related business loans and government-guaranteed mortgages.

The state-related business loans amounted to €10.5 billion. According to BlackRock's methodology, they were classified into the following categories:

1. Greek government-guaranteed loans, broken down into:
 - (a) loans to large state-controlled enterprises;
 - (b) loans to SMEs, either granted under Credit Support Programmes²⁶ or carrying a direct guarantee from the government.
2. Loans to state-owned or controlled entities or companies established for a public purpose.
3. Loans backed by Greek government-related collateral (e.g. loans secured by Greek gov-

ernment bonds, subsidies or other receivables from the State).

BlackRock calculated CLPs for categories 1(b) and 3 on the portion of the exposure either not guaranteed by the Greek government or not backed by Greek government-related collateral. To this end, BlackRock used the Corporate, SME and SBP econometric models depending on the exposure type.

For the remaining state-related business loans as well as government-guaranteed mortgages BlackRock followed the working assumption that the State would fully meet its obligations.

5. RESULTS

BlackRock submitted its final report to the Bank of Greece in December 2013. BlackRock estimated CLPs on the whole domestic loan book of Greek banks, as well as on loans carrying Greek risk in foreign branches and subsidiaries.

The CLPs per loan Portfolio over a three-and-a-half-year and a loan-lifetime horizon on the basis of the Baseline and the Adverse Scenario are depicted in Table II.4.

Regarding Business Loans, the SBP and SME Portfolios exhibit the highest lifetime loss

Table II.4 Credit Loss Projections on a "when realised" basis per loan portfolio¹

(million euro)

Portfolios	Loan balances	Baseline Scenario				Adverse Scenario			
		3½-year CLPs	3½-year CLPs as a percentage of loan balances (%)	Lifetime CLPs	Lifetime CLPs as a percentage of loan balances (%)	3½-year CLPs	3½-year CLPs as a percentage of loan balances (%)	Lifetime CLPs	Lifetime CLPs as a percentage of loan balances (%)
Mortgage	69,858	2,822	4.0	5,077	7.3	3,178	4.5	8,703	12.5
Consumer	25,667	7,249	28.2	11,209	43.7	8,342	32.5	13,057	50.9
Business ²	120,633	20,193	16.7	30,525	25.3	23,752	19.7	37,822	31.4
Total	216,158	30,263	14.0	46,811	21.7	35,273	16.3	59,582	27.6

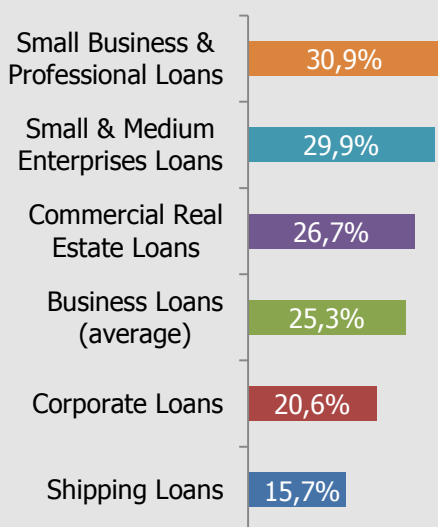
Source: BlackRock Solutions.

¹ Credit loss projections do not take into account loan loss reserves.

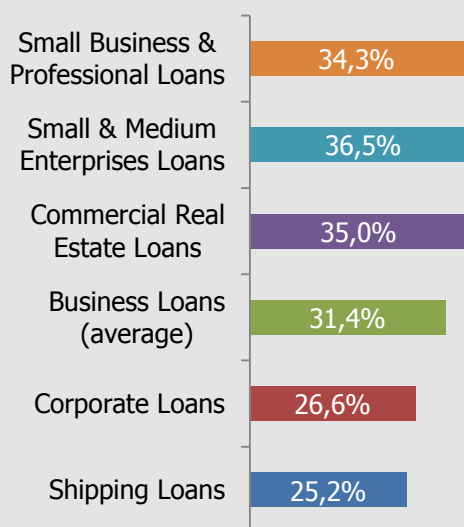
² Business loans include Corporate, SME, CRE, SBP, Shipping, Factoring and Leasing.

Chart II.1 Business Loans – lifetime loss rates¹ per sub-portfolio

(a): Baseline Scenario



(b): Adverse Scenario



Source: BlackRock Solutions.

¹ Loss rates do not take into account loan loss reserves.

rates driven by their retail nature and domestic focus respectively (see Chart II.1).

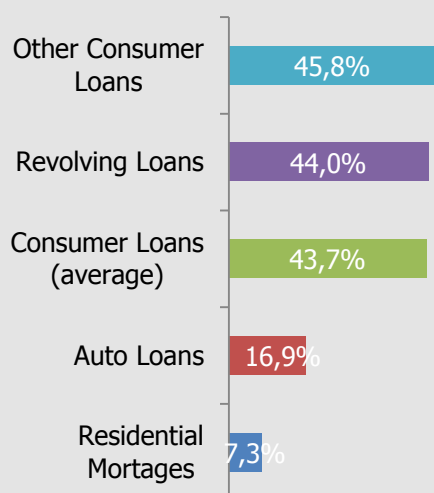
CRE Loans, which constitute a very small part of the Business Portfolio, also exhibit high loss rates. On the contrary, the Shipping Portfolio exhibits the lowest loss rate thanks to the international nature of their business and the availability of collateral. In the Ad-

verse Scenario, the loss rates of various Portfolios exhibit less dispersion than in the Baseline Scenario. The CRE and Shipping Portfolios are most impacted due to the very conservative assumptions regarding commercial real estate prices and vessel valuations respectively.

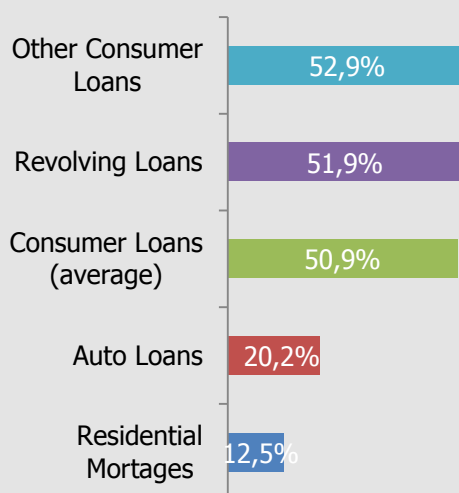
Regarding Household Loans, the dispersion

Chart II.2 Household Loans – lifetime loss rates¹ per sub-portfolio

(a): Baseline Scenario



(b): Adverse Scenario



Source: BlackRock Solutions.

¹ Loss rates do not take into account loan loss reserves.

of loss rates across sub-asset classes is much higher than across Business Loans sub-asset classes. The Mortgages Portfolio, because of its significant collateral backing, has, as anticipated, the lower loss rate (see also Chart II.2). Specifically, within the Consumer Portfolio, auto loans exhibit a considerably lower loss rate than both revolving and other consumer loans. Again in this case the availability of collateral is the key driver for the lower loss rate.

The CLPs per bank are outlined in detail in Table II.5. The three-and-a-half-year CLPs estimated by BlackRock have been a signifi-

cant input towards the capital needs assessment for each individual bank according to the methodology described in Chapter IV.

Table II.5 Credit Loss Projections on a “when realised” basis on the loan portfolio per bank¹

(million euro)

Banks	Loan balances	Baseline Scenario				Adverse Scenario			
		3½-year CLPs	3½-year CLPs as a percentage of loan balances (%)	Lifetime CLPs	Lifetime CLPs as a percentage of loan balances (%)	3½-year CLPs	3½-year CLPs as a percentage of loan balances (%)	Lifetime CLPs	Lifetime CLPs as a percentage of loan balances (%)
Alpha	52,067	6,961	13.4	11,569	22.2	7,937	15.2	14,842	28.5
Eurobank	45,397	6,096	13.4	9,884	21.8	6,969	15.4	12,370	27.2
NBG	46,444	5,201	11.2	8,424	18.1	6,216	13.4	11,173	24.1
Piraeus	67,510	10,994	16.3	15,691	23.2	12,945	19.2	19,644	29.1
ABB	208	13	6.2	14	6.9	15	7.0	18	8.5
Attica	3,549	761	21.4	932	26.3	908	25.6	1,173	33.0
Credicom	372	37	10.1	47	12.7	45	12.1	58	15.5
Panellinia	611	200	32.8	249	40.7	238	38.9	305	49.9
Total	216,158	30,263	14.0	46,811	21.7	35,273	16.3	59,582	27.6

Source: BlackRock Solutions.

¹ Credit loss projections do not take into account loan loss reserves.

ANNEX I: CLPs ON A “DEFAULT BASIS”

BlackRock calculated CLPs on a “when-realised basis” (i.e. at the time of collateral liquidation) and subsequently allocated the losses to the year of default in order to also calculate CLPs on a “default basis”.

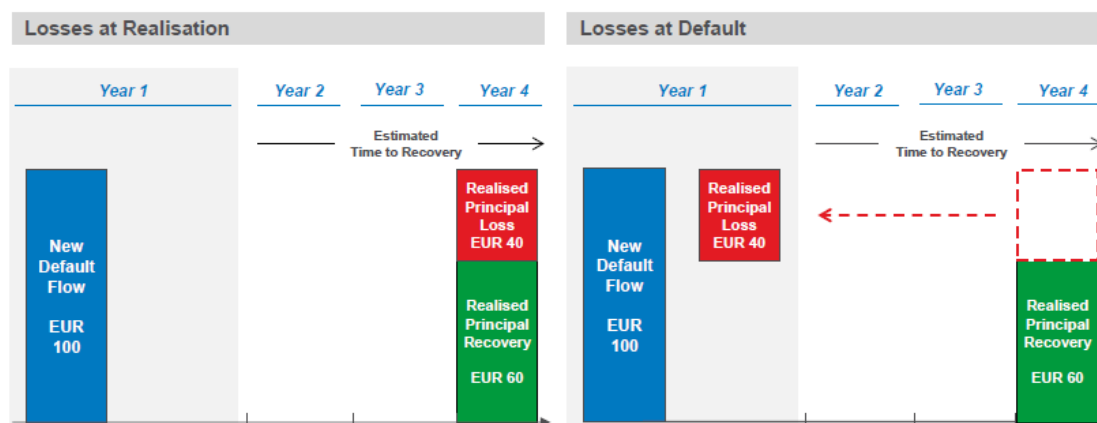


Table Annex I.1 Credit Loss Projections on a default basis per loan portfolio¹

(million euro)

Portfolios	Loan balances	Baseline Scenario				Adverse Scenario			
		3½-year CLPs	3½-year CLPs as a percentage of loan balances (%)	Lifetime CLPs	Lifetime CLPs as a percentage of loan balances (%)	3½-year CLPs	3½-year CLPs as a percentage of loan balances (%)	Lifetime CLPs	Lifetime CLPs as a percentage of loan balances (%)
Mortgage	69,858	4,954	7.1	5,077	7.3	8,291	11.9	8,703	12.5
Consumer	25,667	10,785	42.0	11,209	43.7	12,535	48.8	13,057	50.9
Business ²	120,633	29,244	24.2	30,525	25.3	35,816	29.7	37,822	31.4
Total	216,158	44,984	20.8	46,811	21.7	56,642	26.2	59,582	27.6

Source: BlackRock Solutions.

¹ Credit loss projections do not take into account loan loss reserves.

² Business loans include Corporate, SME, CRE, SBP, Shipping, Factoring and Leasing.

Table Annex I.2 Credit Loss Projections on a default basis on the loan portfolio per bank¹

(million euro)

Banks	Loan balances	Baseline Scenario				Adverse Scenario			
		3½-year CLPs	3½-year CLPs as a percentage of loan balances (%)	Lifetime CLPs	Lifetime CLPs as a percentage of loan balances (%)	3½-year CLPs	3½-year CLPs as a percentage of loan balances (%)	Lifetime CLPs	Lifetime CLPs as a percentage of loan balances (%)
Alpha	52,067	11,168	21.4	11,569	22.2	14,143	27.2	14,842	28.5
Eurobank	45,397	9,483	20.9	9,884	21.8	11,754	25.9	12,370	27.2
NBG	46,444	8,124	17.5	8,424	18.1	10,675	23.0	11,173	24.1
Piraeus	67,510	15,061	22.3	15,691	23.2	18,654	27.6	19,644	29.1
ABB	208	13	6.3	14	6.9	15	7.3	18	8.5
Attica	3,549	866	24.4	932	26.3	1,074	30.3	1,173	33.0
Credicom	372	47	12.7	47	12.7	57	15.4	58	15.5
Panellinia	611	222	36.3	249	40.7	270	44.2	305	49.9
Total	216,158	44,984	20.8	46,811	21.7	56,642	26.2	59,582	27.6

Source: BlackRock Solutions.

¹ Credit loss projections do not take into account loan loss reserves.

III. TREATMENT OF FOREIGN LOAN PORTFOLIOS

Credit loss projections (CLPs) for foreign loan portfolios were estimated by the Bank of Greece using BlackRock's independent reasonability assessment and in accordance with the Expected Loss (EL) methodology developed by the European Banking Authority (EBA) in the context of the June 2011 EU-wide stress testing exercise.

1. CONTEXT AND SCOPE

The Bank of Greece aimed at ensuring that the estimation of CLPs would encompass the entire loan book of Greek banking groups (i.e. both in Greece and abroad), so that the resulting capital needs assessment would be robust on a consolidated basis.

To this end, loans in foreign branches and subsidiaries of Greek banks were divided into two categories:

- Loans carrying Greek risk defined as loans (i) issued to a Greek borrower; or (ii) primarily secured by collateral located in Greece.
- Loans carrying foreign risk defined as all other loans in foreign branches and subsidiaries.

Loans carrying Greek risk in foreign branches and subsidiaries were included in the perimeter of BlackRock's diagnostic study. Hence, BlackRock calculated CLPs on these loans using the methodology presented in Chapter II.

For loans carrying foreign risk, the Bank of Greece developed a top-down methodology for the estimation of CLPs. CLPs were estimated over a three-and-a-half-year horizon

under both a Baseline and an Adverse Scenario, using the methodologies outlined below. In line with the loan portfolios considered in BlackRock's diagnostic study, the reference date used was 30 June 2013.

Especially for the seven largest foreign subsidiaries of Greek systemic banks, BlackRock was assigned to provide an independent reasonability assessment on credit risk parameters and a review on collateral valuations, risk classification, credit policies and distressed operations.

2. METHODOLOGY

Overview

As of end-June 2013, the loans carrying foreign risk amounted to €53.4 billion for the four systemic Greek banking groups (namely Alpha Bank, Eurobank, NBG and Piraeus Bank).²⁷ The foreign risk loans represented 20% of the total loan book.

The foreign risk loans of the seven largest subsidiaries in SEE and Turkey stood at €37.4 billion representing 70% of total foreign risk loans. The Bank of Greece, taking into account the importance of these exposures commissioned BlackRock to conduct a top-down independent assessment of specific processes and bank's internal documentation relating to credit operations policies and the risk management framework of each subsidiary. The credit policy review was performed by way of a high-level analysis of documents provided by the banks and on-site due dili-

²⁷ The remaining Greek commercial banks did not have operations outside Greece.

gence meetings. Blackrock assessed the underwriting and lending criteria, reviewed the documents describing the arrears management process, the modification framework, and performed an inventory check of policies and procedures from a prudential point of view. Blackrock supported its assessment with loan file reviews across all subsidiaries in scope. The objective of the file review was to gain further insight into the loan monitoring and loss mitigation policies and practices of the banks. Furthermore, Blackrock provided an independent reasonability assessment of key credit risk parameters for the seven largest foreign subsidiaries of Greek banks in the region. The findings of the reasonability assessment were incorporated into the Bank of Greece estimation of CLPs.

The Bank of Greece methodology for CLP estimation was similar to the Expected Loss (EL) approach implemented in the context of the EU-wide stress testing exercise conducted by EBA in June 2011. A similar approach had also been used by the Bank of Greece in the context of the 2012 capital needs assessment for the Greek banking sector. The approach was based on bank-submitted starting levels of PDs and LGDs, appropriately challenged by BlackRock and the Bank of Greece. It was complemented by loss rate increments provided by the ECB.

The analysis was conducted separately for twelve countries and six asset classes.²⁸ Exposures to countries that did not belong to the main twelve countries of Greek banks' foreign operations were classified under "rest of the world". Since these exposures represented less than 1% of each group's total exposures,

this approach did not compromise the robustness and accuracy of the exercise.

BlackRock's reasonability assessment

BlackRock conducted an independent reasonability assessment of key credit risk parameters for the seven largest subsidiaries of Greek banks in SE Europe and Turkey.

Specifically, BlackRock assessed the reasonability of the one-year PD and LGD internal bank estimates for each of the seven entities and for each asset class with June 2013 as a reference date.

BlackRock's assessment largely relied on quantitative and qualitative analysis of specific loan-level and portfolio-level data, along with due diligence analysis which included on-site meetings with each bank's management, jurisdiction research, and review of loan files, collateral valuation process, credit policy and distressed operations.

As a result of the reasonability assessment BlackRock graded in six categories²⁹ the credit risk parameters³⁰ of the seven subsidiaries by portfolio.

Estimation of CLPs

The Bank of Greece top-down methodology for CLP estimation was based on an EL approach, where Probability of Default (PD) and Loss Given Default (LGD) were applied to banks' exposures (Exposure-At-Default - EAD) over a three-and-a-half-year horizon as follows:

$$EL = EAD \times PD \times LGD$$

²⁸ Corporate, Commercial Real Estate, Retail Small and Medium Enterprises, Residential Mortgages, Consumer, and Credit Cards.

²⁹ Conservative, Reasonable, Optimistic, Very Optimistic, Extremely Optimistic, Not Reliable.

³⁰ PD and LGD.

The Bank of Greece calculated the starting level of the credit risk parameters per asset class as follows:

- For the seven key subsidiaries reviewed by BlackRock, the levels of the bank-submitted credit parameters were adjusted on the basis of BlackRock's reasonability assessment.
- For the entities outside BlackRock's assessment credit parameters were adjusted using a benchmarking exercise adopting a conservative stance.
- For the "rest of the world" exposures the average PD and LGD of the countries under review was applied.

Then the ECB staff provided the Bank of Greece with relevant estimates of the future increments of loss rates for the period 2012-2016 by country and portfolio, under a Baseline and an Adverse Scenario. For the Baseline Scenario the loss rates were calculated on the basis of the macroeconomic forecasts provided by the International Monetary Fund (IMF, *World Economic Outlook*, October 2013), while for the Adverse Scenario the macroeconomic forecasts were developed by

the ECB staff.

The evolution of the credit risk parameters for each year of the exercise was estimated using the aforementioned ECB staff percentage changes of the loss rates and the adjusted PD and LGD.

For loans already classified as non-performing in June 2013, the EL was calculated as the product of the LGD and the non-performing loan balance, since the level of the PD parameter was equal to one.

For the loans that were performing as of June 2013, the EL for each year was calculated as the product of the EAD and the respective PD and LGD of the corresponding future period. The EAD for each year was calculated after subtracting the amount of the preceding year's non-performing loans (NPLs) from the outstanding exposures.

3. RESULTS

The CLPs for the three-and-a-half-year period, as shown in Table III.1, amounted to €11.2 and €12.8 billion, under the Baseline and the Adverse Scenario, representing 20.9% and 24.0% of total exposures, respectively.

Table III.1 Credit Loss Projections of foreign loans per portfolio¹

(million euro)

Portfolios	Foreign loan balances	Baseline Scenario		Adverse Scenario	
		3½-year CLPs	3½-year CLPs as a percentage of loan balances (%)	3½-year CLPs	3½-year CLPs as a percentage of loan balances (%)
Corporate	22,881	4,885	21.3	5,788	25.3
CRE	3,272	504	15.4	720	22.0
Retail SME	4,052	891	22.0	955	23.6
Residential	10,965	1,708	15.6	1,976	18.0
Consumer	6,636	1,961	29.5	2,085	31.4
Credit Cards	5,566	1,200	21.6	1,295	23.3
Total	53,372	11,148	20.9	12,820	24.0

Source: Bank of Greece.

¹ Credit loss projections do not take into account foreign loan loss reserves and mitigating actions included in Restructuring Plans.

Table III.2 Credit Loss Projections and loss rates of foreign loans per bank¹

(million euro)

Banks	Foreign loan balances	Baseline Scenario		Adverse Scenario	
		3½-year CLPs	3½-year CLPs as a percentage of loan balances (%)	3½-year CLPs	3½-year CLPs as a percentage of loan balances (%)
NBG	26,117	4,005	15.3	4,456	17.1
Eurobank	9,144	1,866	20.4	2,294	25.1
Alpha Bank	10,405	2,936	28.2	3,238	31.1
Piraeus Bank	7,706	2,342	30.4	2,832	36.7
Total²	53,372	11,148	20.9	12,820	24.0

Source: Bank of Greece.

¹ Credit loss projections do not take into account foreign loan loss reserves and mitigating actions included in Restructuring Plans.² The other Greek commercial banks did not have any foreign loan balances.

The Consumer Portfolio had the highest loss rate (Baseline Scenario: 29.5%; Adverse Scenario: 31.4%), contributing to the overall CLPs with the highest weights. The Retail SMEs Portfolio had the second highest loss rate, while corporate loans ranked fourth in terms of loss rates but accounted for a larger share of losses, as their outstanding balances were significantly higher compared with those of the other two loan categories.

The results for foreign risk per bank are shown in Table III.2.

The estimated CLPs for the foreign risk presented in this Chapter constitute one of the inputs for the calculation of banks' capital needs, as analysed in Chapter IV. To this end, the aforementioned figures have been adjusted to take into account mitigating actions (i.e. commitments to the DG Comp in the Restructuring Plans), as well as foreign tax effects.

IV. CAPITAL NEEDS ASSESSMENT

In July 2013, the Bank of Greece, with the technical support of an international financial advisory firm, initiated an assessment of the capital needs of the Greek banking sector, in light of the commitments envisaged in the Memorandum.

By design, this exercise included the banking activities of Greek commercial banks on a consolidated basis. The assessment of capital needs was carried out under both a Baseline and an Adverse Scenario.

The Bank of Greece concluded that for the June 2013-December 2016 period, the Greek banking sector would require approximately €6.4 billion for further strengthening of its capital base under the binding Baseline Scenario.

1. CONTEXT AND SCOPE

The capital needs assessment was conducted in the second half of 2013 by the Bank of Greece, with the technical support of Rothschild, a leading international financial advisory firm. The objective of this exercise was to conservatively estimate the capital needs of all Greek commercial banks on a consolidated basis, in order to ensure minimum Core Tier 1³¹ capital amounts over the June 2013-December 2016 period.

Banks' capital needs were estimated on the basis of the two aforementioned macroeconomic scenarios (see Chapter II) and the following capital thresholds:

- Core Tier 1 target ratio of 8% for the Baseline Scenario;
- Core Tier 1 target ratio of 5.5% for the Adverse Scenario.

These capital thresholds have been aligned with those of the upcoming Comprehensive Assessment³² and of the 2014 EU-wide stress test to be conducted by the ECB and EBA respectively. In general, the Bank of Greece methodology was aligned to the extent possible to the envisaged approach of these exercises on the basis of publicly available information as of February 2014³³. In relation to deferred tax assets (DTA), the approach has been more conservative and in-line with the 2011 Bank of Greece exercise (i.e. cap of existing DTA at 20% of total CT1. Moreover no new DTA creation is allowed during the stress test period).

By design, the exercise was performed on a consolidated basis (i.e. including notably foreign and insurance subsidiaries) over June 2013-December 2016. Capital needs for insurance undertakings were estimated on the basis of a separate stress test which followed the EIOPA stress test methodology³⁴. This exercise was conducted in the second half of 2013 based on year end 2012 figures.

³¹ There are no substantial differences between the Core Tier 1 and the Common Equity Tier 1 Capital for the Greek banks. These differences are more than compensated by the amount of existing DTA not recognized in the reference Core Tier 1 (in excess of €2.5bn).

³² The Comprehensive Assessment is being conducted by the ECB in preparation of assuming full responsibility for supervision as part of the Single Supervisory Mechanism. The Comprehensive Assessment comprises of a supervisory risk assessment, an asset quality review and a stress test.

³³ Sovereign risk, another area to be covered by the EBA 2014 EU-wide stress test, has not been addressed in the context of the capital needs assessment.

³⁴ EIOPA stress tests were initially planned for 2013 but eventually rescheduled for H1 2014.

2. GUIDING PRINCIPLES AND APPROACH

Guiding principles

The capital needs assessment exercise was guided by two principles, which were equally applied across banks:

- (i) Fairness and proportionality: A common methodology was defined and applied consistently across all banks falling under the scope of the exercise, so as to ensure a level playing field. At the same time, the methodology had to consider and account for the historically demonstrated idiosyncratic characteristics of each bank.
- (ii) Conservatism: The assessment was implemented under conservative assumptions, so as to ensure capital adequacy for the entire period.

Bottom-up approach

The Bank of Greece developed a proprietary bottom-up approach to estimate capital needs. This approach was based on the Restructuring Plans submitted by the banks for the June 2013 – December 2016 period, which were meant to incorporate the banks' commitments to DG Comp.

In this context, the Restructuring Plans have been developed under the assumption of a dynamic balance sheet (i.e. allowing the evolution of the composition and size of the balance sheet).³⁵ The methodology section that follows describes this approach in detail.

All numbers for the banks as at the relevant dates for the stress test period are extracted

from the Restructuring Plans submitted by them.

3. METHODOLOGY

Overview

In September 2013, the Bank of Greece requested all Greek commercial banks to submit their Restructuring Plans based on the two aforementioned macroeconomic scenarios.

In mid-November 2013, each bank formally submitted its Restructuring Plan³⁶.

The Bank of Greece adjusted the information obtained from the Restructuring Plans to form the two key components of the capital needs assessment (as presented in Chart IV.1):

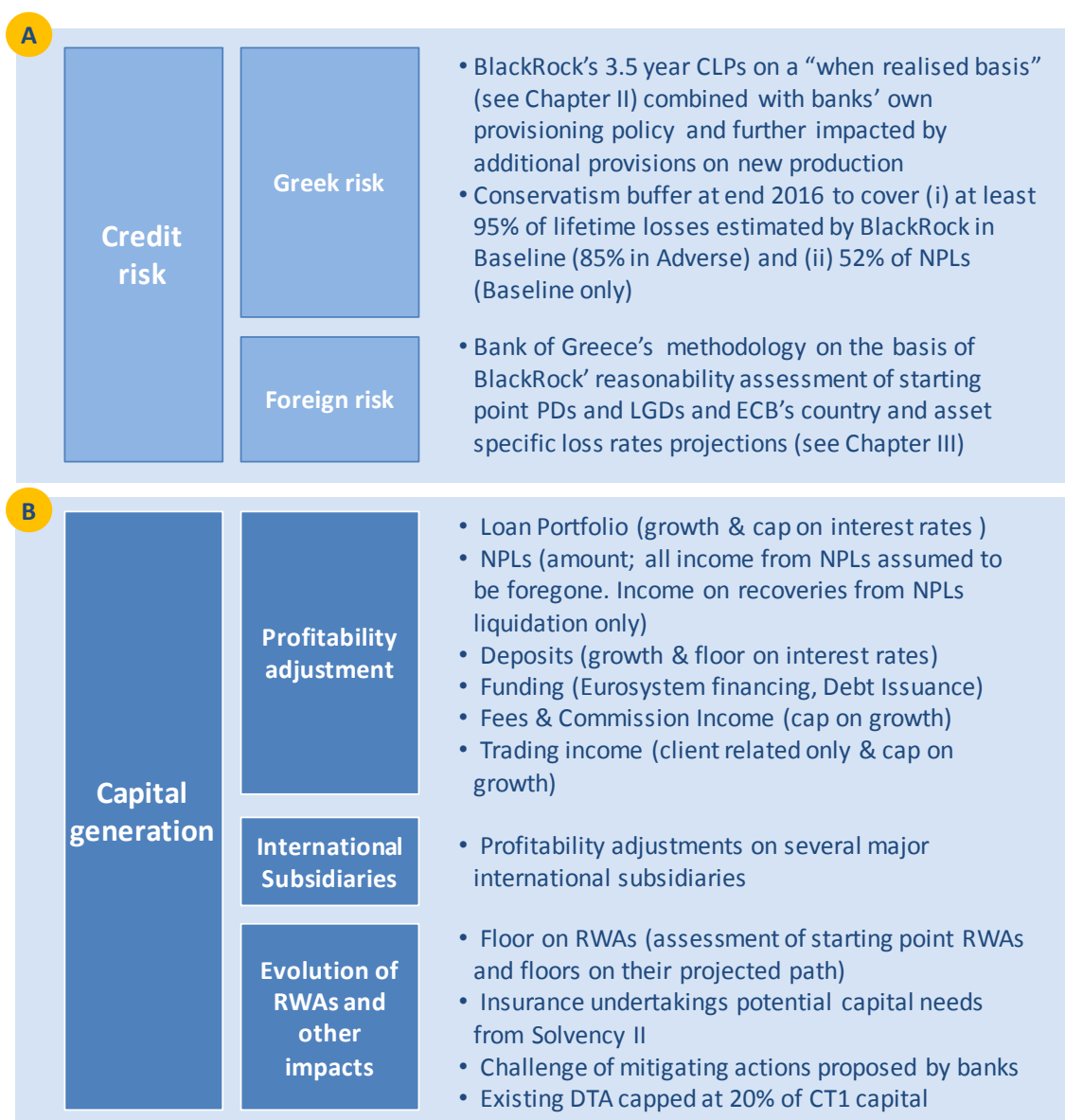
- Component A: Credit Loss Projections (CLPs) on banks' loan portfolios over the June 2013 – December 2016 period, carrying (i) Greek risk, and (ii) foreign-risk, net of existing loan loss reserves; and
- Component B: banks' internal capital generation over the June 2013 – December 2016 period on the basis of conservative Bank of Greece adjustments.

The starting point for the exercise is the reference Core Tier 1 capital as at 30 June 2013. The evolution of Core Tier 1 was then estimated during the stress test period with capital needs calculated at the end of each year over the June 2013-December 2016 period. More precisely, the Bank of Greece estimated the target amount of CT1

³⁵ This approach is consistent with the treatment of the restructuring plans in the context of the EBA 2014 EU-wide stress test.

³⁶ The formal submission consisted of hard copies signed by the Executive Board.

Chart IV.1 Key components of capital needs



Source: Bank of Greece

capital for each bank at the end of each year until 2016 based on the target CT1 ratio set for each Scenario and the adjusted Risk Weighted Assets (RWAs).

The capital needs for each bank were then calculated as the difference between (a) the target amount of CT1 capital and (b) the estimated amount of CT1 capital at the end of each year until 2016. This assessment

was performed for both the Baseline and the Adverse Scenario for each bank.³⁷

The Baseline Scenario was used to determine the capital needs for each bank, while the Adverse Scenario is taken into account

³⁷ The capital needs were subsequently updated for the estimated Core Tier 1 capital as at 31 December 2013. Actual Core Tier 1 number was used for Eurobank which published its full year results on 28/02/14.

in determining the appropriate capital buffers for the Greek banking sector.

The methodology and the results of the capital needs assessment were communicated to banks in individual meetings conducted since December 2013. Banks are required to submit their capital plans by mid-April 2014.

The following two sections describe in detail the key components of the capital needs assessment.

Component A: CLPs on banks' loan portfolios

The objective of this component was to conservatively estimate the credit risk cost for banks over a three-and-a-half-year period as an input to their capital needs. It includes the CLPs on banks' loan portfolios carrying: (i) Greek risk; and (ii) foreign risk, net of existing loan loss reserves.

In their Restructuring Plans, banks estimated on a consolidated basis loan loss provisions until December 2016 to cover:

- existing exposures to residents (Greek risk);
- existing exposures to non-residents (foreign risk); and
- new lending business over the period.

The Bank of Greece, adopting a more conservative stance, challenged the loan loss provisions provided in Restructuring Plans and calculated required CLPs at group level which fully cover the following elements:

- the CLPs from loans carrying Greek risk, as estimated by BlackRock on a “when realised basis” for the three-and-a-half-year period June 2013–December 2016 (see Chapter II);

- the three-and-a-half-year CLPs from loans carrying foreign risk, as estimated by the Bank of Greece (as presented in Chapter III)³⁸ taking into account mitigating actions (disposal commitments to DG Comp);
- the Expected Loss from the new loan production in Greece over the June 2013 – December 2016 period, assumed at 40 basis points (bps) and 50 bps per annum on new loan production for the Baseline and the Adverse Scenario respectively.

The “translation” of BlackRock’s expected loan losses (derived from statistical models on the basis of a set of assumptions) into accounting provisions is not a straightforward exercise. Banks produce, and auditors validate (prior to the publication of financial statements), their own loan loss distribution curves in order to determine impairment levels. Statistically calculated and scenario-driven expected losses are not accounting losses. Their translation into accounting provisions is closer to the International Accounting Standards (IAS) and the International Standards of Auditing (ISA) when the timing of the losses is based on the “when realised” approach. Moreover, according to the IAS and ISA, it is clear that the recognition of impairment losses in excess of those that are determined based on objective evidence is not permitted. The International Accounting Standards Board (IASB) also provides that possible or expected future trends that may lead to a loss in the future do not provide

³⁸ The impact of foreign risk CLPs was calculated after foreign tax.

objective evidence of impairment at present³⁹.

The CLPs were calculated both under the Baseline and Adverse Scenarios and were compared with the amount of provisions forecasted by the banks in respect of:

- the existing loans carrying Greek risk as at 30 June 2013;
- the loans carrying foreign risk; and
- the new loans production.

Any deficit versus the required CLPs creates a capital need on a one for one basis. If a bank has forecasted provisions in excess of the required CLPs, no adjustment to its provisioning curve was performed.

Adopting a conservative stance, the Bank of Greece also required banks to have sufficient provisions as at the end of 2016 to cover:

- at least 95% of lifetime losses as estimated by BlackRock under the Baseline scenario and 85% in the Adverse scenario; and
- at least 52%⁴⁰ of the NPLs as estimated by BlackRock as at the end of 2016 in the Baseline Scenario.

Component B: Bank's internal capital generation

The Bank of Greece estimated the internal capital generation capacity of banks over the June 2013 – December 2016 period using conservative adjustments of pre-

provision profitability, RWAs and the impact of mitigating actions (in particular disposal commitments to DG Comp) as presented below:

(i) Pre-provision profitability for Greek operations

The Bank of Greece applied to banking activities in Greece a number of adjustments on banks' Restructuring Plans. In line with the principle of conservatism, whenever a bank forecast was more conservative compared with the other banks, its forecast was not adjusted towards the peer group average.

The adjustments covered a number of income and expense drivers. In particular:

Customer loans growth and pricing: In both the Baseline and the Adverse Scenario, the evolution of loans for each year was aligned to real GDP growth in order to ensure that there is sufficient credit available to support the Greek economy as per the objectives of the Economic Adjustment Program for Greece.

The purpose of the pricing adjustment was to ensure that a bank's loans pricing by asset class is coherent with market conditions.

Based on the Restructuring Plans, the Bank of Greece capped the interest income rate for each asset class and each year at the peer group average in the Baseline scenario, and at the lower quartile in the Adverse scenario.

As a result, the interest income of banks that had forecasted loan pricing above the predefined cap was adjusted downwards.

Interest income from non-performing loans (NPLs): The intention of the Bank of Greece for this source of income was to

³⁹ An independent auditor's assessment was obtained from EY by Bank of Greece in relation to the points here discussed.

⁴⁰ This corresponds to the 75th percentile among European banks according to the EBA Risk Dashboard Q4 2013 (<http://www.eba.europa.eu/risk-analysis-and-data/risk-dashboard>).

ensure that, in their revenue forecasts, banks took into account appropriately the anticipated amount of NPLs. The Bank of Greece performed adjustments both on the amount of NPLs and on the interest income from existing and anticipated NPLs.

First, the Bank of Greece compared the amount of NPLs projected by the banks with the respective BlackRock NPLs projection for each year and asset class. If the latter was higher, the NPLs amount was adjusted upwards. The interest income from restructured and performing loans was adjusted downwards accordingly.

Second, the Bank of Greece ignored the interest income from the adjusted stock of NPLs making the assumption that all in-

Customer deposits growth and pricing: The objective was to ensure that banks neither assumed an unreasonably low cost of deposits nor overestimated deposits growth.

First, the Bank of Greece defined a market-wide minimum cost (floor) over time per type of deposit (e.g. savings, current, time deposits), based on the Restructuring Plans. This floor was set at peer group average in the Baseline Scenario and at the highest quartile in the Adverse Scenario.

Second, deposits evolution was aligned to GDP growth in order to be consistent with the macroeconomic scenario envisaged and to ensure that loan growth is not supported by ECB / ELA funding.

Table IV.1 Key conservative assumptions in assessing capital needs

Assumptions	Description
Loan and deposit interest rates	<ul style="list-style-type: none"> Adjusted per asset class (via a cap/floor) on the basis of peer group average in the Baseline Scenario and lowest/highest quartile in the Adverse Scenario.
Income from NPLs	<ul style="list-style-type: none"> Amount of NPLs adjusted upwards on the basis of BlackRock estimates of NPLs. Interest income from NPLs as forecasted by the banks has been ignored. Replaced by recovery yield on the proportion of NPLs that the bank would recover over time (derived from BlackRock's NPLs liquidation schedule).
Cost of funding	<ul style="list-style-type: none"> Cost of Eurosystem and ELA funding stressed from 2014 onwards (Baseline Scenario only). Eurosystem funding adjusted on the basis of collateral availability. Potential funding gap replenished with debt securities, interbank repo funding and ELA funding with appropriate cost, in this order

Source: Bank of Greece.

come will be foregone. The Bank of Greece recognized instead income from the recoveries based on the BlackRock NPLs liquidation schedule. The yield on these recoveries was set at 2% on the basis of the assumption that any proceed from recoveries would be used to reduce potential ELA funding.

In the Baseline Scenario, the resulting potential net funding deficit is assumed to be refinanced via three sources as presented below and in the following order:

- i. Debt securities issuance depending on the bank's capacity.
- ii. Secured interbank funding up to the amount of available collateral esti-

mated in banks' Restructuring Plans.

- iii. Emergency Liquidity Assistance (ELA) funding.

Under the Adverse Scenario, Bank of Greece assumed that Greek banks would have no access to the wholesale markets.

As a result, interest expenses for any bank forecasting deposit cost below the predefined floor were appropriately adjusted.

Central bank funding: The cost of funding is among the risk areas to be covered in the upcoming EBA 2014 EU-wide stress test. In this context, a stress on the cost of central bank funding was imposed in this exercise in the Baseline Scenario. In particular, the cost of Eurosystem funding was stressed from 2014 onwards up to 75 basis points (bps) and the cost of ELA was stressed from 2014 onwards up to 600 bps.⁴¹

Furthermore, Eurosystem funding was adjusted depending on the availability of eligible collateral.

Cost and evolution of other funding sources: The objective was to ensure that banks' funding cost from other sources is realistic, given the economic environment, prevailing market conditions and the bank specific situation.

In the Baseline Scenario, a cap on debt securities issuance was introduced as a percentage of total liabilities for each bank.

Under the Adverse Scenario, the Bank of Greece assumed that the markets would be closed.

Preference shares: No repayment of the preference shares was assumed in the capital shortfall estimation. The Greek government bonds that had been provided to banks against their preference shares, which are maturing in May/June 2014, have been assumed to be repaid in cash.

Net fee and commission income (F&C income): In treating F&C income, the aim was to ensure that the assumed evolution of this revenue driver was consistent with each bank's underlying business.

The Bank of Greece considered two different types of F&C income:

- F&C related to loans, which were capped at 2013 levels as a percentage of loans;
- The cumulative growth of other F&C was capped at 20% over the June 2013 – December 2016 period for the Baseline Scenario (at 10% for the Adverse Scenario).

The F&C income of banks was adjusted downwards, whenever the caps were binding.

Trading income: Care was taken to ensure that banks' profitability did not rely on financial operations but on core banking activities. The Bank of Greece suppressed gains from trading income to nil.

However, client related recurring trading income derived from fee generating activities was not excluded from banks' income, but its cumulative growth was capped at 20% over June 2013-December 2016 period in the Baseline Scenario (at 10% for the Adverse Scenario).

(ii) International subsidiaries

⁴¹ These stress factors should not be interpreted as a forecast for the evolution of benchmark interest rates.

In light of the analysis conducted for the CLPs of foreign subsidiaries (Chapter III), any significant deviations from prevailing market conditions regarding pre-provision profitability were conservatively adjusted.

The Bank of Greece applied the concept of materiality for the monitoring of the Restructuring Plans of banks' international subsidiaries. The main subsidiaries of each bank have been reviewed and appropriate adjustments to their pre-provision profitability were performed, if required, primarily on the basis of regulatory information and College of Supervisors' feedback.

In light of its importance and relative size compared to other international subsidiaries, a specific stress test exercise was performed on Finansbank. This covered the growth of deposits and loans as well as the overall pre-provision profitability of Finansbank.

All capital impacts related to foreign subsidiaries were calculated net of foreign tax.

(iii) Evolution of Risk-Weighted Assets and other impacts

RWAs adjustment: As the intention was to ensure that banks do not underestimate their risk exposure, the Bank of Greece made an assessment of the amount of RWAs at the beginning of the exercise and of its projected path during the stress test period. The following adjustments to the three types of RWAs were considered:

- Credit RWAs, expressed as a percentage of net outstanding loans, which cannot drop below each bank's June 2013 level. No credit given for further implementation of IRB methodology or optimisation of credit RWAs;

- Market RWAs, projected path is floored at each bank's June 2013 level;
- Operational RWAs, which were adjusted to business activity level based on the 3 year historical average of operational RWA as a percentage of net banking income.

As a result, RWAs were adjusted for any bank that did not meet one or more of the previously specified criteria.

Mitigating actions: The Bank of Greece took into consideration those capital actions which were incorporated into the Restructuring Plans and applied appropriate adjustments where needed.

Insurance capital needs: Potential capital needs for insurance activities of Greek banks under Solvency II framework⁴² have been taken into account incorporating the results of the recent insurance stress testing exercise conducted with the EIOPA's methodology. This exercise was conducted in the second half of 2013 based on year end 2012 figures.

Deferred Tax Assets (DTA): Adopting a conservative stance, the Bank of Greece kept a prudential filter on DTA for the period of the stress test. The existing net accounting DTA were capped at 20% of Core Tier 1 capital and no new DTA were recognised in the horizon of the exercise.

4. RESULTS

The assessment concludes that for the period June 2013-December 2016, the Greek banking sector would require €6.4 billion to be adequately capitalised as illustrated in

⁴² Implementation date of Solvency II framework: 01/01/2016

**Chart IV.2 Process for calculating capital needs in the Baseline Scenario
(June 2013 – December 2016; consolidated basis)**

(billion euro)

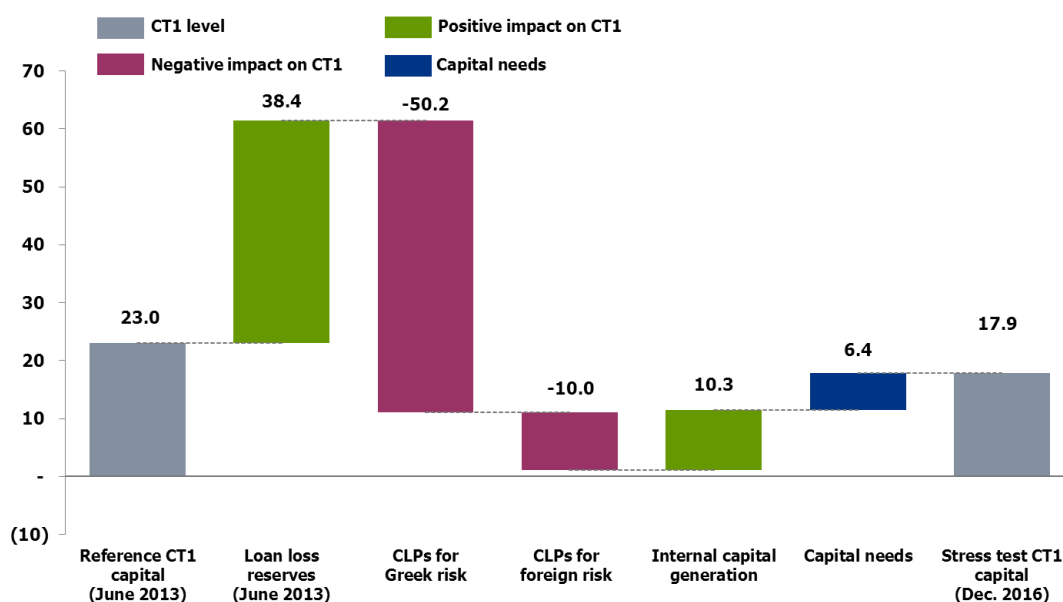


Chart IV.2. The relevant components of this amount are depicted with breakdown by banks in Table IV.2.

Table IV.3 summarises the capital needs and coverage of BlackRock Lifetime Losses and NPLs as at the end of 2016. It shows

that in the Baseline scenario, the provisions used to calculate the capital needs cover 107% of the BlackRock Lifetime Losses and that the coverage of NPLs by provisions is at 56%.

**Table IV.2 Summary of capital needs calculation in the Baseline Scenario
(June 2013 – December 2016; consolidated basis)**

(million euro)

Banks ¹	Reference Core Tier 1 capital (June 2013) (A)	Loan loss reserves (June 2013) (B)	CLPs for Greek risk ² (C)	CLPs for foreign risk (D)	Internal capital generation ³ (E)	Stress Test Core Tier 1 capital (Dec. 2016) (F)	Capital needs (G) = (F) - (A) - (B) - (C) - (D) - (E)
Alpha	7,380	10,416	-14,720	-2,936	4,047	4,450	262
Eurobank ⁴	2,228	7,000	-9,519	-1,628	2,106	3,133	2,945
NBG ⁵	4,821	8,134	-8,745	-3,100	1,451	4,743	2,183
Piraeus	8,294	12,362	-16,132	-2,342	2,658	5,265	425
Attica	225	403	-888	0	106	243	397
Panellinia	61	66	-237	0	-26	31	169
Total	23,009	38,380	-50,241	-10,005	10,341	17,866	6,382

Source: Bank of Greece.

¹ The exercise concluded that for ABB, Credicom and IBG no additional capital was needed.

² CLPs for Greek risk are calculated on the basis of the methodology described in page 10.

³ Internal capital generation based on banks' Restructuring Plans for June 2013 – December 2016, as conservatively stressed according to the Bank of Greece methodology (see Chapter IV).

⁴ Eurobank Loan loss reserves as of June 2013 pro-forma of the provisions of New Hellenic Postbank and New Proton Bank (c. €1.7bn) that were acquired in August 2013.

⁵ NBG Loan loss reserves as of June 2013 pro-forma of the provisions of FBB and Probank.

Table IV.3 Summary of capital needs and key ratios

(million euro)

Banks ¹	Capital needs over the Stress Test period		Coverage of BlackRock lifetime losses Greek Risk as at 31/12/2016		Provisions / NPLs coverage ratio Greek Risk as at 31/12/2016	
	Baseline	Adverse	Baseline	Adverse	Baseline	Adverse
Alpha	262	560	127%	106%	65%	60%
Eurobank	2,945	4,980	96%	85%	56%	53%
NBG	2,183	2,502	104%	85%	52%	47%
Piraeus	425	757	103%	87%	52%	50%
Four systemic banks	5,816	8,798	108%	91%	56%	52%
Attica	397	434	95%	85%	56%	57%
Panellinia	169	186	95%	85%	65%	67%
Total	6,382	9,418	107%	91%	56%	53%

Source: Bank of Greece.

¹ The exercise concluded that for ABB, Credicom and IBG no additional capital was needed.

ANNEX II: ADVERSE SCENARIO RESULTS

Chart Annex II.1 Process for calculating capital needs in the Adverse Scenario (June 2013 – December 2016; consolidated basis)

(billion euro)

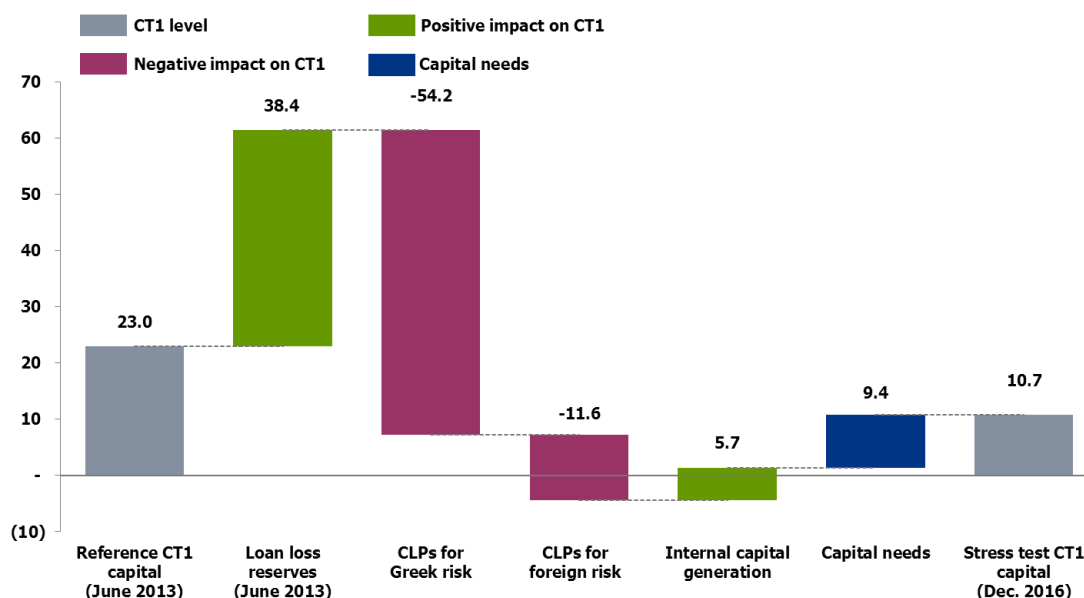


Table Annex II .1 Summary of capital needs calculation in the Adverse Scenario (June 2013 – December 2016; consolidated basis)

(million euro)

Banks ¹	Reference Core Tier 1 capital (June 2013) (A)	Loan loss reserves (June 2013) (B)	CLPs for Greek risk ² (C)	CLPs for foreign risk (D)	Internal capital generation ³ (E)	Stress Test Core Tier 1 capital (Dec. 2016) (F)	Capital needs (G) = (F) - (A) - (B) - (C) - (D) - (E)
Alpha	7,380	10,416	-15,720	-3,238	3,172	2,570	560
Eurobank ⁴	2,228	7,000	-10,522	-2,001	25	1,710	4,980
NBG ⁵	4,821	8,134	-9,509	-3,536	656	3,068	2,502
Piraeus	8,294	12,362	-17,183	-2,832	1,831	3,228	757
Attica	225	403	-1,000	0	77	139	434
Panellinia	61	66	-260	0	-35	17	186
Total	23,009	38,380	-54,195	-11,606	5,726	10,732	9,418

Source: Bank of Greece.

¹ The exercise concluded that for ABB, Credicom and IBG no additional capital was needed.

² CLPs for Greek risk are calculated on the basis of the methodology described in page 10.

³ Internal capital generation based on banks' Restructuring Plans for June 2013 – December 2016, as conservatively stressed according to the Bank of Greece methodology (see Chapter IV).

⁴ Eurobank Loan loss reserves as of June 2013 pro-forma of the provisions of New Hellenic Postbank and New Proton Bank (c. €1.7bn) that were acquired in August 2013.

⁵ NBG Loan loss reserves as of June 2013 pro-forma of the provisions of FBB and Probank.

ANNEX III: ABBREVIATIONS AND ACRONYMS

ABB	Aegean Baltic Bank
AQR	Asset Quality Review
BR	BlackRock Solution
CLPs	Credit Loss Projections
CRE	Commercial Real Estate
CT1	Core Tier 1
DG Comp	European Commission, DG Competition
DTA	Deferred Tax Assets
EAD	Exposure At Default
EBA	European Banking Authority
EBITDA	Earnings Before Interest, Taxes, Depreciation and Amortization
EC	European Commission
ECB	European Central Bank
EL	Expected loss
ELA	Emergency Liquidity Assistance
F&C	Net fee and commission income
FLB	Foreign Loan Book
GDP	Gross Domestic Product
HFSF	Hellenic Financial Stability Fund
IAS	International Accounting Standards
IASB	International Accounting Standards Board
IBG	Investment Bank of Greece
IMF	International Monetary Fund
ISA	International Standards of Auditing
LGD	Loss Given default
LTV ratio	Loan-to-Value ratio

NBG	National Bank of Greece
NPLs	Non-Performing Loans
OECD-Europe	All European member-countries of the OECD
PD	Probability of Default
RWAs	Risk Weighted Assets
SBP	Small Business and Professional
SEE	South-East Europe
SME	Small and Medium Enterprises
TAR	Troubled Assets Review

